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ENCYCLOPÆDIA BRITANNICA

SEVENTH EDITION.

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THE

ENCYCLOPÆDIA BRITANNICA

OR

DICTIONARY

OF

ARTS, SCIENCES, AND GENERAL LITERATURE.

SEVENTH EDITION,

WITH PRELIMINARY DISSERTATIONS ON THE HISTORY OF THE SCIENCES,

AND

OTHER EXTENSIVE IMPROVEMENTS AND ADDITIONS;

INCLUDING THE LATE SUPPLEMENT,

A GENERAL INDEX,

AND NUMEROUS ENGRAVINGS.

VOLUME VIII.

ADAM AND CHARLES BLACK, EDINBURGH;
M.DCCC.XLII.

ENCYCLOPÆDIA BRITANNICA.

DIALOGISM, in *Rhetoric*, is used for the soliloquies of persons deliberating with themselves.

DIALOGUE, in literature and in common life, a conversation between two or more persons, and either written or oral.

As the end of speech is conversation, no kind of writing can be more natural than dialogue, which represents this. Accordingly we find it was introduced at a very early period; for there are several instances of it in the Mosaic history. The ancient Greek writers, especially the philosophers, also fell very much into dialogue, as the most convenient and agreeable method of communicating their sentiments and instructions to mankind. And indeed it seems to be attended with very considerable advantages, if well and judiciously managed; for it is capable of rendering the driest subjects entertaining and pleasant, by its variety, and by the different characters of the speakers. Besides, things may be canvassed more minutely, and many lesser matters, which serve to clear up a subject, may be introduced with better grace, by means of questions and answers, objections and replies, than can be conveniently done in a continued discourse. There is likewise a further advantage in this way of writing, that the author is at liberty to choose his speakers; and therefore, as Cicero has well observed, that when we imagine that we have persons of an established reputation for wisdom and knowledge talking together, this circumstance necessarily adds a weight and authority to the discourse, and more closely engages the attention. The subject-matter of dialogue is very extensive; for whatever is a proper argument of discourse, public or private, serious or jocose—whatever is fit for wise and ingenious men to talk upon, either for improvement or diversion—is suitable for a dialogue.

From this general account of the nature of dialogue, it is easy to perceive what kind of style best suits it. Its affinity with epistles shows there ought to be no great difference between them in this respect. Indeed, some have been of opinion that it ought rather to sink below the style of an epistle, because dialogues should in all respects represent the freedom of conversation, whereas epistles ought sometimes to be composed with care and accuracy, especially when written to superiors. But there seems to be little weight in this argument, since the design of an epistle is to say the same things, and in the same manner, as the writer judges would be most fit and proper for him to speak if present; and in a dialogue the design is similar with respect to the several persons concerned in it. Upon the whole, therefore, a plain, easy, and simple style, suited to the nature of the subject, and the particular characters of the persons concerned, seems to be alike suitable to both.

But as greater skill is required in writing dialogues than letters, we shall give a more particular account of the principal things necessary to be regarded in their composition, and illustrate them chiefly from Cicero's excellent dialogues concerning an orator. A dialogue then consists of two parts; an *introduction*, and *the body of the discourse.*

The *introduction* acquaints us with the place, time, persons, and occasion of the conversation. Thus Cicero places the scene of his dialogues at the country seat of Crassus; a very proper retreat, both for such a debate and the parties engaged in it. And as they were persons of the first rank, employed in the greatest affairs of the state, and as the discourse occupied them for two days, he represents it to have happened at the time of a festival, when no business was done at Rome, and an opportunity was thus afforded them of being absent.

And because the greatest regard should be had in the choice of the persons, who ought to be such as are well acquainted with the subject upon which they discourse, in these dialogues of Cicero the two principal disputants are Crassus and Antony, the greatest orators of that age, and therefore the most proper persons to dispute respecting the qualifications essential for their art. One would think it scarcely necessary to observe that the conference should be held by persons who lived at the time, and thus were capable of conversing together. But yet some good writers have run into the impropriety of feigning dialogues between persons who had lived at distant times. Plato adopted this method, in which he has been followed by Macrobius. But others, who have been willing to bring persons to discourse together who lived in different ages, without such inconsistency, have written dialogues of the dead. Lucian has made himself most remarkable in this way. As to the number of persons in a dialogue, they may be more or fewer; so many as can conveniently carry on a conversation without disorder or confusion, or they may be only two. Some of Cicero's dialogues have but two, others three or more, and those concerning an orator seven. But it is convenient in some respects that they should all be persons of different characters and abilities; a circumstance which contributes both to the variety and beauty of the discourse, like the different attitudes of figures in a picture. Thus, in Cicero's dialogues last mentioned, Crassus excelled in art, Antony principally by the force of his genius, Catullus by the purity of his style, Scevola by his skill in the law, Cæsar by wit and humour; and Sulpitius and Cotta, though young men, were both excellent orators, yet they differed in their manner. But there should be always one principal person, having the main part of the conversation; like the hero in an epic poem or a tragedy, who excels the rest in action, or the principal figure in a picture, which is always made the most conspicuous. In Plato's dialogues this is Socrates, and Crassus in those of Cicero above mentioned.

It is usual likewise, in the introductions, to acquaint us with the occasion of the discourse. Indeed this is not always mentioned; as in Cicero's dialogue concerning the parts of oratory, where the son begins immediately with desiring his father to instruct him in the art. But it is generally taken notice of, and most commonly represented as accidental; the reason of which may be, that such discourses appear most natural, and may likewise afford some kind of apology for the writer in managing his different characters, since the greatest men may be supposed not always to speak with the utmost exactness in an accidental conversation. Thus Cicero, in his dialogues concerning an orator, makes Crassus occasionally fall upon the subject of oratory, in order to divert the company from the melancholy thoughts of what they had been discoursing of before, with relation to the public disorders, and the dangers which threatened their common country. But the introduction ought not to be too long and tedious. Mr Addison complains of this fault in some authors who employ dialogue. "For though," as he says, "some of the finest treatises of the most polite Latin and Greek writers are in dialogue, as many very valuable pieces of French, Italian, and English, appear in the same dress; yet in some of them there is so much time taken up in ceremony, that, before they enter on their subject, the dialogue is half over."

We come now to the *body* of the discourse, in which some things relating to the persons, and others to the subject, are proper to be remarked.

And as to the *persons*, the principal thing to be attended to is to keep up a justness and consistency of character throughout the whole. And the distinct characters ought to be so perfectly observed, that even from the very words it may be always known who is the speaker. This renders dialogue more difficult than single description, by reason of the number and variety of characters which are to be drawn at the same time, and each of them managed with the greatest propriety. The principal speaker should appear to be a person of great sense and wisdom, and best acquainted with the subject. No question ought to be asked him, nor objection started, but what he should fairly answer; and all that is said by the rest should principally tend to promote his discourse, and carry it through in the most artful and agreeable manner. When the argument is attended with difficulties, one other person or more, of equal reputation, or nearly so, but of different sentiments, should be introduced to oppose him, and maintain the contrary side of the question. This affords an opportunity for a thorough examination of the point on both sides, and for answering all objections. But if the combatants are not pretty equally matched, and masters of the subject, they will treat it but superficially. Through the whole debate, however, there ought not to be the least wrangling, peevishness, or obstinacy; nothing indeed but the appearance of good humour and good breeding, together with a readiness to submit to conviction and the force of truth, according as the evidence shall appear to be on one side or the other. In Cicero, these two characters are Crassus and Antony; and from them Mr Addison seems to have taken his Philander and Cynthio in his *Dialogues upon the Usefulness of Ancient Medals*, which are formed pretty much upon Cicero's plan. When younger persons are introduced, or such as are not equally acquainted with the subject, they should rather be inquisitive than disputative; and the questions they ask should be neither too long nor too frequent, in order that they may not too much interrupt the debate, nor appear over talkative before wiser and more experienced persons. Sulpitius and Cotta sustain this character in Cicero, and Eugenius in Mr Addison. It is very convenient, however, that there should be one person of a witty and jocose humour, to enliven the discourse at proper seasons, and render it the more entertaining, especially when the dialogue is drawn out to any considerable length. Cæsar performs this part in Cicero; and in Mr Addison, Cynthio, a person of a similar turn, opposes Philander in a humorous way. Mr Addison's subject admitted of this; but the seriousness and gravity of Cicero's argument required a different speaker for the jocose part. Many persons ought not to speak immediately after one another; though Scaliger and others think a fourth person may sometimes be permitted to speak in the same scene without confusion. However, if this is not commonly allowed upon the stage, where the actors are present, and may be distinguished by their voice and habit; much less should it be so in a dialogue, where we have only their names to distinguish them.

With regard to the *subject*, all the arguments should appear probable at least, and nothing should be advanced which may seem weak or trivial. There ought also to be an union in dialogue, in order that the discourse may not ramble, but keep up to the main design. Indeed, short and pleasant digressions are sometimes allowable, for the ease and entertainment of the reader; but every thing should be so managed that he may still be able to carry on the thread of the discourse in his mind, and keep the main argument in view, till the whole be finished. The writers of dialogue have not confined their discourses to any certain space of time, but either concluded them with the day, or broken off when their speakers have been tired, and resumed them again the next day. Thus Cicero allows two days for his three dialogues concerning an orator; but Mr Addison extends his to three days, allowing a day for each. But the same method has not always been observed in composing dialogues; for sometimes the writer, by way of narrative, relates a discourse which passed between other persons. Such are the dialogues of Cicero and Mr Addison last mentioned, and many others both of the ancients and moderns. But at other times the speakers are introduced in person as talking to each other. This, as Cicero observes, prevents the frequent repetition of those words, "he said," and "he replied;" and by placing the hearer, as it were, in the conversation, gives him a more lively representation of the discourse, and thus makes it the more affecting. In this manner, therefore, Cicero wrote his *Dialogue of Old Age*, in which Cato, who was then advanced in years, recounts the satisfaction of life which may be enjoyed in old age; and, in fact, he tells his friend

Atticus he was himself so affected with that discourse, that when he reviewed it, he sometimes fancied they were not his own words, but Cato's. There are some other dialogues of Cicero written in the same way; and both Plato and Lucian generally chose this method.

DIALTHÆA, in *Pharmacy*, an unguent formerly much used as a resolvent, and so called from *Althæa*, or marshmallows, which is the principal ingredient in it.

DIALYSIS, in *Grammar*, a mark or character, consisting of two points placed over two vowels of a word, in order to separate them, because otherwise they would make them a diphthong, as *Mosaïc*, &c.

DIAMASTIGOSIS, a festival at Sparta in honour of Diana Orthia, which received that name *απο του μαστιγούν*, from *whipping*, because boys were whipped before the altar of the goddess. These boys, called Bomonicæ, were originally free-born Spartans, but in the more delicate ages they were of mean birth, and generally of a servile origin. This operation was performed by an officer, in a severe and unfeeling manner; and, that no compassion should be raised, the priest stood near the altar with a small light statue of the goddess, which suddenly became heavy and insupportable if the lash of the whip was more lenient or less rigorous than necessary. The parents of the children attended the solemnity, and exhorted them not to commit any thing, either by fear or groans, that might be unworthy of Laconian education. These flagellations were so severe that the blood gushed profusely, and many expired under the lash, without uttering a groan or betraying any marks of fear. Such a death was reckoned very honourable; and the corpse was buried with much solemnity, with a garland of flowers on its head. The origin of this festival is unknown. Some suppose that Lycurgus first instituted it in order to inure the youth of Lacedæmon to bear labour and fatigue, and to render them insensible to pain and wounds. Others maintain that it is a mitigation of an oracle, which ordered that human blood should be shed on Diana's altar; and, according to their opinion, Orestes first introduced this barbarous custom, after he had brought the statue of Diana Taurica into Greece. There is another tradition which mentions that Pausanias, as he was offering up prayers and sacrifices to the gods before he engaged with Mardonius, was suddenly attacked by a number of Lydians, who disturbed the sacrifice, and were at last repelled with staves and stones, the only weapons with which the Lacedæmonians were provided at that moment. In commemoration of this, therefore, the whipping of boys was instituted at Sparta, and thereafter the Lydian procession.

DIAMETER, in *Geometry*, a right line passing through the centre of a circle, and terminated at each side by the circumference. See GEOMETRY.

DIAMOND, *adamas* of the ancients, *almas* of Persia, and *heera* of Hindustan, is the most brilliant of gems; and although known from the remotest times, if we may judge by the casual notice made of it in Scripture, it had in the earlier periods of history obtained little more than a name. Pliny states that it bore a price *above all things in the world*, and was known to very few except princes and crowned heads. His meagre remarks on this gem are even less satisfactory than those upon almost any other; which affords another reason to conclude that the diamond still remained in his time an object of great rarity. The localities quoted by Pliny appear to be quite erroneous, at least subsequent observations give us reason to think so.

Up to the commencement of the eighteenth century diamonds were wholly derived from India, where they were found in detached crystals, accompanied with grains of gold, amongst metallic sand washed down from surrounding mountains. In 1728 a similar territory, loaded with the two most valuable substances in nature, was discovered on the southern continent of the New World. When in pursuit of gold, crystals of diamond were often found; but the labourers being ignorant of their value, laid them aside as curiosities. A miner, who is said to have arrived in Brazil at this time, first directed attention towards them; and, without attempting to appropriate his discovery to his own aggrandisement, he led his comrades to turn their pursuit to the more engaging object. It soon, therefore, attracted the notice of the government, and was shortly afterwards taken possession of in name of the sovereign.

Hitherto the supply of diamonds was entirely confined to Hindustan and the island of Borneo; and, as might reasonably be expected, the opening of a new field, the extent of which was as yet wholly unknown, could not fail to affect the market. The discredit which was at first thrown upon the accounts from Brazil, as also on the purity and perfection of the stones, repressed the fears of the Asiatic dealers, and the increased demand after the purchase of the Pitt diamond, a circumstance which no doubt rendered that gem far more *recherché* at the gay and luxurious court of France, all tended to increase the demand, and keep it more upon an equilibrium with the increased supply than could possibly have been expected. At a subsequent period, no doubt, the revolution of France interfered with the value of jewels; but the surplus thus produced was soon absorbed by the wealth of Britain, and diamonds of the first water for a long time maintained their ground.

At the present day this perhaps cannot be said to hold good. As a commercial commodity, diamonds must have suffered depression like all others, and may perhaps be valued at from twenty-five to thirty per cent. particularly those beyond the smallest sizes, under the prices which they bore in the times of Tavernier; although Mawe appears to have been anxious to inculcate a different doctrine. After his examination of the Brazilian district, he says there would be no difficulty in calculating the period requisite to work out the whole of the diamond ground in that country; and as many of the mines of Hindustan are considered as exhausted, the period must come sooner or later when diamonds will be no longer to be had.

In both countries the gem is confined within the limits of the tropics. In India, Golconda has always been cited as one of its principal repositories, although none was ever found in the immediate vicinity of that fortress, from the circumstance perhaps of the geological character of the neighbourhood, which is entirely syenitic. It may have arisen, however, from the fact, that the diamond mines of Raolconda and Ganee Purteeal were situated in the territory of the Kootub Shahee kings of Golconda. When that dynasty was overthrown, and their country occupied by the officers of the Mogul emperors, Golconda ceased to be the capital, and Hyderabad, which is only a few miles distant, became the occasional seat of the new government. The territory in which the mines are situated has since been ceded to the East India Company. It lies near Condapilly, on the northern bank of the Kistna, about fifty miles from the sea, and near the Pass of Bezoara, where the river appears at some period to have forced its way through a chain of hills, and to have emptied an extensive lake which had existed to the westward of them. All attempts to work them have been abandoned, as the produce has ceased to refund the expense of labour. The localities of the diamond in Hindustan are so various that it would be almost endless to enumerate them. Those on the Mahanuddy, with those on the Kistna and at Mallavilly, north-west of Ellore, may be mentioned as probably the most productive of this beautiful gem. The island of

Borneo is the only other eastern locality which can boast of its production. It occurs at Pontiana, in that island, directly under the line, and at Benjarmassin, about three degrees south of the equator. Here it is said to be of a quality superior to that of the gems found in the other Indian localities, and to be distinguished in consequence by the name of *Landak*, the place they are found in. Here also the diamond occurs in alluvial soil, accompanied with gold. One diamond was found about a century ago, of 367 carats, supposed to be now in the hands of the chief of Pontiana.

From Heyne's account of the working of diamond mines in Hindustan, it seems to afford a very miserable livelihood. He states that the diamond has hitherto been found only in alluvial soil, or in the most recent rocks; and that the stones are not scattered through the whole of these beds, but confined to one rather harder than the rest. The upper stratum, of eighteen inches, consists of sand, gravel, and loam; next there is a deposit of stiff black clay or mud, of about four feet; and next the diamond bed, which is distinguished by a mixture of large rounded stones. It is from two to two and a half feet thick, closely cemented together with clay. Sometimes this stratum is covered with calcareous tuffo. Here shallow pits are excavated, of a few feet in diameter, in such spots as the practice of the workman may induce him to select; he sinks to a depth of a few feet, and searches the bed which he considers most promising for his purposes, and if he meets with little encouragement, he shifts his situation, and proceeds elsewhere. Thus a great deal of the country may be turned to waste and neglected, and, when it comes to be again wrought over more carefully, may give rise to the absurd fancy of regeneration.

The miners, M. Voysey (*Asiatic Researches*, vol. xv. p. 120) says, are of opinion all over India, that the chips and small rejected pieces of former searchers actually increase in size, and in process of time become large diamonds; and he finishes his paper, by hoping that some future mineralogist would ascertain whether there were any foundation for the vulgar opinion of the continual growth of the diamond; particularly as he hoped at some future period to produce undeniable proof of the re-crystallization of amethyst, zeolite, and felspar, in alluvial soil. This respectable gentleman did not live to bring forward his proofs; but had he been doomed to arrive at the age of the patriarchs of old, we are of opinion he would have been puzzled to produce them.

In Brazil, the diamond is more confined to one spot than in India. The district of Minas Geraes comprehends, as far as we yet know, the whole of the diamond grounds hitherto discovered in the New World. There the workings appear to be carried on more systematically than in India. The operations at the Serra do Frio we have already described in the article Brazil (vol. v. p. 199). The Serra do Frio, or cold mountain, is a mountainous platform, having an elevation of from sixteen to eighteen hundred metres. The district over which the diamonds are searched for, extends about sixteen leagues from north to south, by about eight from east to west. It is situated twelve leagues north of Tejuco, on the river Tigitouhonha, which falls into the river San Francisco. By the decomposition of the granite, an agglomerate is formed, composed of rounded white quartz pebbles, and light-coloured sand, to which the natives give the name of cascalho; and it is in this substance that the diamonds are found, along with gold, which is sometimes crystallized. It is exactly similar to some of the samples of the diamond deposits of Hindustan sent to the Royal Society of Edinburgh by Mr Swinton, but differs considerably from others, where a conglomerated sandstone of considerable tenacity has in several instances been sent, as the matrix of the diamond.

From any thing we are yet able to judge, it does not appear that the diamond has ever yet been seen in a matrix which could be esteemed its original position. Heyne has given two coloured engravings of diamonds in the matrix, and they have the merit of representing very faithfully specimens of this description we have seen at home; but they are in all probability only diamonds accidentally agglutinated in ferruginous matter having no character of a rock. The Musnuddy, which joins the Mahanuddy, is mentioned as affording an indication which might lead to a favourable result in such an investigation. At its confluence with the Maund River, near Chunderpoor, and not farther down than Sonpoor, it is only on the left bank of the river that diamonds are found. Hence the Maund is the point at which the examination should commence; and if the country can be effectually penetrated, it would be well worthy the attention of some enterprising mineralogist.

We have no satisfactory geological account of any of the diamond countries; a slight sketch by Voysey, in the article above quoted, is the best that we can refer to. He particularly alludes to a range of hills, called the Nalla Malla, or Blue Mountains, about Cummum, on the Gunlacummum river, which are composed of schistose rocks, of all varieties, from clay-slate to pure limestone, accompanied with quartz rock, sandstone, sandstone brescia, flinty slate, hornstone slate, and a tuffaceous limestone, containing imbedded, rounded, and angular masses of all these rocks. These are bounded on all sides by granite, which appears to pass under and form the base. The only rock of this formation on which the diamond is found is the sandstone brescia. "I have as yet," says he, "only visited the rich mines of Banaganpilly (lying in Heyne's map in 78° 4′ by 15° 4′), where the brescia is found under a compact sandstone rock, differing in no respect from that which is found under other parts of the main range. It is composed of a beautiful mixture of red and yellow jasper, quartz, calcedony, and hornstone, cemented together by a quartz paste. It passes into puddingstone, composed of rounded pebbles of quartz, &c. cemented by an argillo-calcareous earth, of a loose friable nature, in which the diamonds are most frequently found."

Heyne states, that in some of the mines in India the diamonds are found entirely broken or crushed, and only of value for pounding; but at the same time thinks it must be owing to carelessness. He mentions also that the diamonds of Cuddapah are carried to Madras to be used for the same purpose, and the price he quotes for a carat of stones fit for brilliants is only seven rupees.

No crystal in nature is more beautiful than that of the diamond. It is sometimes so pure and so pellucid, with its angles and faces so perfectly symmetrical, as to shine like a dew-drop in the rays of the sun. Its primitive form is that of the equilateral octahedron. It passes into the dodecahedron and the cube, presenting modifications in each. The colourless diamond of the first water is the most valuable; but very fine diamonds sometimes present a deep red tinge, also yellow, orange, green, blue, and black. Those which have a slight tint of yellow are often remarkably brilliant, and are said to be of a superior hardness.

The value of diamonds is always calculated in carats, which consists of four grains; but it must be remembered, that the diamond grain differs from the Troy grain, as it takes five of the former to weigh four of the latter, or more exactly one carat = 3·174 gr. Troy.

In valuing diamonds, either rough or cut, the practice is to take the weight in carats, to square that weight, and then to multiply the product by such a rate of price as may correspond to the state and quality of the stone; thus, if a natural crystal of diamond be clear, without flaws, and of a favourable shape, the price by which the square of its weight should be multiplied is L.2; so that if the stone weigh one carat, its value will be L.2, if two carats, $2 \times 2 = 4$, and $4 \times 2 = 8$, or a stone of two carats is worth L.8. A stone of ten carats, in the same way, will give $10 \times 10 = 100$, and $100 \times 2 =$ L.200, the value of a perfect rough diamond of this weight.

If the diamond has been worked into a brilliant of just proportions, the same rule is observed of squaring the weight in carats; but a much higher price is used as the multiplier of the product; as L.8 is considered to be the proper multiplier when the stone is perfect in water and shape. Thus a diamond of $5\frac{1}{2}$ carats gives $30\frac{1}{4}$ as its square, and this multiplied by 8 makes L.242 as its price. If the stone has been worked into the form which is termed a rose, L.6 is used as the multiplier; and if it be of the form termed table-cut, it is still lower.

Considerable modifications, however, must be made in these multipliers, according to the quality of the diamonds and the state of the market. If a brilliant be what is termed "off colour," that is, not absolutely colourless, or if it be in any other way imperfect in shape or purity, a corresponding diminution must be made in the multiplier. Thus a brilliant with a yellow or a milky hue, or with a small speck or flaw, may not be multiplied by more than L.4, L.5, or L.6, according to the nature or extent of the imperfection. The state of the demand in the market must likewise have great influence. At present the demand for good brilliants of one carat and under is greater in proportion to the supply than for heavier stones, and such stones will therefore sometimes cost L.10 the carat; whilst there being fewer purchases for the larger sizes, they may often be had in commerce at a lower rate than has been mentioned above.

The finest known diamonds are as follow:

That of the crown of France (Pitt diamond), weighing $136\frac{3}{4}$ carats, the value of which, taken according to the above rule, would be L.141,058. The dimensions of this fine stone are stated to be,

Length	1·2437 inches.
Breadth	1·177
Depth	·859

Weight in Troy grains, 434.

That of the Grand Duke of Tuscany (now Austrian), weighing $139\frac{1}{2}$ carats, valued as above at L.153,682.

That of the Emperor of Russia, weighing 195 carats. This diamond is rose cut.

That of the Great Mogul, weighing $279\frac{9}{16}$ carats, also rose cut.

That of the King of Portugal, weighing 1680 carats, being rough, not less than L.5,644,800.

It is consequently quite evident that this rule can obtain only among diamonds of moderate size; and if it should establish something by which a price may be named, all else must be left to subsequent arrangement.

Of the remarkable diamonds we have enumerated, the first is that known by the name of the Regent or Pitt diamond. It was found at Pasteal, in the Golconda district. It was imported into this country by Mr Pitt, governor of Madras, who purchased it from a native for 48,000 pagodas, about L.20,400 at the exchange of the day, and after being offered to different crowned heads in Europe, was purchased by the regent of France in 1717 as a jewel for the crown. It was placed by Napoleon in the hilt of the sword of state, and, according to Brard, the price paid for it was 2,250,000 francs; Jeffreys calls it L.125,000, and other authors say L.130,000. Any of these, however, although by much the largest price ever paid for any jewel, is not equal to the rule of value. This is esteemed the finest and most perfect diamond known.

The second was purchased for a bit of rock-crystal, on a stall in the market-place of Florence, at the cost of a few pence; it is of a beautiful lemon-yellow colour, and is now in the possession of the house of Austria. The diamond mentioned as the property of the Emperor of Russia ornaments the top of his sceptre. It is of the size of a pigeon's egg, and is said to have been the eye of an Indian idol pillaged by a deserter from the French service, who had the address to get himself installed as a priest in the service of the Malabar deity at Seringham, as narrated by Dutens. The Empress Catherine purchased it for L.90,000, together with an annuity of L.4000.

The Great Mogul is described by Tavernier as an irregularly-shaped diamond, but cut and polished. It was found at Colore, in the district of Golconda, in the year 1550; and is said to have weighed 900 carats before cutting, but this appears a most enormous sacrifice. Of the Brazilian diamond some suspicions have been entertained. It has been insinuated that it is only a mass of very fine white coloured topaz, and it is not likely that the king of Portugal will run the hazard of ascertaining the fact.

The supply of diamonds from Brazil, according to Baron d'Eschwege, during the eighty-four years from 1730 to 1814, was at the rate of 36,000 carats per annum; but the return from the registers of the administration of the diamond mines from 1800 to 1806 was only 19,000 carats. It is also added, that the revenue derived by government during the first period was only eighteen or nineteen francs the carat, whilst from forty to fifty were obtained during the last; a certain indication of a diminished supply. A singular circumstance is noticed with respect to the uniformity of the diamond ground of Do Frio. The same cubic mass of cascalho will yield, on washing, pretty nearly the same number of carats, in large or small diamonds, so that the superintendent can calculate on the probable produce of the washing.

Large stones do not abound in Brazil, but there are some of considerable dimensions. Mawe mentions one from the little rivulet D'Albaite of 120 carats, but they do not often exceed from eighteen to twenty.

The prices of diamonds quoted by Heyne, who visited with a scrutinizing eye the principal mines of Hindustan, differ from those laid down by the rule of Tavernier and Jeffreys. Without attempting to reconcile them, we shall quote the value which the Hindus put upon what they consider as the best, and denominate the Brahma diamond; it is sold by the manjalin, which is equal to two carats, and each carat at the price of ten pagodas.

One manjalin	10	Madras pagodas.
Two	24	
Three	40	
Four	80	
Five	100	
Six	150	
Seven	250	
Eight	400	

He adds that these are the prices of stones free from speck, flaw, or crack. Cut stones are valued in a different way.

The most remarkable circumstance in the history of the diamond is to be found in the nature of its composition. This proud, this imperial ornament, which has ever occupied the summit of the diadem, this most brilliant of gems, and hardest of all known bodies, is, after all, but a morsel of charcoal, which has been made to yield to the rays of the sun, and dissolve into a noxious vapour. As early as 1607, Bœtius de Boodt threw out the hint that diamond was inflammable. In 1673 Boyle discovered that when it was exposed to a great heat it was dissipated into acrid vapour. In 1694, the experiments of Boyle were confirmed by those of Cosmo III. Grand Duke of Tuscany, with his celebrated burning glass. About the same time, but whether before or not is uncertain, Sir Isaac Newton was led, from the great refractive power of the diamond, to pronounce it "an unctuous substance coagulated." Lavoisier proved it to be composed of carbon, by throwing the sun's rays concentrated by a powerful lens upon a diamond inclosed in a vessel with oxygen gas; when the diamond and the oxygen disappeared, and carbonic acid was generated. Sir George Mackenzie repeated the experiments of Boyle in 1800; and, finally, when Sir Humphry Davy visited Florence in 1814, the experiment of the grand duke was performed again with the same lens; and mineralogists no longer hesitated to place the gem amongst inflammable bodies.

According to Ellicot, the specific gravity of Brazil diamonds is 3·513, and of India diamonds 3·519. The former is the mean of four, the latter of ten experiments.

Diamond cutting was little understood till 1476, when an artist of the name of Berghen, residing at Bruges, introduced the practice of using diamond powder for forming and polishing the facets. Holland, in consequence, long maintained a monopoly of this trade; and to this day the smaller diamonds are almost entirely manufactured for the European market, at Amsterdam. The Pitt diamond was, however, cut and polished in London, as most of the larger sized stones continue to be. It is a very laborious and tedious operation. The grinding into the required form is entirely done by the hand. Two stones are cemented to the ends of tool handles, and rubbed with a powerful pressure against each other, a leaden model being first taken of the rough stone intended to be cut. The faces are thus determined. The two stones are then rubbed together over a little metal box having a double bottom, the upper one being loose and perforated with small holes, through which the diamond dust passes, and is carefully preserved. The desired form being thus obtained, the dust is afterwards used in polishing the faces of the diamond, mixed up with sweet oil, on a common lapidary's wheel, and the brilliancy of the gem brought out. The period of constant work required to reduce a stone of between twenty-four and thirty carats to a regular form will extend to at least seven or eight months constant work. The Pitt diamond was said to occupy two years. From the outline in Plate CCII. fig. 1, there was a great deal of extraneous matter to reduce, and that space of time may very likely have been required. When the mass to be removed is of such a size as to render it of importance to keep it entire, the piece is cut off by means of a steel wire, extended on a bow of cane or whalebone, anointed with diamond powder. This process is very commonly adopted in India. The diamond is sometimes also split by means of a chisel under a sharp stroke of a hammer; but this means requires great firmness of mind and dexterity of hand, for a valuable stone is sometimes destroyed by an unlucky blow.

The forms into which the diamond is cut are the brilliant, the rose, and the table. The first is composed of a principal face, which is called the table, surrounded by a fringe composed of a number of facets, which is all that is visible above the bezil when set. The proportion for the depth should be half the breadth of the stone, terminated with a small face, parallel to the table, and connected with the surface by elongated facets. As the octahedron is the most common natural form of the stone, and the brilliant cut being by far the most advantageous in point of effect, and the most economical form that can be adopted, it is hence preferred. The others are suggested by the shape of the mass.

The rose is entirely covered with facets on the surface, and is flat below. The table form is adopted in consequence of the shape of the mass, whether crystal or fragment, and produces the least effect. It is principally used in India, where the native jewellers cleave stones into plates, having often a large surface with little proportioned weight or brilliancy, except at the edges, which are ornamented by being cut into facets. The great diamond of the Mogul emperor, called Derriah Noor, is of this description; that called Koh-é-noor is rose-cut.

Much of the value of diamonds depends on the cutting of the stone. A late celebrated philosopher, who required a piece of diamond for philosophical purposes, found a large mass in the hands of a jeweller. It was of an awkward form, and presented a flaw which very greatly deteriorated its value, as, in consequence of the refraction and reflection which took place within the mass, the flaw seemed to occupy nearly the whole of the interior. The gentleman, however, was not afraid. He paid a large sum for the stone, directed the workman in cutting it, amputated the piece he wanted, separating the flaw, and sold the remainder back to the jeweller, after being properly cut and polished, for double the price he paid for it.

Hopes were recently excited, that a new diamond district had been discovered in Siberia by the celebrated traveller Humboldt. He thought he had met with appearances in a territory belonging to Count Demidoff, analogous to that of Minas Geraes, and recommended a search for the gem. But as two years have since elapsed without any confirmation of this suggestion, the old localities of Asia and Brazil are likely to remain without competition.

Explanation of the Plate, No. CCII.—The three figures at the top, No. 1, 2, 3, are representations of the Regent or Pitt diamond, the Great Mogul, and the Grand Duke, of the full size and form. No. 4 presents the brilliant cut, looked at perpendicularly. No. 5, the same sidewise. No. 6 and 7 also represent the brilliant before it undergoes the process of re-cutting. No. 8 and 9 are the vertical and lateral appearances of the rose-cut diamond; and No. 10 and 11, that of the table-cut. The scale No. 12 exhibits the sizes of the set diamond within the bezil, together with the depth of the stone, and the number of carats a diamond of that size is likely to weigh. This estimate can only be an approximation to the exact weight; but the weight of a set stone may thus be very nearly ascertained. No. 13 is the figure of the octahedral diamond seen perpendicularly, with the table traced where the stone should be cut; and No. 14 is the same crystal seen laterally, with the table and the opposite face also traced. By these figures it will be seen how much more advantageous it is to adopt the brilliant form than any other.

Diamonds have been imitated with great success by the French artists. To this composition, to which they give the name of *strass*, they not only communicate the adamantine lustre of the zircon, but succeed in giving it such a similitude to the real stone in all respects, hardness excepted, that it is nearly impossible for unpractised eyes to detect the difference. Recently quartz has been used with great effect to form the faces of factitious stones.

Diamond *used by Glaziers*, is an instrument made of steel or iron, into the point of which a diamond is introduced and fixed by solder. Care must be taken to place the gem so that, by applying the instrument in a particular position, the angle of the crystal will come in contact with the glass.

Diamond, in *Heraldry*, a term used for expressing the black colour in the achievements of peerage.

Guillim does not approve of blazoning the coats of peers by precious stones instead of metals and colours; but the English practice allows it. Morgan says the diamond is an emblem of fortitude.

DIAMOND *Harbour*, a harbour in the western branch of the Ganges, on the Hooghly river, about thirty-four miles below Calcutta in a straight line, but much more by the windings of the river. Here the Company's ships generally unload, and take in great part of their homeward bound cargoes. There are mooring chains for their accommodation, and storehouses on shore; and in the adjacent villages, consisting of a few thatched houses, with some petty shops, provisions may be purchased. But the place is very unhealthy, especially during the periodical rains in July, August, and September, owing to the exhalations from the swamps, and the heavy dews which fall at night. The country on both sides of the river is infested with tigers.

DIAMOND *Island* is situated on the east side of the Bay of Bengal, twelve miles south from Cape Negrais. It is about a mile and a half long, by one mile broad; low, covered with wood, and surrounded by shoals, which render it dangerous for boats to land. It has fresh water, and abounds with turtle. It belongs to the Burmese, and is uninhabited. Long. 94. 12. E. Lat. 15. 51. N.

DIAMPER, a town of Hindustan, in the province of Cochin, said to be inhabited chiefly by Christians. Here a synod was held by the Portuguese archbishop and others, in the hopes of converting the Nestorians to the faith of the Roman Catholic church, but without effect. Long. 76. 37. E. Lat. 9. 55. N.

DIANA, the goddess of hunting. According to Cicero, there were three of this name; a daughter of Jupiter and Proserpine, who became mother of Cupid; a daughter of Jupiter and Latona; and a daughter of Upis and Glauce. The second is the most celebrated, and to her all the ancients allude. She was born at the same birth as Apollo; and the pains which she saw her mother suffer during her labour gave her such an aversion to marriage, that she obtained permission of her father to live in perpetual celibacy, and to preside over the travails of women. In order to shun the society of men, she devoted herself to hunting, and was always accompanied by a number of chosen virgins, who, like herself, abjured the use of marriage. She is represented with a bow and quiver, and attended by dogs, and sometimes drawn in a chariot by two white stags. Sometimes she appears with wings, holding a lion in one hand, and a panther in the other, with a chariot drawn by two heifers, or two horses of different colours. She is represented as tall; her face has something manly in it; her legs are bare, well shaped, and strong; and her feet are covered with a buskin worn by huntresses among the ancients. She received many sirnames, particularly from the places where her worship was established, and from the functions over which she presided. She was called *Lucina*, *Ilythia*, or *Juno Pronuba*, when invoked by women in childbed; and *Trivia* when worshipped in the crossways, where her statues were generally erected. She was supposed to be the same as the moon and Proserpine or Hecate, and from that circumstance she was called *Triformis;* and some of her statues represented her with three heads, namely, those of a horse, a dog, and a boar. She was also called *Agrotera*, *Orithia*, *Taurica*, *Delia*, *Cynthia*, *Aricia*, and the like. She was supposed to be the same as the Isis of the Egyptians, whose worship was introduced into Greece along with that of Osiris under the name of Apollo. When Typhon waged war against the gods, Diana, to avoid his fury, metamorphosed herself into a cat. She is generally known in the figures representing her, by the crescent on her head, by the dogs which attend her, and by her hunting habit. The most famous of her temples was that of Ephesus, which formed one of the seven wonders of the world. (See EPHESUS.) She was there represented with a great number of breasts, and other symbols, which signified the earth or Cybele. Though she was the patroness of chastity, yet she forgot her dignity in order to enjoy the company of Endymion; and the favours she granted to Pan and Orion are also recorded among the mythic scandal of antiquity. The inhabitants of Taurica were particularly attached to the worship of this goddess, and they cruelly offered on her altar all the strangers who suffered shipwreck on their coasts. Her temple in Africa was always served by a priest who had murdered his predecessor; and the Lacedæmonians yearly offered her human victims till the age of Lycurgus, who changed this barbarous custom for the sacrifice of flagellation. The Athenians generally offered her goats; and others a white kid, and sometimes a boar pig or an ox. Among plants, the poppy and the dittany were sacred to her. Diana, as well as her brother Apollo, had some oracles, among which those of Egypt, Cilicia, and Ephesus, are the best known.

DIANA'S BANK, or DIANA'S SHOAL, a small sandy islet in the Indian Sea, scarcely visible from the masthead, its situation lying so low. Long. 151. 5. E. Lat. 15. 45. S.

DIANÆ ARBOR, or ARBOR LUNÆ, in *Chemistry*, the beautiful arborescent form of silver, dissolved in nitric acid, and precipitated by another metal; so called from its resembling the trunk, branches, and leaves of a tree.

DIANO, a city of Italy, in the Neapolitan province Principato Citeriore, containing 4146 inhabitants.

DIAPASON, in *Music*, a musical interval, which most authors who have written on the theory of music use to express the octave of the Greeks.

DIAPASON, among the musical instrument makers, a kind of rule or scale by which they adjust the pipes of organs, and cut the holes of hautboys, flutes, and the like, in due proportion for performing the tones, semitones, and concords, with precision.

DIAPASON Diaex, in *Music*, a kind of compound concord, of which there are two sorts; the greater, which is in the proportion of 10:3; and the lesser, in that of 16:5.

DIAPASON Diapente, in *Music*, a compound consonance in a triple ratio, as 3:9. This interval, says Martianus Capella, consists of nine tones and a semitone, nineteen semitones, and thirty-eight dieses. It is a symphony made when the voice proceeds from the first to the twelfth sound.

DIAPASON Diatessaron, in *Music*, a compound concord founded on the proportion of eight to three. To this interval Martianus Capella allows eight tones and a semitone, seventeen semitones, and thirty-four dieses. This is when the voice proceeds from its first to its eleventh sound. The moderns would rather call it the *eleventh*.

DIAPASON Ditone, in *Music*, a compound concord, whose terms are as 10:4, or as 5:2.

DIAPASON Semiditone, in *Music*, a compound concord, whose terms are in the proportion of 12:5.

DIAPENTE, in ancient music, an interval marking the second of the concords, and with the diatessaron an octave; in modern music it is called a *fifth*.

DIAPER, a kind of cloth on which are formed various figures, and which is chiefly employed for table-linen.

DIAPHANOUS, an appellation given to all transparent bodies, or such as transmit the rays of light.

DIAPHORETICS, among physicians, all medicines which promote perspiration.

DIAPHRAGM (*Diaphragma*), in *Anatomy*, a part vulgarly called the midriff, and by anatomists *septum trans-*

versum. It is a strong muscular substance, separating the breast or thorax from the abdomen or lower venter, and serving as a partition between the abdominal and the thoracic viscera. (See ANATOMY, *Index.*) Plato, as Galen informs us, first called it *diaphragm,* from the verb *διαφραττειν, to separate.* Till his time it had been called φρενες, from a notion that an inflammation of this part produced frenzy, which is not more warranted by experience than another tradition, that a transverse section of the diaphragm with a sword causes the patient to die laughing.

DIAPHORESIS (Διαφορησις), in *Rhetoric,* is used to express the hesitation or uncertainty of the speaker.

DIARBEKIR, a city of Asiatic Turkey, and capital of the pashalic of Diarbekir, situated on a mass of basaltic rock, which rises in an eminence on the western bank of the Tigris, the stream of that river flowing by the foot of this hill from north-east to south-west, as it makes a sharp bend in that direction from the northward. The form of the town is very nearly circular. It is about three miles in circuit, and is encompassed by a lofty thick wall of black stone. This wall, which is supposed to be a work of the Romans, is fortified by numerous round and square towers at irregular intervals, which being high, and strongly built of hewn stone, present an appearance of great strength. The most strongly fortified portion of the city is on the north, where the square towers are very thickly placed, and there is a long battery of guns mounted, pointing through covered embrasures; but the whole is now in a neglected and ruinous condition. The town is also environed by a ditch. The city has four gates, which lead to Mardin, to Asia Minor or Rumelia, to the mountains of Armenia and Koordistan, and to the river. The citadel, standing about midway between the two last-mentioned gates, is thus in the north-east angle of the town, and, seated on the eminence of rock in that quarter, overlooks the stream of the Tigris below, and, by its elevation, commands the whole of the town. It is surrounded by a wall, is divided into many courts, and contains the palace of the pasha, which is rather a commodious than a splendid building. Attached to it are extensive stables and an open space, in which the horses and the horsemen are exercised. One of the places used as a stable presents the ruins of a handsome and noble edifice, with finely-constructed domes of brickwork, and a beautiful door with columns and pilasters, the remains, as Mr Buckingham observes, of an old Christian building. The citadel is now almost completely in ruins. There is a fine view of the town from this height. The houses are built of black basalt in the lower stories, and of dark-coloured brick in the upper ones; this, with a succession of flat terraces, gives a sameness and gloominess to the aspect of the town, which, however, is somewhat relieved by the view of the mosques, towers, and little garden-plots seen in different parts of the town. The houses present a handsome appearance, and many of them are elegant. Of the mosques seen from the citadel, there are fifteen with minarets, nine having circular shafts and galleries in the Mahommedan style, and the remaining six having square towers, after the manner of Christian churches. There are five other mosques with domes or cupolas only, and several smaller ones, making altogether twenty-five Mahommedan places of worship. Among the minarets of the mosques, some were observed by Mr Buckingham, to whose travels in Mesopotamia we are chiefly indebted for this account of Diarbekir, to be highly sculptured; and in several of the square towers were intermixed layers of red burnt brick, mixed with masonry of stone, after the manner of the Roman towers in the walls of Antioch. Amidst the ruins of the castle some fine arches of highly burnt bricks were also observed, which, from their form, as well as material, looked more like Roman than Saracenic work. The bazars and baths contain brick work of a similar kind, which Mr Buckingham thinks is decidedly Mahommedan. Broken columns of black coral are seen scattered in different quarters of the town; and among these are several Ionic capitals of Greek origin. Of the Christian churches, the Armenians have two, one of them large and richly decorated, and the other smaller, but more tastefully adorned. The Catholics have one church, with a convent attached to it; the Syrians and the Greeks have also each a place of worship; and the Jews have a small synagogue for their service. There are upwards of twenty baths in the town, and about fifteen khans or caravanserais. The Khan Hassan Pasha is particularly fine; and in its lower court the corn-market is usually held. Its magazines within the piazza, which runs round this, are generally filled with goods. In the upper galleries are carried on several trades and manufactures. There are also convenient lodgings here for travellers; and there is an upper story, with apartments for the harems or families of those who may sojourn here, with kitchens, fire-places, and other domestic conveniences. The bazars are well supplied with goods of all descriptions, and during the hours of business are thronged with people. They are, however, narrow, crooked, and mostly roofed over with wood, being neither so regularly laid out, nor so well covered in, as they generally are in the large towns of Turkey. The manufactures of the town are chiefly silk and cotton stuffs, printed muslins, shawls, and handkerchiefs, morocco leather in skins of all colours, smiths' work in hardware, and pipes for smoking, made of the jasmin branch, covered with muslin, and embroidered with gold and silver thread. About 1500 looms are supposed to be employed in the weaving of stuffs; and there are about 300 printers of cotton, with as many manufacturers of leather in the skin, besides shoemakers, saddlers, and other workmen. There are 100 smiths, and 150 makers of ornamented pipe-stems, besides those who make the clay-bath, amber mouth-pieces, &c. European cloths are introduced here through Aleppo, as well as most of the glass-ware, which is of German manufacture; fine muslins, Cashmere shawls, spices, and drugs, are brought from India through Bagdad. The common manufactures for domestic uses are supplied at home, and provisions and fruit are abundant and cheap.

The governor of the pashalic and city of Diarbekir has the dignity of three tails, and is immediately dependent on the sultan. He has a force under him of 1000 men, of whom more than one half are Turkish cavalry, and the remainder Turkish and Albanian foot. There are, besides, several petty chiefs among the Turks and the Koords, who are bound, for certain privileges which they enjoy, to furnish each his contingent of troops on the pasha's requisition. The people, though accustomed to despotic rule, consider the government of the pasha as secure; though, according to Mr Buckingham, there were few Turkish towns in which there seemed to be more of personal liberty, competence, and comfort, among all classes of people.

From the circumstance of the walls and buildings of this city being constructed almost wholly of black stone, it is called by the Turks Kara Amid, or the Black Amid. Its ancient name was Amida; the name of Diarbekir proceeds chiefly from the Arabs, as the name of Amid is still used by the Turks in all their public writings. Amida was successively taken, retaken, and destroyed, in the ancient wars between the Persians and Romans. It was pillaged by Tamerlane in the year 1393; and successive sieges and captures followed by the Persian kings, until it was conquered and taken by Selim, the first sultan of the Osmanlee Turks, in the year 1515. In 1605 it again fell under the power of Persia; but it was afterwards retaken by the Turks, under whose dominion it has since continued. General Gardanne computes the population at 80,000, Macdonald Kinneir at 38,000, and Mr Buckingham, the latest traveller, at 50,000. The great majority consist of Osmanlee Turks, who are soldiers, government officers, merchants, and mechanics. The Armenians, who are the next numerous class, amount to 1000 families. The Arab, Turkish, and Armenian followers of the Catholic communion number 500 families, the Syrian sect 400, and the Greeks about 50 families. Almost all the Jews have of late emigrated to Bagdad, Aleppo, or Constantinople. The inhabitants of Diarbekir are thought to be more fanatical in their hatred of Christians than in other parts of the empire. This place is 187 miles north-west of Mardin, 220 north-east of Orfah, and 350 north-east of Aleppo. Long. 39. 52. E. Lat. 37. 55. N.

DIARTHROSIS, in *Anatomy*, a kind of articulation or juncture of the bones, which, being pretty lax, affords room for a manifest motion. The word comes from δια, and αρθρον, *juncture*. It is opposed to *synarthrosis*, in which the articulation is so close that there is no sensible motion at all.

DIARY, a term sometimes used for a journal or day-book, containing an account of every day's proceedings.

DIASCHISM, among musicians, denotes the difference between the comma and enharmonic diesis, commonly called the *lesser comma*.

DIASTOLE, among physicians, signifies the dilatation of the heart, auricles, and arteries; and is opposed to the *systole*, or contraction of the same parts. See ANATOMY.

DIASTOLE, in *Grammar*, a figure in prosody by which a syllable naturally short is made long.

DIASYRMUS, in *Rhetoric*, a kind of hyperbole, being an exaggeration of some low and ridiculous thing.

DIATESSARON, among ancient musicians, a concord or harmonic interval, composed of a greater tone, a less tone, and one greater semitone; its proportion in numbers is as 4 : 3.

DIATONIC, in *Music*, a word compounded of the Greek preposition δια, signifying transition, and τονος, tension, is indifferently applied to a scale or gammut, to intervals of a certain kind, or to a species of music, whether in melody or harmony, composed of these intervals. Thus we say the *diatonic* series, a *diatonic* interval, *diatonic* melody or harmony. The diatonic scale forms the system of diatonic music, and consists of diatonic intervals.

DIBBLE, or DIBBER, a simple but useful instrument in gardening, used for planting all sorts of young plants or slips.

DICE, among gamesters, certain cubical pieces of bone or ivory, marked with dots on each of their faces, from one to six, according to the number of faces.

Sharpers have several ways of falsifying dice; first, by sticking a hog's bristle in them, so as to make them run high or low as they please. Secondly, by drilling and loading them with quicksilver, which is found out by holding them gently by two diagonal corners, when, if false, the heavy sides will turn always down. Thirdly, by filing and rounding them. But all these ways fall very far short of the art of the dice-makers, some of whom are so dexterous this way that a gambling sharper will give any money for their work.

DICÆARCHUS, a scholar of Aristotle, who composed a great number of books, which were much esteemed. Cicero and his friend Pomponius Atticus valued him highly. He wrote a book to prove that men suffer more mischief from one another than from all evils besides; and the work which he composed concerning the republic of Lacedæmon was extremely honoured, and read every year before the youth in the assembly of the ephori. Geography was one of his principal studies, on which science there is a fragment of a treatise of his still extant, and preserved among the *Veteris Geographiæ Scriptores minores*.

DICHOTOMY, a term used by astronomers for that phasis or appearance of the moon in which she is bisected, or shows just half her disk. In this situation the moon is said to be in a quadrate aspect, or to be in her quadrature.

DICKER, in old writers, denotes the quantity of ten hides of skins of which twenty made a last; also ten pairs of gloves, ten bars of iron, and the like, are sometimes expressed by the term *dicker*.

DICKINSON, EDMUND, a celebrated English physician and chemist, was born in 1624. He studied and took his degrees at Merton College, Oxford; and in 1659 published his *Delphi Phœnicizantes*, in which he attempted to prove that the Greeks borrowed the story of the Pythian Apollo, and all that rendered the oracle at Delphos famous, from the Holy Scriptures, and particularly the book of Joshua; a work which procured him great reputation both at home and abroad. He practised physic first at Oxford; but removing to London in 1684, his good fortune in recovering the Earl of Arlington from a dangerous sickness procured his promotion as a physician in ordinary to Charles II. and to his household. As that prince understood and loved chemistry, Mr Dickinson grew into great favour at court, and was continued in his appointments under James II. After the abdication, he retired from practice, and died in 1707. He published many other things, *Physica vetus et vera*, containing a system of philosophy, chiefly framed on principles collected from the Mosaic history.

DICTATOR, a magistrate at Rome invested with regal authority. This officer was first chosen during the Roman wars against the Latins. The consuls being unable to raise forces for the defence of the state, because the plebeians refused to inlist if they were not discharged of all the debts which they had contracted with the patricians, the senate found it necessary to elect a new magistrate with absolute and uncontrollable power to take care of the state. The dictator remained in office for six months, after which he was again elected if the affairs of the state seemed to be desperate; but if tranquillity was re-established, he generally resigned his power before the time had expired. He knew no superior in the republic, and even the laws were subjected to him. He was called dictator, because *dictus*, named by the consul, or *quoniam dictis ejus parebat populus*, because the people implicitly obeyed his command. He was named by the consul in the night, *viva voce*, and his election was confirmed by the augurs. As his power was absolute, he could proclaim war, levy forces, conduct them against an enemy, and disband them at his pleasure. He punished as he pleased, and from his decision there lay no appeal, at least till later times. He was preceded by twenty-four lictors with the *fasces*; and during his administration, all other officers, except the tribunes of the people, were suspended. In short, he was the master of the republic. But amidst all this independence he was not permitted to go beyond the borders of Italy; he was always obliged to march on foot in his expeditions; and he never could ride in difficult and laborious marches without previously obtaining formal leave from the people. He was chosen only when the state was in imminent danger from foreign enemies or inward seditions. In the time of a pestilence a dictator was sometimes elected, as also in order to hold the *comitia*, or to celebrate the public festivals, or drive a nail into the capitol, by which superstitious ceremony the Romans believed that a plague could be averted or the progress of an enemy stopped. But this office, so respectable and illustrious in the first ages of the republic, became excessively odious by the usurpations of Sylla and Julius Cæsar; and after the death of the latter, the Roman senate passed a decree abolishing for ever the dictatorship in Rome. The dictator, as soon as elected, chose a subordinate officer, who was called his master of horse, *magister equitum.* This officer was respectable; but he was totally subservient to the will of the dictator, and could do nothing without the express order of the latter. This subordination, however, was some time afterwards removed; and during the second Punic war the master of the horse was invested with a power equal to that of the dictator. A second dictator was also chosen for the election of magistrates at Rome after the battle of Cannæ. The dictatorship was originally confined to the patricians; but the plebeians were afterwards admitted to share it. Titus Lartius Flavus was the first dictator, in the year of Rome 253.

DICTIONARY, in its original acceptation, is the arranging of all the words of a language according to the order of the alphabet, and annexing a definition or explanation to each word. When arts and sciences began to be improved and extended, the multiplicity of technical terms rendered it necessary to compile dictionaries, either of science in general, or of particular sciences, according to the views of the compiler.

DICTIONARY *of the English Language.* The design of every dictionary of language is to explain, in the most accurate manner, the meaning of every word; and to show the various ways in which it can be combined with others, in as far as this tends to alter or modify its meaning. The dictionary which does this in the most accurate manner is the most complete work of the kind; therefore the principal study of a lexicographer ought to be to discover the method which may seem best adapted for that purpose. Dr Johnson, with great labour, has collected the various meanings of every word, and quoted the authorities; but it would have been an improvement if he had given an accurate definition of the precise meaning of every word; pointed out the way in which it ought to be employed with the greatest propriety; showed the various deviations from the original meaning, which custom had so far established as to render allowable; and fixed the precise limits beyond which it could not be employed without becoming a vicious expression. With this view it would have been necessary to exhibit the nice distinctions which take place between words nearly synonymous, and without which many words can only be defined in such a manner that they must be considered as exactly synonymous. We omit making any quotations from Johnson in order to point out these defects; and shall content ourselves with giving a few examples, to show in what manner, according to our idea, a dictionary of the English language ought to be compiled.

IMMEDIATELY, *adv. of time.*

1. Instantly, without delay. Always employed to denote future time, and never past. Thus we may say, *I will come immediately;* but not *I am immediately come from such a place.* See PRESENTLY.
2. Without the intervention of any cause or event; as opposed to *mediately.*

PRESENTLY, *adv. of time.*

1. Instantly, without delay. Exactly synonymous with *immediately;* being never with propriety employed to denote any thing but future time.
2. Formerly it was employed to express present time. Thus, *The house presently possessed by such a one,* was often used, but this has now become a vicious expression; and we ought to say, *The house possessed at present.* It differs from *immediately* in this, that even in the most corrupt phrases it never can denote past time.

FORM, *subst.* The external appearance of any object, when considered only with reference to shape or figure. This term, therefore, in the literal sense, can only be applied to the objects of sight and touch, and is therefore nearly synonymous with *figure;* but these terms differ in some respects. *Form* may be employed to denote more rude and unfinished shapes; *figure,* those which are more perfect and regular. *Form* can never be employed without denoting matter, whereas *figure* may be employed in the abstract: thus we say a square or a triangular *figure,* but not a square or triangular *form.* And in the same manner we say the *figure* of a house; but we must denote the substance which forms that figure if we use the word *form;* as, *a cloud of the form of a house.* See FIGURE.

2. In contrast to irregularity or confusion. As beauty cannot exist without order, it is by a figure of speech employed to denote beauty, order, and the like.
3. As *form* respects only the external appearance of bodies, without regard to their internal qualities, it is, by a figure of speech, employed in contrast to these qualities to denote empty show, without essential qualities. In this sense it is often taken when applied to religious ceremonies, pageantry, and so forth.
4. As *form* is employed to denote the external appearance of bodies, so, in a figurative sense, it is applied to reasoning, denoting the particular mode or manner in which this is conducted; as, *the form of a syllogism,* &c.
5. In the same manner it is employed to denote the particular mode of procedure established in courts of law; as, *the forms of law, religion,* and the like.
6. *Form* is sometimes, although improperly, used to denote the different circumstances of the same body; as, *water in a fluid or a solid form.* But as this phrase regards the internal qualities rather than the external figure, it is improper, and ought to be, *water in a fluid or a solid state.*
7. But when bodies of different kinds are compared with one another, this term may be employed to denote other circumstances than shape or figure; for we may say, *a juice exuding from a tree in the form of wax or resin;* although, in this case, the consistence, colour, &c. and not the external arrangement of parts, constitutes the resemblance.
8. From the regular appearance of a number of persons arranged in one long seat, such persons so arranged are sometimes called a *form;* as, *a form of students,* &c. And,
9. By an easy transition the seat itself has also acquired that name.

GREAT, *adj.* A relative word, denoting largeness of quantity, number, &c., serving to augment the value of those terms with which it is combined, and opposed to *small* or *little.* The principal circumstances in which this word can be employed are the following:

1. When merely inanimate objects are considered with regard to quantity, *great* is with propriety employed to denote that the quantity is considerable: as, *a great mountain, great house,* and the like; and it is here contrasted with *small.* When *great* is thus employed, we have no other word which is exactly synonymous.
2. When inanimate objects are considered with regard to their extent, this term is sometimes employed, although with less propriety; as, *a great plain, a great*

field, and the like. In this sense it is nearly synonymous with *large;* and these terms were often used indiscriminately, but with some difference of meaning; for, as *large* is a term chiefly employed to denote extent of superficies, and as *great* more particularly regards the quantity of matter, therefore, when *large* is applied to any object which is not merely superficial, it denotes that it is the extent of surface which is there meant to be considered, without regard to the other dimensions; whereas, when the term *great* is employed, it has reference to the whole contents. If, therefore, we say *a large house*, or *a large river*, we express that the house, or the river, has a surface of great extent, without having any necessary connexion with the size in other respects. But if we say *a great house*, or *a great river*, it at once denotes that these objects have not only a large surface, but are also of great size in every respect.

3. *Great*, when applied to the human species, never denotes the size or largeness of body, but is applied solely to the qualities of the mind. Thus when we say that *Socrates was a great man*, we do not mean that he was a man of great size, but that he was a man who excelled in the endowments of the mind. The terms which denote largeness of size in the human body are *big*, *bulky*, *huge*.
4. *Great* is sometimes applied to the human species, as denoting high rank. In this case it is oftener used in the plural number than otherwise. Thus we say simply *the great*, meaning the whole body of men in high station, as opposed to the *mean*. It should seldom be employed in this sense, as it tends to confound dignity of rank with elevation of mind.
5. As this is a general term of augmentation, it may be joined with all nouns which denote *quantity*, *quality*, *number*, *excellence*, or *defects;* or such as imply *praise*, *blame*, *anger*, *contempt*, or any other affection of the mind.
6. It is employed to denote every step of ascending or descending consanguinity, as *great-grandfather*, *great-grandson*, and so on.

High, *adj.* Exalted in a perpendicular direction at a distance from the surface of the earth, and opposed to *low*.

1. *High* is a term altogether indefinite, and is employed to express the degree of elevation of any inanimate body. Thus we say *a high mountain*, *a high house*, *steeple*, *tower*, *pillar*, and the like. Nor is there any other word which can here be considered as synonymous; *lofty* being employed only to denote a very eminent degree of elevation.
2. To express the perpendicular elevation of vegetables either *high* or *tall* may be employed, as being in this case nearly synonymous. We may therefore say a *high* or *tall tree*, a *high* or *tall mast*, and so forth, but with this difference between these two expressions, that *tall* can be more properly applied to those which are much elevated and of small dimensions; and *high*, to such as are more bulky and of greater size.
3. The perpendicular height of man can never be expressed by the word *high*, *tall* being here the proper expression. And although *high* is sometimes used to express the height of other animals, yet it seems to be an improper expression. See Tall.
4. *High*, when applied to the human species, always refers to the mind, and denotes *haughtiness*, *stateliness*, *pride*, and when combined with expressions indicating energy of mind, it denotes that in a higher degree. In this sense it is opposed to *meanness*, *abjectness*, and *humility*.
5. As this is an indefinite term, tending to denote any thing which is elevated above us, it may be combined with almost every noun which admits of this elevation. Hence, as objects high above us are always out of our reach, it is in a metaphorical sense used to denote any thing which seems to be above the ordinary condition of mankind, or those qualities or endowments of mind which are not easily acquired; as, *dignity* or *elevation of sentiment*, *dignity of rank*, *acuteness in reasoning on difficult subjects*, *pride*, *haughtiness*, or any other quality which seems beyond the ordinary level of mankind; *dearness of price*.
6. In the same manner we apply this term to time, which having a metaphorical resemblance to a river flowing on with an unceasing current through all successive ages, any thing of remote antiquity is denoted by the term *high*.
7. Likewise to those degrees of latitude far removed from the line, where the pole becomes more elevated.
8. And also to some particular crimes, as being attended with peculiar degrees of guilt, as *high treason*.

Tall, *adj.* Something elevated to a considerable degree in a perpendicular direction, and opposed to *low*.

1. This term is chiefly employed to express the height of man and other animals; and is applied to denote the height of the body only, without having any reference to the mind. When applied to man, no other word can be substituted in its stead; when applied to other animals, *high* is sometimes considered as nearly synonymous. See High.
2. It is likewise employed to denote the perpendicular height of vegetables, and in this case it is nearly synonymous with *high*. See High.
3. It can in no case be employed to express the height of merely inanimate objects, as we can never say a *tall steeple*, *tower*, or *pillar*, but a *high steeple*, &c. For the distinctions in these cases, see High.

Long, *adj.* A relative term, denoting the distance between the extremes of any body which is extended more in one of its geometrical dimensions than in another. It is opposed to *short*.

1. This term may be applied to all inanimate objects, of whatever kind, whose dimensions in one way exceed their dimensions in the other, and when not in an erect posture, whatever be the other circumstances attending them, whether it relates to superficies alone or to solid bodies, whether these be bounded or open, straight or crooked, flexible or rigid, or in any other circumstances whatever: thus we say *a long* or *short line*, *a long* or *short ridge*, *street*, *ditch*, *rope*, *chain*, *staff*, and the like. But it is to be observed, that although *long* is in the strict sense only opposed to *short*, yet as it expresses the extension of matter in one of its geometrical proportions, it is often contrasted by those words which express the other proportions when we mean only to describe the several proportions; as, *a table long and broad*. And as these several dimensions are expressed by different words, according to the various forms, modifications, and circumstances in which bodies are found, therefore it is in this sense contrasted by a great diversity of terms; as, *a long and broad* or *wide*, *narrow* or *strait*, *street* or *lane; a long and thick* or *small rope*, *chain*, *staff*. For the distinctions in these cases see Broad, Wide, &c.
2. Objects necessarily fixed in an erect position can never have this term applied to them, and therefore we cannot say *a long*, but a *high tower* or *steeple*. And for the same reason, while trees are growing and fixed in an erect position, we cannot apply this term to them; but when they are felled and laid upon the

ground, it is quite proper and necessary. Thus we do not say *a long*, but *a tall* or *high tree*, while it is growing; but we say *a long*, not *a tall log of wood;* and in the same manner we say *a tall mast* when it is fixed in the ship, but *a long mast* while it lies upon the beach. See Tall and High.

3. Those vegetables which are of a tender, pliant nature, or so weak as not to be able to retain a fixed position, being considered as of a middle nature between erect and prostrate bodies, admit of either the terms *long, tall*, or *high;* as, *a long* or *tall rush* or *willow wand*, or *a long, tall*, or *high stalk of corn*. See High and Tall.
4. The parts of vegetables, when considered as distinct from the whole, even when growing and erect, assume the term *long;* for we do not say *a tall*, but *a long shoot of a tree*, and *a tree with a long stem*, in preference to *a tree with a high stem*.
5. For the same reason, a staff and pole, even when fixed in a perpendicular direction, assume the word *long*, in preference to *tall* or *high*.
6. With regard to animals, the general rule is applied, without any exceptions; *tall*, and not *long*, being employed to denote the height of the human body when in an erect posture; and *long*, and not *tall*, to denote its length when in an incumbent situation. *Long* applied to all other animals which do not walk erect, always denotes their greatest length in a horizontal position from head to tail.
7. In a figurative sense, it denotes, with regard to time, any thing at a great distance from us.
8. As also, any thing that takes up much time before it is finished, as, *a long discourse, a protracted note in music*, and the like.

Broad, *adj.* The distance between the two nearest sides of any body whose geometrical dimensions are larger in one direction than in another. It has a reference to superficies only, and never to the solid contents, and is opposed to *narrow*.

1. *Broad*, in the strictest acceptation, is applied to denote those bodies only whose sides are altogether open and unconfined; as, *a broad table, a broad wheel*, &c. and in these cases it is invariably contrasted with *narrow;* nor is there any other word which in these cases can be considered as synonymous with it, or be used in its stead.
2. When any object is in some sort bounded on the sides, although not quite closed up, as a road, street, ditch, and the like, either *broad* or *wide* may be employed, but with some difference of signification; *broad* being most properly used for those which are more open, and *wide* for those which are more confined: nor can this term be ever applied to such objects as are closely bounded all around, as a house, a church, and the like, *wide* being here employed. For the more accurate distinctions in these cases see the article Wide.

Wide, *adj.* A term employed to denote relative extent in certain circumstances, and opposed to *narrow* and *strait*.

1. This term is in its proper sense applied only to denote the space contained within any body closed all round and on every side; as, a house, gate, or the like; and it differs from *broad* in this, that it never relates to the superficies of solid objects, but is employed to express the capaciousness of any body which contains vacant space; nor can capaciousness in this sense be expressed by any other word but *wide*.
2. As many bodies may be considered either with respect to their capaciousness or superficial extent, in all these cases either the term *broad* or *wide* may be used; as, *a broad* or *wide street* or *ditch*, &c.; but with a greater or less degree of propriety, according to the circumstances of the object, or the idea which we wish to convey. In a street where the houses are low and the boundaries open, or in a ditch of small depth and large superficies, as this largeness of superficies bears the principal proportion, *broad* would be more proper; but if the houses are of great height, or the ditch of great depth, and capaciousness is the principal property which affects the mind, we would naturally say *a wide street* or *ditch;* and the same may be said of all similar cases. But there are some cases in which both these terms are applied, with a greater difference of meaning; thus we say *a broad* or *a wide gate*. As the gate, however, is employed to denote either the aperture in the wall, or the matter which closes that aperture, these terms are each of them used to denote that particular quality to which they are generally applied; and as the opening itself can never be considered as a superficies, the term *wide*, in this case, denotes the distance between the sides of the aperture; whilst, on the contrary, *broad* denotes the extent of matter fitted to close that aperture; nor can these two terms be in any case substituted for one another.
3. As a figurative expression, it is used as a cant phrase for a mistake; as, *you are wide of the mark;* that is, not near the truth.

Narrow, *adj.* A relative term, denoting a proportional smallness of distance between the sides of the superficies of plain bodies, and opposed to *broad*.

1. As this is only applied to superficies, it is exactly contrasted by *broad*, and is applied in all cases where the term *broad* can be used (see Broad); and in no other case but as a contrast to it, excepting the following.
2. It sometimes is employed to describe the smallness of space circumscribed between certain boundaries, as opposed to *wide*, and nearly synonymous with *straight;* thus we say *a wide* or *a narrow house, church*, and the like. For the necessary distinctions here, see the article Strait.
3. In a figurative sense it denotes *parsimony, poverty, confined sentiments*, and so forth.

Strait, *adj.* A relative term, denoting the extent of space in certain circumstances, and opposed to *wide*. See Wide.

1. This term is employed, in its proper sense, to denote only space, as contained between surrounding bodies in such circumstances as to denote some degree of confinement, and is exactly opposed to *wide;* as, *a wide* or *a strait gate*, &c. See Wide.
2. So necessary is it that the idea of confinement should be connected with this word, that in all those cases where the space contained is large, as in a church or house, we cannot express a smaller proportional width by this term. And as we have no other word to express space in these circumstances, we are obliged to force the word *narrow* from its natural signification, and make it express this. See Narrow.
3. In some particular cases, *narrow* or *strait* may be applied to the same object; as, *a narrow* or *a strait line;* but here *strait* is never employed except where an idea of confinement is suggested, and where it is exactly contrasted to *wide;* nor can *narrow* be employed except in such circumstances where *broad* would be a perfect contrast to it. Therefore these two terms may be always used in the same circumstances as those which contrast with them. For an account of these see Wide.

4. The term *strait* is likewise in a peculiar manner used to denote the smallness of the internal diameter of those bodies which are fitted to receive or contain others, as any kind of bag, tube, body clothes, mortises, and others of the same kind; and in all these cases this term may be employed to denote the smallness of their lesser diameter, and never the term *narrow*. But in certain circumstances the word *tight* may be substituted for it. See TIGHT.

5. *Strait*, in a figurative sense, denotes any sort of confinement of sentiment or disposition.

TIGHT, *adj.* A term employed in certain circumstances to denote the internal capacity of particular bodies, and nearly synonymous with *strait*.

This term is confined entirely to denote the smallness of the internal dimensions of such objects as are formed to cover, or to receive or contain, other solid bodies, and can be employed in no other case. And although it agrees with *strait*, in always denoting confinement, and by being applicable to the same species of objects, yet it differs in the following respects: 1. If there be any difference of the diameter of the objects to which the term *strait* can be applied, it has always reference to the smaller; yet *tight* may be applied to any sort of confinement, whether it regards the length or breadth. 2. *Strait* can be applied to all bodies of capacity when of small diameter, without any sort of reference to the nature of the substance which it may be capable of containing. For we can say *a strait bag, a strait sleeve, a strait mortise, a strait gate*, and so on, whereas *tight* can only be applied to any body when it is considered as having reference to another body which is intended to be contained in it, and is pinched from want of room. Thus we say *the sleeve of a coat is too tight for the arm, the mortise is too tight for the tenon*, and so forth; but we cannot say *the bag* or *the gate is too tight*, because they are fitted to receive any sort of objects. And hence it happens that in many cases the dimensions of the same body may be expressed by *tight* or *strait*, when considered in different circumstances. Thus we may say, *this sleeve is too strait*, when we look at a coat lying on the table and consider its proportions; but it is not till we have tried it upon the arm which it is intended to cover, that we call it *tight*. And we may say, *a gate is too strait* or *too tight;* but in the first case we consider it as being too confined for admitting objects to pass through it; and in the next, as being too confined with respect to the "leaves" which are to shut the aperture not allowing them space to move with freedom.

These examples may serve to give some idea of the plan of an English dictionary composed upon philosophical principles. But, besides the circumstances above enumerated, there are many others which would require particular attention in the execution of a work of this kind. In the English language a great variety of terms occur which denote matter under certain general forms or circumstances, without regarding the minute diversities that may take place; as the word *cloth*, which denotes matter as manufactured into a particular form, including under it all the variety of stuffs manufactured in that particular way, of whatever materials, colour, texture, or fineness they may be. The same may be said of *wood, iron, yarn*, and a great variety of terms of the same nature, some of which cannot assume any plural; whilst others admit of it in all cases, and others, again, admit or refuse it according to the different circumstances in which they are considered.

In a dictionary, therefore, all this variety of cases ought to be clearly and distinctly pointed out under each particular article. This is the more necessary, as some of these words have others formed from them which might be readily mistaken for their plurals, although they have a very different signification; as *clothes*, which does not denote any number of pieces of different kinds of *cloth*, but *wearing apparel*. The following example will illustrate this head.

WOOD, *subst.* A solid substance of which the trunks and branches of trees consist.

1. This term is employed to denote the solid parts of vegetables of all kinds, in whatever form or circumstances they are found. Nor does it admit of a plural with propriety, unless in the circumstances after mentioned; for we say, *many different kinds of wood*, in preference to *many kinds of woods;* or we say, *oak, ash*, or *elm wood*, not *woods*.
2. But where we want to contrast wood of one quality or country with that of another, it admits of a plural; for we say, *white woods are in general softer than red;* or, *West Indian woods are in general of greater specific gravity than the European woods*. But unless where the colour, or some quality which distinguishes it from growing wood, is mentioned, this plural ought as much as possible to be avoided, as it always suggests an idea of growing wood.
3. *Wood* likewise denotes a number of trees growing near one another, being nearly synonymous with *forest*. See FOREST. In this sense it always admits of a plural; as, *Ye woods and wilds whose melancholy gloom*, &c.

A dictionary cannot be reckoned complete without explaining obsolete words; and if the terms of the several provincial dialects were likewise given, it would be of great utility. Nor would this occupy much space, because a number of these words need no other explanation than to mark along with them the words which had come in their place, when there happened to be one perfectly synonymous; and in those cases where the same idea could not be expressed in modern language without a periphrasis, it would be of use to explain them distinctly; so that, when a writer found himself at a loss for a term, and was obliged to search for one beyond the bounds of his own language, he might take one of these, if he found it expressive and energetic, in preference to another drawn from a foreign language. This would at least have one good effect; it would render our language more fixed and stable, not to say more accurate and precise, than by borrowing from foreign languages. The following examples may serve to give some idea of the manner of treating this part of the work.

MOE, or MO, *adj.* An obsolete term still employed in the Scotch dialect, and by them pronounced *mae*, denoting a greater number, and nearly synonymous with *more;* but it differs in this respect, that in the Scotch dialect, *mae* and *mair* (English *more*) are each employed in their distinct sphere, without encroaching upon one another, *mae* being employed to denote number, but never quantity or quality, and *mair* to denote quantity and quality, but never number; thus they say *mae*, not *mair, apples, men*, &c. and *mair*, not *mae, cloth, earth, courage*, &c. See MAIR. Both these terms are supplied by the word *more*, which in the English language is applied indiscriminately to denote quantity, quality, and number. See MORE.

As the English language is so exceedingly irregular in the pronunciation, the same letter in the same situation often assuming sounds totally different in different words, it is impossible to establish any general rules on this subject which do not admit of many exceptions; therefore a dictionary is the best means of ascertaining and pointing out the proper pronunciations of words. For, if the writer first pointed out all the different sounds which the same letter could ever be made to express, and assigned to every particular sound which each letter could be made to assume, a particular mark, appropriated to denote that particular sound of the letter whenever it occurred, by placing these particular marks above the letters in the dictionary, the sound of each letter would be pointed out in all cases with the utmost certainty. It is impossible to illustrate this by examples, without first ascertaining all the sounds of each letter, which would lead into a discussion too long for this place.

We shall only further observe, that besides having the accented syllable of every word *properly* distinguished in a dictionary to assist in the pronunciation, the English language requires another essential improvement, namely, the use of accents to distinguish the meaning of *words* and *phrases*, which, although it is not so properly confined to a lexicographer, yet it is not quite without his sphere. Thus, the word *as* admits of two very different sounds, as well as different significations; for example, "Cicero was nearly *as* eloquent *as* Demosthenes;" in which the first *as* is pronounced *ass*, and the last is pronounced *az*. Now it often happens that, in reading, the particular way in which it ought to be understood is not pointed out by the context till after the word itself is pronounced, which has an equal chance at least of being pronounced wrong; whereas, if it were always accented when employed in the one sense, and not in the other, it would free the reader from this perplexity. There are other cases in which the proper use of accents in writing would be of great consequence; as at the beginning of a sentence when it is put as a question, or used ironically. But this does not so properly belong to the lexicographer as the grammarian.

The above examples, we hope, will be sufficient to give the reader some idea of the plan which we would propose, and will enable him to determine whether or not a dictionary, executed in this way, would convey to his mind a more perfect knowledge of the English language than those dictionaries which have hitherto been published. These examples are given rather with a view to show the manner in which a work of this kind may be conducted, than as perfect and unexceptionable explanations of the several articles there enumerated; and therefore we have not thought it necessary to produce any authorities, although we are sensible that they would be requisite in such a work.

DICTYMNIA, or DICTINNIA, in *Mythology*, were feasts celebrated at Lacedæmon and in Crete, in honour of Diana Dictymnia or Dictynnia, or of a nymph taken for her, who, having plunged herself into the sea to escape the passion of Minos, was caught in a fisherman's net or δικτυον, and hence the name.

DICTYS CRETENSIS, a very ancient historian, who served under Idomeneus, king of Crete, in the Trojan war, and wrote the history of that expedition in nine books. Tzetzes tells us that Homer formed his Iliad upon the plan of that history. It is, however, maintained that the Latin history of Dictys now extant is spurious.

DIDACTIC, in the schools, signifies the manner of speaking or writing adapted to teach or explain the nature of things. The word is formed from the Greek διδασκω, *doceo*, I teach.

There are many words which are only used in the didactic and dogmatic way; and there are also many works, ancient and modern, both in prose and verse, written after this method. Such are the Georgics of Virgil, Lucretius's poem *De Rerum Natura*, and Pope's Essays on Criticism and on Man.

DIDEROT, DENIS, a French writer and philosopher, was the son of a cutler, and born at Langrès in the year 1712. He received his education among the Jesuits, and being destined for the church by one of his uncles, who had a canonry to bestow upon him, he assumed the tonsure. But he discovered so little inclination for the ecclesiastical profession, that his father sent him to Paris to prosecute his studies, and afterwards placed him with an attorney. It soon appeared, however, that he was more attached to different departments of literature and science than disposed to submit to the drudgeries of the profession to which his father had destined him; and having neglected his business, his allowance was withheld, which obliged him to shift for himself, and to give lessons in order to procure a subsistence. The studies to which Diderot devoted his attention were extremely various. Physics, geometry, metaphysics, moral philosophy, and belles-lettres, were at different times the objects of his pursuit; and he even indulged in poetry and works of invention. But he attached himself chiefly to graver and more serious studies. Diderot possessed great fluency and animation of language in conversation; and this accomplishment, with a decisive tone and manner, procured him both partizans and protectors.

One of the first of his publications was a translation of Stanyan's *History of Greece*. In the year 1745 he published *Principles of Moral Philosophy*, 12mo, a work by which he obtained some reputation. But the year following, when he published a piece entitled *Pensées Philosophiques*, he acquired considerable celebrity. This work was highly commended by the partizans of the new philosophy, amongst whom he had now enlisted himself. The same work was afterwards reprinted under the title of *Etrennes aux Esprits Forts:* it was very much read, and is supposed to have contributed greatly to the diffusion of those free opinions which had now become so prevalent in France. Soon after this period, Diderot, in conjunction with D'Alembert, concerted the plan of that vast undertaking, the *Dictionaire Encyclopédique*. The professed object of this work was to form a magazine of every branch of human knowledge; but it has been alleged that it was also intended by the authors and editors as the great engine by means of which established opinions, whether of a religious or political nature, which they supposed had their origin in fraud and superstition, were to be subverted. The department of this work which was entrusted to Diderot was the description of arts and trades (*arts et métiers*). In fact, he was the principal architect of this great edifice; and, besides the Prospectus, and the *Système des Connaissances Humaines*, which has been much commended on account of its classification, he contributed many articles in various departments of science. But his writings in the Dictionary have been considered as extremely verbose and diffuse; and in all of them he is too fond of metaphysical subtilties and the pompous parade of scientific language. The first two volumes of the Dictionary appeared in the year 1751, and the first edition was completed and published in 1767; but although Diderot was occupied in this laborious undertaking for a period of nearly twenty years, the recompense which he obtained for his labours is said to have been extremely small.

During this time he composed various other works. Amongst these may be mentioned *A Letter on the Blind*, for the use of those who see. This work made a good deal of noise, and, in consequence of some of the sentiments it contained, gave offence to the government, for which reason the author was detained in confinement during six months at Vincennes. This piece was soon followed by another, entitled *A Letter on the Deaf and Dumb*, 2 vols. 12mo, 1751. The *Sixth Sense*, which was published in

1752; *Thoughts on the interpretation of Nature*, which appeared in 1754; and *The Code of Nature*, in 1755; are similar works, and may be ranked in the same class. His moral character was considerably affected by the publication of *Bijoux Indiscrets*, in two vols. 12mo, which is a collection of licentious tales; but for this he made some kind of compensation when he published two prose comedies, entitled *Le Fils Naturel*, 1757, and *Le Père de Famille*, 1758, which are not only interesting as dramatic pieces, but exhibit a pure and correct morality. The latter is considered as one of the best comedies of the sentimental kind which has appeared on the French stage, and it has accordingly been much admired. He afterwards published a pamphlet on Public Education, which undoubtedly contains some useful hints, but at the same time it proposes many things which are utterly absurd and impracticable. To the list of his works now mentioned we may add an eulogy on Richardson, which is full of warmth and enthusiasm; and an Essay on the Life and Writings of Seneca the Philosopher. This was his last production, and was published in 1779.

The character of Diderot suffered considerably from some defamatory attacks which he had made on his former friend Rousseau, who had quarrelled with the French philosophers, and had separated himself from their school. From the *Confessions* of the philosopher of Geneva, it would appear that they expected of him some anecdotes which would not have redounded much to their honour. In one of his letters Rousseau, speaking of Diderot, says, "Although born with a good heart and an open disposition, he had an unfortunate propensity to misinterpret the words and actions of his friends, and the most ingenuous explanations only supplied his subtle imagination with new interpretations against them."

Diderot was married and had a family; and, although he possessed considerable irritability of temper, he was, it seems, a kind husband and a tender parent. At the conclusion of the Dictionary, the state of his affairs having rendered it necessary for him to dispose of his library, it was purchased by the empress of Russia, who, with the king of Prussia, was at that time the great encourager of literature and literary men. These sovereigns were also considered as disciples of the French school. The price which Diderot received for his library was fifty thousand livres, and he was to have the use of it during his life. But some of his biographers, with what truth we know not, have not hesitated to charge him with disposing of it a second time; they state, that when some person commissioned by the empress wished to see it, the philosopher declined the visit on various pretences, until he had had time to fill it with books borrowed from booksellers. The examination, it is obvious, must have been extremely superficial, otherwise the truth would have been at once detected. Diderot had been admitted a member of the Academy of Sciences at Berlin; but the doors of the French Academy remained closed against him to the last. He died suddenly, as he rose from table, on the 31st July 1784. His literary and philosophical works were collected and published by his friend Naigeon, in 15 vols. 8vo, at Paris, in 1798. This collection has been enlarged, in subsequent republications, to 22 vols. 8vo, Paris, 1821; and it contains a Memoir of Diderot.

Diderot, it would seem, had a hand in several of the most remarkable works of his time, published under the names of others. "Who does not know," says Grimm, in his *Correspondance*, "that nearly a third of the *Histoire Philosophique* of Raynal belongs to him? He laboured on it during two years, and a considerable part of it was even composed under my own eyes. Diderot himself was often startled at the boldness with which he had made his friend the abbé speak. 'Who,' asked he, 'who will venture to subscribe this?' 'I,' replied the abbé, 'I will subscribe it; proceed, I tell you.' What man of letters is there who may not easily recognise in the book *De l'Esprit* (of Helvetius), and in the *Système de la Nature*, all the fine passages which are, and could only be, from the pen of Diderot? If we undertook to make a more complete enumeration, we should run the risk of naming many ungrateful individuals." (*Correspondance Littéraire, Philosophique, et Critique*, tom. iv. p. 85.) Grimm further states that Diderot furnished a great number of pages to the *Système de la Nature*, and that he likewise laboured, though to less extent, on the *Système Social* and the *Morale Universelle*, also published by Baron d'Holbach. Such were some of the indirect literary efforts of Diderot. But neither as a writer nor as a philosopher did he make for himself any very enviable reputation. As a writer he was decidedly a bad model; he had neither plan nor connection, and knew not how *proprie communia dicere*, whilst his style was deformed by obscurity, neologisms, and a tone of insufferable dogmatism; but nevertheless he was often vigorous, sometimes eloquent, and hit off happy traits of expression, as well as striking truths, which, however, would have gained much by being more simply enunciated. In fact, he had frequently the air of being *in cathedra;* he aimed at ambitious formularies, and fatigued by his strained style, by his prodigal sallies, and by an enthusiasm which seldom appeared natural. As a philosopher he wrote under the influence of a heated imagination rather than under that of cool reason. He was almost always exalted and extravagant; seldom or never simple and natural. His friends, however, have celebrated his goodness, his frankness, his easy and obliging character, and the vigour and *entraînement* of his conversation. Grimm, who has praised him warmly in his *Correspondance*, regards Diderot as having had the most naturally encyclopædiacal head of any man that ever lived. He admires his energy, his warmth, the variety of his ideas, the multiplicity of his acquirements, the impetuous tumult of his imagination, and the charm and irregularity of his conversation. Then he adds, "However willingly I may pardon all men for believing nothing, I think that it would have been very desirable for the reputation of Diderot, perhaps even for the honour of his age, if he had not been an atheist. The determined war which he thought himself obliged to carry on against God, caused him to lose the most precious moments of his life." (*Correspondance*, 3me partie, tom. iv. p. 87.) But Naigeon, who is less considerate than Grimm, praises his friend without qualification, adding, besides, that "his age has not done him justice." It is possible indeed that some persons may have too much depreciated the merit of Diderot; but others again exalted it beyond all measure. The general opinion in regard to him, however, seems now to be pretty well fixed, and posterity has at length put him in his right place. He had talent; he was capable of warmth and elevation; but he wanted sagacity, moderation, and taste. "He has written fine pages," says Marmontel in his *Mémoires*, "but he never knew how to make a book." He adopted a desolating and destructive system, and he dishonoured his cause by the exaggeration of most of his principles, and by the license which reigns in many of his productions. This explains the reason why he never entered the academy, whose doors, as we have already stated, were constantly shut against him, notwithstanding the anxious desire of his friends to procure him admission. Voltaire, who had himself solicited his election, appears latterly to have become less enamoured of the merit of Diderot, and even to have formally censured some of his works. D'Alembert also coolled towards him, and at last they did not even see each other. His rupture with

Rousseau, however, was the work of the latter, who began the war which was afterwards waged between them. But Diderot maintained his connection with Baron d'Holbach, whose sentiments approached the nearest to his own on several important points; and in the society of the baron he was relished and admired by reason of his facility in speaking on subjects of all sorts, and no doubt also by his antipathy to that creed, and to those institutions, which were no longer revered or respected. On this topic he never tired, and his friends often amused themselves with affording him opportunities to abandon himself to his imagination, or, in other words, to blaspheme for their diversion. In an unexcited state he exhibited constraint, awkwardness, timidity, and even a kind of affectation. He was never truly Diderot except when his fancy had transported him as it were beyond himself. Enthusiasm had become the condition of being most natural to his mind, nay, even to his voice and features; and he was himself only when in a state of intellectual inebriety. Grimm has reproached him with having consumed in fugitive conversations the time which he might have devoted to more durable labours; but Diderot loved to talk, especially when he could indulge his vehement volubility without interruption; for, as Voltaire once remarked on leaving a company where Diderot had engrossed the whole talk, "*Cet homme-là n'est pas propre pour le dialogue.*" The correspondence recently published has thrown but little new light on the character of this remarkable man, nor has it tended in any material degree to increase the estimation in which his talents and dispositions were previously held by the world.

DIDIER, St, a city of the department of the Upper Loire, in France, with 3203 inhabitants, who are employed chiefly in the silk manufacture.

DIDO, called also Elisa, a daughter of Belus, king of Tyre, who married Sichæus or Sicharbas, her uncle, who was priest of Hercules. Pygmalion, who succeeded to the throne of Tyre after Belus, murdered Sichæus in order to obtain possession of the immense riches which he had acquired; and Dido, disconsolate for the loss of her husband, whom she tenderly loved, and by whom she was equally esteemed, set sail in quest of a settlement with a number of Tyrians, to whom the cruelty of the tyrant had become odious. According to some accounts, she threw into the sea the riches of her husband which Pygmalion so greedily desired; and by this artifice compelled the ships which had come by order of the tyrant to obtain the riches of Sichæus to join in her flight. During her voyage Dido visited the coast of Cyprus, where she carried away fifty women who had prostituted themselves on the seashore, and gave them as wives to her Tyrian followers. A storm drove her fleet on the African coast, and she bought of the inhabitants as much land as could be covered by a bull's hide cut into thongs. Upon this piece of ground she built a citadel called *Byrsa;* and the increase of population, and the rising commerce among her subjects, soon obliged her to enlarge her city and extend the boundaries of her dominions. Her beauty, as well as the fame of her enterprise, gained her many admirers; and her subjects wished to compel her to marry Iarbas, king of Mauritania, who threatened them with a dreadful war. Dido begged three months to give her decisive answer; and during that time she erected a funeral pile, as if wishing by a solemn sacrifice to appease the manes of Sichæus, to whom she had promised eternal fidelity. When all was prepared, she stabbed herself on the pile in presence of her people; and by this uncommon action obtained the name of *Dido*, or valiant woman, instead of Elisa. According to Virgil and Ovid, the death of Dido was caused by the sudden departure of Æneas, of whom she had become deeply enamoured, and whom she could not obtain as a husband. This poetical fiction represents Æneas as living in the age of Dido, and introduces an anachronism of nearly 300 years. Dido left Phœnicia 247 years after the Trojan war, or the age of Æneas; that is, about 953 years before Christ. This chronological error proceeds not from the ignorance of the poets, but it is supported by the authority of Horace.

> Aut famam sequere, aut sibi convenientia finge.

Whilst Virgil, in a beautiful episode, describes the desperate love of Dido, and the submission of Æneas to the will of the gods, he at the same time gives an explanation of the hatred which existed between the republics of Rome and Carthage; and informs his reader that their mutual enmity originated from their very foundation, and was apparently kindled by a more remote cause than the jealousy and rivalship of two flourishing empires. Dido after her death was honoured as a deity by her subjects.

DIDYMUS of Alexandria, an ecclesiastical writer of the fourth century, who, though he is said to have lost his eyes at five years of age, when he had scarcely learned to read, yet applied so earnestly to study, that he attained all the philosophic arts in a high degree, and was thought worthy to fill the chair in the famous divinity school at Alexandria. He was the author of a great number of works; but all which we have now remaining are, a Latin translation of his book upon the Holy Spirit, in the works of St Jerome, who was the translator; short strictures on the Canonical Epistles; and a book against the Manicheans.

DIE, an arrondissement in the department of the Drome, in France, 946 square miles in extent. It is divided into nine cantons and 117 communes, and contains 60,518 inhabitants. The capital, a city of the same name, is situated on the right bank of the Drome. It has some silk mills and cloth manufactures, and contains 3421 inhabitants. Near to it is one of the wonders of Dauphiné, the inaccessible mountain, whose base and summit are of the same extent. Long. 5. 13. E. Lat. 44. 44. N.

DIEBURG, a city in the grand duchy of Hesse Darmstadt, once a small sovereignty of the Counts Lerchenfelds, but now mediatised. It contains 408 houses, and 2216 inhabitants.

DIEKIRCH, a city, the capital of the department of the same name, in the duchy of Luxemburg. The department is divided into six cantons, and contains a population of 47,074 persons. The city is situated on the river Eure, and contains 2627 inhabitants, who live by preparing gypsum, and by tanning leather.

DIEMEN'S Land. See Australasia.

DIEMERBROEK, Isbrand, a learned professor of physic and anatomy at Utrecht, was born at Montfort, in Holland, in 1609, where he acquired great reputation by his lectures and his practice, and died at Utrecht in the year 1674. He wrote a treatise on the plague, and several works on anatomy and medicine, which were printed at Utrecht in 1685, folio.

DIEPENDEEK, a town in the province of Limburg, in the Netherlands, on the river Demer, with 2136 inhabitants.

DIEPHOLZ, a county, forming with Hoya one of the provinces of the kingdom of Hanover. It extends over 266 square miles, or 170,240 acres, and contains 14,200 inhabitants. One part of it, called Auburg, was transferred in 1815 from Hesse Cassel. The only industry except agriculture is applied to the spinning and weaving of flax. The chief place of the same name is situated on the river Hunte, and contains 353 houses, with 2068 inhabitants.

DIEPPE, an arrondissement of the department of the Lower Seine, in France. It is 490 square miles in extent, and contains eight cantons, divided into 222 communes, with a population of 104,207 persons. The chief place is the city of the same name on the Seine, at the mouth of the river Arques. It is fortified on the sea and land sides, and is in the shape of an irregular triangle, whose longest side is towards the sea. It contains 3000 houses, and about 20,000 inhabitants, chiefly dependent on the commerce of the port. Being the best inlet for Paris, it is the great depôt for colonial goods, and the resort of foreign ships, especially of those from America. There are many manufactures, but principally of the kind connected with the equipment of ships; and, besides these, some sugar and salt refineries. From this port William the Conqueror sailed with his forces for England. Long. 0. 59. 7. E. Lat. 49. 55. 17. N.

DIERDORF, a town in the Prussian province of the Lower Rhine, formerly in the principality of Neuwied, and now belonging to the mediatised prince of that name, whose palace is there. It is situated on the river Holtzbach, and contains 1150 inhabitants.

DIES MARCHIÆ was the day of congress or meeting of the English and Scotch, annually appointed to be held on the marches or borders, in order to adjust all differences between them.

DIESIS, in *Music*, is the division of a tone less than a semitone; or an interval consisting of a less or imperfect semitone. Diesis is the smallest and softest change or inflexion of the voice imaginable; it is called a *faint*, and expressed by a St Andrew's cross or saltier.

DIESPITER, in *Antiquity*, a name given to Jupiter, and signifying *diei pater*, father of the day. St Augustin derives the name from *dies*, day, and *partus*, production or bringing forth, it being Jupiter who brings forth the day; and Servius and Macrobius were of the same opinion; the former adding, that in the language of the Osci they called him *Lucencius*, which means the same as *Diespiter* in Latin.

DIESSENHOFEN, a circle in the canton of Thurgau, in Switzerland, including the town of that name, in which are 1200 inhabitants, and a few villages.

DIETETICS.

THE necessity of aliment is explained by a knowledge of the functions of the body, and its selection depends upon the same principles. The living machine, as well as those that are inanimate, wastes in proportion as it is used, and this waste must be supplied. To learn the kind of supply required, the kind of waste and its mode must be ascertained.

General view of the subject.

The human body is of a very compound nature; indeed it is the most compound of all bodies, as well as the most complicated of all machines. It is composed of solids and fluids, and these again consist of various chemical elements in different states of combination. A great part of the mass of our bodies consists of water, and certain animal substances, to which chemists have given the name of fibrin, albumen, gelatin, mucus, and osmazone. Our bones consist principally of phosphate of lime. Besides these, some other principles enter into the composition of our bodies, though in comparatively small proportion. All the elementary matters of which these principles consist are continually discharged by the various excretions, but generally in states of combination different from those in which they existed as a part of our body. By the lungs a great deal of carbon and hydrogen is exhaled in the form of carbonic acid gas and vapour; by the skin carbon and hydrogen are also thrown off in considerable quantity; by urine, in addition to carbon, hydrogen, and oxygen, much azote, phosphorus, and lime, are discharged in the form of urea and the phosphate of lime; and by the alvine evacuation, not only the indigestible parts of our aliment are expelled, but also carbon, hydrogen, and azote, which formed integrant parts of our bodies, and have fulfilled their functions in the form of bile, mucus, and intestinal flatus. We therefore see that there is a constant waste of carbon, azote, hydrogen, oxygen, phosphorus, and lime, going on, which must be replaced. But there are only two sources from which this waste can be repaired, the atmosphere in which we live, and the aliment which we introduce into our stomach. The atmosphere consists of oxygen and azotic gases, and it is very doubtful whether any part of either be absorbed or converted into a part of our bodies. At least we may assume, that from the air no part of the materials to supply the waste of the body is derived. These must, therefore, be furnished entirely from the matters introduced into the stomach, and those which are calculated to restore any of the deficient elements or principles alone are alimentary. It is not at all necessary that these elements should be in the same state of combination with the principles whose loss they are to supply. It is sufficient that the elements be there, for it is the very essence of the function of digestion to analyse the alimentary matters, and reunite their elements into other combinations assimilated to our nature. From this view of the subject, it would however seem, that the more nearly the alimentary substances approach to the nature of the substances whose waste they are to supply, the less change upon them is necessary, and their digestion and assimilation will be more easy. Upon these principles, animal substances should be more easily digested than vegetable, and a larger proportion of their elements should be assimilated, while a smaller proportion should be separated to form excrementitious or indigestible compounds. In the same manner, vegetable substances are more digestible, and generate less excrementitious matter, than inorganic substances, which furnish only a small proportion of assimilable matter, and which must be separated from combinations totally foreign to our nature.

Besides alimentary substances properly so called, there is another class of substances which do not contribute much to repair the waste of our bodies, and yet perform an essential part in the function of digestion. These are called condiments, and their use is to stimulate the organs of digestion to greater activity; and, in fact, they are all much more sapid than the proper alimentary substances, which are in themselves generally insipid or mawkish.

From the view we have taken of aliments, it will appear that they are furnished by all the kingdoms of nature; the mineral kingdom supplying chiefly water and lime, while the vegetable, in addition to these in smaller quantity, yields much carbon and hydrogen; and the animal kingdom, in addition to a proportion of all the preceding elements, furnishes almost all the azote which enters into our composition. Although this statement be generally true, there are facts which at first do not seem to accord with it; and there are some grounds for believing that living bodies have either the power of changing the elementary nature of bodies, or of analysing these bodies we at present consider as simple, so that one is apparently changed into another. Thus some animals, in the state of nature, live only upon animal substances, and it is easy to conceive how, by a very simple process, the blood and flesh of their prey should become a part of their proper blood and flesh. Their elements, and even the combinations of them, are alike. But there are other animals whose flesh and blood do not differ materially from those of carnivorous animals, and which live almost entirely upon vegetable substances far removed from animal nature, and containing little if any azote.

This subject has lately engaged the attention of Magendie,[1] the most distinguished Parisian physiologist of the present day; and his views are the most important lately promulgated upon this point, and throw very great light upon the subject of dietetics. To ascertain the sources from which animals derive the azote which enters into their bodies, he performed some experiments, which appear to prove that azote is an indispensable constituent in the food of animals. For the subjects of his experiments he chose dogs, because, like man, they can be supported by vegetable as well as animal food, and he confined them to the use of pure water, and substances totally devoid of azote. *Sugar*, perfectly pure, was first tried. Of this, and of distilled water, he allowed an unlimited quantity to a small dog, three years old. For the first seven or eight days it seemed to agree very well with this diet. It was lively, active, and eat and drank as usual. In the second week it began to fall off, although its appetite continued very good, and it eat from six to eight ounces of sugar in the course of twenty-four hours. Its alvine excretions were scarce and scanty, while that by urine was abundant. In the third week it became more emaciated, it lost its liveliness, and its appetite began to fail. During this period also its eyes became affected in a singular and very distressing manner. The emaciation increased every day, its strength failed, and although it continued to eat from three or four ounces of sugar daily, it became so weak that it could neither chew nor swallow, and of course could not move. It died on the thirty-second day of the experiment; and, on opening its body, there was a total absence of fat; the muscles were reduced to one sixth of their bulk, and the stomach and intestines were much contracted. The gall and urinary bladder were both filled with fluid; but on analysis, the bile and urine resembled those of herbivorous animals. The urine, instead of being acid, as in those which eat flesh, was like that of herbivorous animals, sensibly alkaline, and did not contain a trace of uric acid or the phosphates, while the bile contained the picromel so remarkable in ox gall. The excrements also contained much less azote than usual. This experiment was twice repeated, with nearly the same result.

Olive-oil was next tried with two healthy young dogs, which seemed to agree with them for the first fifteen days, but then produced the same bad effects, and both died on the thirty-first day.

Gum was given to several dogs, and always with the same result.

Butter, an animal substance, but which does not contain azote, was also tried; and although, after the thirty-second day, the dog was allowed as much meat as it could eat, it died on the thirty-sixth day, similarly affected.

M. Magendie also killed several dogs at a proper period, after they had got a full meal of oil, sugar, or gum, in order to observe the nature of the chyle thus furnished. The chyle of the oil was of a decided milky white, whilst those of the gum and sugar were transparent, opaline, and more watery. These experiments, in M. Magendie's opinion, render it doubtful whether the oils, fats, gum, and especially sugar, are so nutritive as is generally supposed. But before we adopt his conclusion, we must remember that whole nations subsist upon food which contains very little if any azote. The Hindus live almost entirely upon rice, the peasants of Lombardy upon maize, those of Ireland upon potatoes, the slaves in the West Indies get fat during the cane crop, and the negroes of Senegal during the gum harvest, and herbivorous animals are nourished at all times upon grass. M. Magendie is not ignorant of these facts, but tries to explain them away by doubting the accuracy of some of the relations, and alleging that few vegetables are altogether destitute of azote. He cites, in confirmation of his observations, the experiments of Dr Stark, who injured himself by trying to live on sugar, bread, and water; and of M. Clouet, who grew extremely weak upon potatoes and water; and instances the insufficiency of sugar and a little rum to support the crew of a shipwrecked Hamburg vessel. The legitimate conclusions from all the facts relating to this subject seem to be,

1. That animals derive the azote which enters into their composition entirely from their food, and hence that no animal can live for a considerable time upon food totally destitute of azote.

2. That animals, even those naturally carnivorous, can live a certain time upon food entirely destitute of azote, in consequence of which the excretions of the naturally carnivorous become altered, and throw off less azote than when fed on animal food, acquiring the properties which these excretions have in animals whose food contains a very small proportion of azote.

3. That vegetable and animal substances destitute of azote are highly nutritious, provided, at the same time, azote be supplied from the admixture of some other aliment containing it, though in small proportion.

Upon these principles, alimentary substances may naturally and philosophically be divided into three great classes.

I. Those which contain azote, carbon, hydrogen, and oxygen.

II. Those which contain carbon, hydrogen, and oxygen.

III. Those which contain neither azote nor carbon.

I. *Alimentary Principles which contain Azote, Carbon, Hydrogen, and Oxygen.*

The aliments which contain azote correspond with the animal substances in general, and are calculated to repair the waste of our solids and fluids, without great alteration or effort in the digesting organs. All the immediate principles of this class are not, however, equally digestible, or possessed of the same properties. We shall say a few words of each.

Fibrin constitutes the great mass of the solid matter of the muscles of animals, especially of those which are old and have dark-coloured dry flesh. It is also a principal constituent of the blood of all animals. There can be no doubt, therefore, that it is pre-eminently nutritious in these its natural forms of combination, but we know of no experiments to ascertain its nourishing powers when used alone. The purest form of fibrin which occurs in common circumstances is the fibre of flesh which has been long boiled in a great quantity of water, as in the remains of the meat from which beef-tea is made, or of that boiled down for soup. This is generally considered, and is often thrown away, as totally indigestible, and deprived of all its nourishing principles; but this is probably a vulgar error, for animal fibre in this state still contains, as much as ever, all the elementary substances which are necessary for animal food; and the only circumstance which can account for their indigestibility, is their great aggregation, which it is the business of cookery to overcome. Fibrin also forms a large proportion of the substance of some of the internal organs of animals, all of which are nutritious. Pure fibrin is white and opaque when moist, but acquires a dark colour on being dried. It does not become putrid when kept in the air, nor even when immersed in water for a considerable length of time. It contracts and shrinks on the application of heat, and gives out, on being burnt, the smell of burning horn or feathers. It is insoluble in cold water; is corrugated by boiling in water; is insoluble in alcohol; but strong acetic acid swells it considerably, and renders it transparent like cartilage, in which state it may be dissolved, or, at least, diffused through water by long boiling.

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[1] *Mémoire sur les propriétés nutritives des substances qui ne contiennent pas d'azote*, 8vo, Paris, 1816.

Fibrin varies in every species of animal, and in the same animal at different ages, either from a difference in its nature, or from a difference in the matter with which it is combined. In many fishes, and the lower classes of animals in general, it is semitransparent and colourless. In veal, pork, salmon, chicken, and some other kinds of poultry, it has a pink colour; in beef and mutton it is of a fuller red; and in pigeon and game, both birds and quadrupeds, it is dark coloured. In general it is more tender in the female than in the male, and in the young animal than in the old.

Albumen is also a principal constituent of animal substances, in which it exists in two states, one uncoagulated and the other coagulated. Of the former, the purest example occurs in the raw white of eggs. Cartilage, horn, hair, nails, consist chiefly of the latter. It is also a principal constituent of blood and brain; and it seems to be the chief substance of oysters, mussels, and snails. Uncoagulated albumen is sometimes solid, often glairy, always transparent, and, when fluid, is soluble in water, and its taste is bland or almost insipid. At 165° Fahrenheit it is converted into a white solid mass, of which we have a familiar example in the white of a hard-boiled egg. There can be no doubt that albumen, especially in its uncoagulated state, is highly nutritious and easily digestible.

The curd of milk may be considered as a variety of albumen, although it possesses some peculiar properties, especially that of being converted into cheese by a particular mode of management.

Gelatin is a third very principal constituent of animal solids, as bones, ligaments, tendons, membranes, skin, muscles, &c. and exists in much larger proportions in the flesh of young than of adult animals. Thus we see the gravy of veal and lamb always gelatinize, while that of beef and mutton does not. The swimming bladder of the several species of sturgeon is gelatin in a state of very great purity, and by boiling it may be extracted pure from the shavings of hartshorn. Its taste is bland and nearly insipid. It is characterized by its solubility in water, being much increased by a boiling temperature, and by the solution, when of a certain strength, gelatinizing or cooling. It is highly nutritious, and supposed to be the most easily digestible of animal matters.

Mucus differs from albumen chiefly in not being coagulated by heat or corrosive sublimate, and from gelatin in not being precipitated by vegetable astringents, nor gelatinizing when its solution is concentrated. It exists nearly pure in saliva, and is a constituent of most of the secretions. There can be no doubt of its easy digestion and nutritious quality.

Of these four principal constituents of animal matter we may remark, that in themselves they are almost insipid; that gelatin exists almost entirely in a solid form, more or less dense; that mucus and albumen exist in every form of aggregation, from perfect fluidity to the density of cartilage; and that fibrin is only fluid in the living blood, but in every other instance is a tough solid: and that gelatin is very soluble in boiling water, and gelatinizes on cooling; that albumen in soluble in cold water, and coagulates at 165°; and that fibrin is not soluble either in cold or hot water. We may also remark that, although chemists have given very definite characters of each, as if they constituted absolutely distinct species of matter, these characters are taken from certain selected kinds of each, and that, in reality, we find that there is a regular and insensible gradation from mucus, through gelatin and albumen, to fibrin; and that, as in the process of animalization, as well as in the progress of life, they pass into each other, and many intermediate states are found which cannot be distinctly referred to any of them.

Osmazome, or animal extractive, differs very much from the preceding principles; chemically, in being soluble in alcohol, and to the senses, in being very savoury or sapid. It is upon this, which seems to admit of considerable varieties, that the flavour of animal food, and of each of its kinds, depends. It exists chiefly in the fibrous organs, or combined with fibrin in the muscles, while the tendons and other gelatinous organs seem to be destitute of it. The flesh of game and old animals also probably contain it in greater quantity than that of young animals abounding in gelatin.

Gluten is the only vegetable substance which contains a notable proportion of azote in its composition. When separated from other principles, it forms a tough, ductile, elastic, and tenacious mass of a gray colour, resembling, when drawn out, thin animal membrane; when dried it is brittle, hard, and slightly transparent, like glue. When kept moist it ferments and acquires some of the properties of cheese. Immersed in water it at last putrefies. When burnt or distilled it resembles in its properties horn or feathers. It is soluble in concentrated acetic acid, and, by the assistance of heat, in muriatic acid and in the alkalies. It then bears a strong analogy to the animal substances in general, resembling, by different properties, fibrin, albumen, and gelatin. It is very generally found, though only in a small proportion, in the vegetable kingdom, in all the farinaceous seeds, in the leaves of cabbages, cresses, &c.; in some fruits, flowers, and roots, and in the green feculum of vegetables in general; but it is particularly abundant in wheat, and imparts to wheat-flour the property of fermenting and making bread. On the nutritious powers of gluten separated from other principles nothing certain is known; but the superior nutritious powers of wheat-flour over that of all other farinaceous substances sufficiently proves that, in combination with starch, it is highly nutritive; and in all probability it is the gluten of the green feculum which supplies the azote necessary for the support of the herbivorous animals.

II. *Alimentary Principles which contain Carbon, Hydrogen, and Oxygen.*

Starch is very abundantly diffused through the vegetable kingdom. It exists in great purity in various farinaceous grains, such as rice, barley, maize, and millet; it is combined with gluten in wheat; with saccharine matter in some grains, as oats, and in many leguminous seeds, such as haricot-beans, lentils, vetches, and peas; with viscous mucilage, in rye, potatoes, and Windsor beans; with fixed oil and mucilage in the emulsive seeds, such as nuts, almonds, cocoa, tamarinds, in linseed, rapeseed, hempseed, poppyseed, and, in general, all those from which an oil can be obtained by expression. Lastly, starch is sometimes united to a poisonous substance. Of this singular union of a nutritious with an injurious principle the most remarkable instance occurs in the roots of the Jatropha manihot, and of many species of arum, to the former of which the negro slaves of the West Indies are indebted for their cassada bread, and from the latter is prepared the best arrow-root starch. Only one species of grain, the *Lolium temulentum*, is hurtful; but many leguminous seeds are poisonous, of which the most familiar example occurs in the laburnum peas.

Starch is artificially prepared in great purity from various substances. *Starch* is got from wheat and potatoes, *arrow-root* from various species of arum, *cassada-flour* from the manioc root, *salep* from the orchideæ in general, *sago* from the pith of various species of palm-trees, *tapioca* from the bitter and sweet cassava root. In all of these varieties of form, starch furnishes a bland and wholesome nutriment.

Gum or *Mucilage* is also a principal ingredient in the composition of our alimentary vegetables. The distinctive character of gum is its solubility in cold as well as hot water, and its insolubility in alcohol. It is devoid of smell, and to the taste it is bland and agreeable. In Arabia, Senegal, and the East Indies, it is obtained in great quantities from the various species of *Mimosa*, from the bark of which it exudes in great purity; and in hot climates in general it is furnished by many trees, especially those which have an astringent bark. In our own country an example of its production is seen on the bark of the plum and cherry trees. Where it is produced in sufficient quantity it constitutes a principal article of diet; and the Africans of Senegal are said to live entirely upon it during the gum harvest. Eight ounces of gum are the daily allowance, and furnish sufficient nourishment, for each man.

Mucilage is the alimentary principle of many of our esculent vegetables. In some it is united only to green colouring matter, as in the leaves of beet and spinach; with bitter matter, which may be prevented by the process of blanching, as in endive, lettuce, succory, and cardoon, or by using the plant very young, as in asparagus. It exists also in every part of the mallow tribe; in many roots, as scorzonera, salsafy, and Jerusalem artichokes, in the receptacle of the flower of the artichoke. It is combined with an acid in sorrel leaves; with saccharine matter in many fruits, as the fig and date; in roots, as the carrot, parsnip, and beet; and with slight acrimony in the turnip, cabbage leaves, cauliflower, and broccoli, and with considerable acrimony in the radish, cress, and mustard. It exists in great quantity, combined with a peculiar nauseous principle, in onions, garlic, shalot, leek, &c.; and, lastly, in small quantity, with much aroma, in those vegetables which are used only for seasoning, as parsley, thyme, &c. In short, it is very generally found throughout the vegetable kingdom, and in every mode of union with other principles.

Sugar, the common properties of which, in a state approaching to purity, are familiar, is also highly nutritious. It is crystallizable, soluble in water both cold and hot, in alcohol and the weak acids, readily undergoing, when dissolved in sufficient water, the vinous and acetous fermentation, but, on the other hand, when concentrated, preserving vegetable substances. Chemically considered, it presents many varieties. It exists in greatest quantity, combined with mucilage, in the juice of the sugar cane, of the maple tree, the manna ash tree, and of beet-root. It seems to be a constant attendant upon the inflorescence of vegetables, for almost every flower furnishes honey to the bee, and is a chief constituent of all the acerb, subacid, and sweet fruits, in combination with vegetable jelly. Sugar is produced, or at least collected, by several insects. To the bee we are indebted for honey; and a species of locust in New Holland covers the trees and ground with a kind of sugar. In all animals a principle having some analogy with sugar exists in the bile, and it is a product of morbid action in the disease called diabetes.

Oil and fat are also nutritious. They differ most obviously in fluidity, and they coincide in being insoluble in water, and in containing a larger proportion of hydrogen than the alimentary matters already spoken of. The oils may be divided into the fluid and concrete, and both are furnished by the vegetable and animal kingdoms. Fluid oil exists in quantity in the emulsive seeds; in some of them combined with prussic acid, as in the bitter almond, and in others with an acrid matter, as in the seeds of the ricinus; but it is obtained in greatest quantity and purity from the olive. The animal fluid oils are all more or less nauseous, as spermaceti oil, seal oil, whale oil, and cod liver oil. The concrete oils are generally furnished by the animal kingdom, and these are often bland and agreeable when fresh, but are apt to become rancid in proportion as they are less solid. Butter is the least consistent, if we except the fat of some birds; then hog's lard, the subcutaneous fat of beef, and the kidney fat of beef and mutton in succession. The only concrete oil obtained from the vegetable kingdom is the butter of cocoa.

III. *Alimentary Principles which do not contain Carbon.*

Water is perhaps the only real alimentary substance which belongs to this class, but it is one of the most essential. It is not only necessary to replace the constant waste of water which is drained off from our bodies, by the secretions, the cuticular discharge, and the vapour of the breath, but it is in itself strictly digestible, and capable of supplying either hydrogen or oxygen to the system, as may be required, according to the nature of our other food. When we consider how large a proportion of the whole weight of our bodies consists of water only, and that the fluids require more frequent renewal than the solids, the necessity of water as an aliment cannot be disputed. Some animals, as the rabbit, are supposed to be capable of living a long time or altogether without water; but this is a mere deception, for their vegetable food consists almost entirely of water. On the other hand, Dr Fordyce kept gold fishes six months in distilled water, and thought himself warranted in concluding that animals could live in water and air alone. Pouteau allowed some of his patients nothing but water for several weeks, without their falling off; and the histories of shipwrecked mariners prove with how small a portion of solid food man can subsist, provided he has sufficient allowance of water, whilst without water, or a substitute, no quantity of solid food can support man for even a few days.

Earths are, perhaps, not altogether unalimentary. Not to mention the depraved appetite of many young females, and of the dirt-eating negroes of the West Indies, for chalk, cinders, and such substances, earth is sought after and devoured by whole nations. The luxurious Capuans paid a considerable tribute to the Neapolitans for an earth called *Leucogæum*, which they considered necessary for the preparation of a favourite dish, *Alica*. The Tungusses, according to Laxmann, eat a fine clay with rein-deer's milk. Chandler saw the women and children in Samos chewing pieces of steatite as a luxury. La Billardière saw the same practised in New Caledonia, and found edible earth sold in the market in several villages in Java. Throughout all India lime is used along with the betel leaf. Kepler partook of the butter earth, which is eaten with great relish, spread upon bread, by the millstone quarriers of Thuringia; and, lastly, Humboldt has made us acquainted with the existence of a whole nation of earth-eaters, the Ottomacs on the Orinoco.[1] We may also mention that bird-fanciers find it necessary to supply birds shut up in cages with sand and earth. All these facts, we are aware, might be explained upon principles different from the digestibility of the earthy substances taken into the stomach; and we have no idea that any earthy substances can supply carbon or azote to the system; but we have absolute proof that earthy matter may enter into the circulation, in the growth and absorption of the bony frame of our body, for which phosphate of lime is as necessary as carbon or azote for our soft solids.

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[1] Tableaux de la Nature. Par A. Humboldt, 2 tomes 12mo, Paris, 1808.

Sea Salt is more obviously necessary than earth. Even in insular and maritime situations it is voluntarily used as a condiment by all; but it is only in inland countries, at a distance from the sea, that its necessity is duly appreciated. Muriate of soda enters into the composition of all our fluids, and is thrown off by many of our secretions; hence its waste must be supplied, and where the vegetables are not naturally impregnated with it, it becomes one of the most indispensable articles of our food.

Alimentary substances, as presented to us by nature or prepared by art, may be considered in various points of view.

Digestibility of various alimentary substances.

They differ in regard to digestibility, or the facility with which they are decomposed by the powers of the stomach, to enter into new combinations fitted to repair the waste of the blood. In this particular, also, they may differ in respect to the length of time, or in regard to the digestive power of the stomach, required for their digestion. Thus the digestion of one substance may be slow, though ultimately complete, even in a weak stomach, and that of another quick enough in a strong stomach, although imperfectly digested by one that is weak. In reference to their digestibility, aliments are commonly described as being light or heavy; but in this respect there is very great difference in regard to different individuals, the same substances being light to one and heavy to another, and *vice versa.*

Sir Astley Cooper made some experiments to ascertain the comparative digestibility of different kinds of raw meat without fat; and the following table exhibits the loss 100 parts of each sustained in the stomach of dogs, which were killed, one, two, three, and four hours after being fed.

Pork	10	20	98	100
Mutton	9	46	87	94
Beef	0	34	37	75
Veal	4	31	46	69

In another experiment, after four hours, the digestibility appeared in the following order,—cheese, mutton, pork, veal, beef. Fat appeared to be also much more digestible than cheese; beef than potato, and codfish than beef. Boiled veal was much more digestible than roast; and of different parts of the same kind of food, the digestibility was in the following order,—fat, muscles, skin, cartilage, tendon, and bone.[1] From the experiments detailed in the inaugural dissertation of Dr Macdonald, *De Ciborum Concoctione*, Edinburgh, 1818, which were made in company with the late Dr Gordon, there appears to be great irregularity in the time necessary for the completion of digestion, so that they scarcely furnish any conclusion as to the comparative digestibility of different substances. Dr Macdonald infers that, of those he tried, butter was the most, and rice the least, digestible in the stomach of the dog. In the experiments which Dr Stark made upon himself, to ascertain the nutritious properties of oily substances, he found that, with a daily allowance of thirty ounces of bread and three pounds of water, two ounces of olive oil taken at one meal was so large a quantity as to be disagreeable; three ounces in the day caused some uneasiness in his bowels; and four ounces griped him very much, although he gained weight; but this experiment was not conclusive, as at that time he was suffering under sloughing gums, the effects of a protracted diet of sugar. A diet of four ounces of pure fat, obtained from the subcutaneous fat of beef, made into a pudding, with twenty ounces of flour, and twelve or twenty ounces of water, with the remainder of three pounds of water in drink, was both nourishing and agreeable; but when the fat was increased to six ounces, great part of it passed unassimilated, and his bowels were affected. The same pudding without the suet was not sufficiently nutritious, and did not satisfy his appetite in the same manner. When the pudding was made with butter, although only four ounces were used, he was made very ill by it. Oil of butter agreed very well; and oil of marrow, of all the fats Dr Stark tried, he found to be the mildest in the bowels. His gums having again become purple and swelled, with petechial appearances on his body, while making these experiments, suggested to him the following queries, which seem important to the science of dietetics. "Although at present I take more food than what is absolutely necessary for the support of the body, I remain perfectly well, whereas I have several times suffered considerable inconvenience from committing any excess in the quantity of oils. Is it not evident that excess in the quantity of oils is more hurtful to the body than excess in any other article of food? and that, of course, we ought to be particularly careful in regulating the quantity and quality of the oils we may employ in diet? Is it not probable, then, that animal oils, though they nourish and increase the weight of the body, are not of themselves sufficient to prevent a morbid alteration from taking place in the blood and fluids? whilst, on the other hand, the lean of meat, though less nutritious, is of more efficacy in preserving the fluids of the body in a sound state."[2]

Difference of aliments in respect of nutrition, taste, &c.

Aliments also differ in regard to the proportional quantity of nourishment they furnish, and, in this point of view, they are said to be strong and weak, or rich and poor. This difference may arise either from the proportional quantity of digestible and indigestible parts in the various kinds of aliment, or from the digestible parts being different in kind, and furnishing a supply of a different kind to the blood. There is even in this respect some opposition between light food and strong food, and it may be generally observed, that food which is most quickly digested, requires the soonest to be repeated, while digestible food, that is only slowly digested, supports the body for a greater length of time.

Aliments also differ in the impression they make on our palate; and it is chiefly in this respect that they are considered by the epicure. This impression proceeds from two distinct qualities in the aliment; the one depending upon their grosser physical properties, and the other upon their finer, recognizable only by the senses of taste and smell. To the former class belong the sensations of solid and fluid, hard and soft, tough and tender, crisp and stringy, hot and cold, greasy, glutinous, gritty, smooth, &c. These are judged of by the tongue and palate, rather as organs of touch than of taste, and are altogether independent of flavour, as capable of affecting the organs of taste and smell. The latter class consists of all the variety of tastes properly so called, namely, sweet, bitter, sour, salt, alkaline, astringent, aromatic, nauseous, pungent, acrid, spirituous, cooling, &c., and also the want of taste, the vapid or mawkish. Of these, some are almost universally agreeable, and others generally disliked, but much depends upon idiosyncracy, state of health, education, habit of the individual, and upon the degree or quantity of flavour.

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[1] A Treatise on the Nature and Cure of Gout and Rheumatism, including General Considerations on Morbid States of the Digestive Organs; some Remarks on Regimen, and Practical Observations on Gravel. By Charles Scudamore, M. D. 8vo, London, 1817.

[2] The Works of the late William Stark, M. D. consisting of Clinical and Anatomical Observations, with Experiments Dietetical and Statistical, revised and published from his original Manuscripts. By James Carmichael Smyth, M. D. 4to, London, 1788.

Aliments also differ in the impression made upon the stomach; but the sensations arising from this source are more obscure and less varied. Except the sensation of heat, which may arise from caloric, and is transient, or from acrimony or spirit, which is more durable, most of the sensations experienced in the stomach are indications of its mechanical state, or of affections of the appetite. Hence we have the feeling of gratification, from removal of a sense of emptiness, of repletion, distension, cessation of hunger or thirst, satiety, and sickness.

General observations on diet.

We should also consider the effect of different kinds of diet, when the body is in a state of health, and different states of disease; but accurate experiments are still wanting to enable us to give any thing more than fragments of this interesting subject. It is extremely difficult to institute these experiments satisfactorily. They are irksome to the person on whom they are tried; and so many causes tend to interfere with the results, that it is only by frequent repetition that the real effects can be fairly deduced.

Our diet may be either proper, or it may err, and this either in quantity or quality. When the quantity is too small, the body is not nourished; it becomes lean, the fat disappears, and the muscles either get soft and flabby, or shrivelled and dried up, accompanied by loss of strength or stiffness, with predisposition to an actual disease. Errors in regard to the quantity of food are merely relative; so much depends upon circumstances, as individuality of constitution, period of life, state of health, degree of mental and corporeal exertion, habit and temperature. Each person may be said to have a different standard quantity, deviations from which are to be accounted errors. In our army, the rations allowed for each soldier at home are, three quarters of a pound of meat, boiled so as to afford broth, with 1½d. worth of potatoes and other vegetables, one pound of bread, or one and one eighth pound of oatmeal; and in most cases one pound of milk or coffee is purchased for his breakfast. On service the rations are, one pound of meat, one and a half pound of bread, and one pint of wine or one sixth of a pint of spirits.

Mr Buxton states that the diet allowed to the prisoners in the jails in London varies from fourteen ounces of bread per day, and two pounds of meat per week, which, he says, is not enough to support life, up to one pound and a half of bread, one pound of potatoes, two pints of hot gruel, and either six ounces of boiled meat, without bone, and after boiling, or a quart of strong broth, mixed with vegetables, per day, which is as much more than enough; and Mr Buxton thinks that the meat should be discontinued. A fit prison diet, in his opinion, should consist of one pound and a half of bread, at least one day old, to each prisoner, daily, and one pint of good gruel for breakfast; and, upon good behaviour, half a pound of meat on Sundays.[1]

Some experiments have been made in order to ascertain the quantity of different kinds of food necessary for the sustenance of individuals. Dr Franklin, when a journeyman printer, lived a fortnight on bread and water, at the rate of ten pounds of bread a week. Dr Stark, whose weight was 171 pounds avoirdupois, found that thirty-eight ounces of bread daily were not more than sufficient to satisfy his appetite; forty-eight ounces were the utmost he could consume in one day, and the greatest quantity he could take at one meal, without uneasiness, was thirty ounces; and, with this diet, he required necessarily three pounds of water for drink, for with only two pounds he was not satisfied. In another experiment, thirty ounces of bread and three pounds of water, with six ounces of boiled beef, sufficed: with four ounces of the beef his appetite was not satisfied; with two pounds of bread and three pounds of infusion of tea, he found that one pound of cold stewed beef was not more than sufficient: he was not satisfied with four ounces of beef to breakfast; but eight ounces at dinner, and four ounces at supper, were rather too much.

Absolute starvation produces diminished excretions, fetid breath, foul skin, and death. The most distressing histories of this dreadful end are recorded in the account of shipwrecks, and of those unfortunate persons who fall into the hands of the Arabs of the desert. Man can sustain the absolute want of food for several days, more or fewer in number according to circumstances; the old better than the young, and the fat, probably, better than the lean. The total want of drink can be borne only a very short time, and its effects are even more distressing than those of want of food. They have been strikingly described by Mungo Park and by Ali Bey, as experienced in their own persons. The narratives of shipwrecked mariners also prove with how very little food life may be supported for a considerable length of time; and the history of those impostors who pretend to live altogether without food or drink display this adaptation of the wants of the body to its means of supply in a still more striking manner; for, even after the deception in such cases as that of Ann Moore is exposed, it will be found that the quantity of aliment actually taken was incredibly small.[2]

Captain Woodard has added to his interesting narrative many instances of the power of the human body to resist the effects of severe abstinence.[3] He himself and his five companions rowed their boat for seven days without any sustenance but a bottle of brandy, and then wandered about the shores of Celebes six more without any other food than a little water and a few berries. Robert Scotney lived seventy-five days alone in a boat, with three pounds and a half of meat, three pounds of flour, two hogsheads of water, some whale oil, and a small quantity of salt. He also used an amazing quantity of tobacco. Six soldiers deserted from St Helena in a boat on the 10th of June 1799, with twenty-five pounds of bread and about thirteen gallons of water. On the 18th they reduced their allowance to one ounce of bread and two mouthfuls of water, on which they subsisted till the 26th, when their store was expended. Captain Inglefield and eleven others, after five days of scanty diet, were obliged to restrict it to a biscuit divided into twelve morsels for breakfast, and the same for dinner, with an ounce or two of water daily. In ten days, a very stout man died, having become unable to swallow, and delirious. Lieutenant Bligh and his crew lived forty-two days upon five days' provisions.

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[1] An Inquiry whether Crime or Misery are produced or prevented by our present System of Prison Discipline. By Thomas Fowell Buxton, M. P. 12mo, Edinb. 1818.

[2] An Examination of the Imposture of Ann Moore, called the Fasting Woman of Tutbury, illustrated by Remarks on other Cases of Real or Pretended Abstinence. By Alexander Henderson, M. D. 8vo, London, 1813. Also, Rev. Leigh Richmond, in Medical and Physical Journal, by Samuel Fothergill, M. D. and William Royston, 469, vol. xxix. 8vo, London, 1813.

[3] The Narrative of Captain David Woodard and Four Seamen. 2d edit. 8vo, London, 1805.

In the tenth volume of Hufeland's *Journal*, M. Gerlach, a surgeon-major of the Prussian army, has related a very remarkable and well authenticated case of voluntary starvation. A recruit, to avoid serving, had cut off the forefinger of his right hand. When in hospital for the cure of the wound, dreading the punishment which awaited him, he resolved to starve himself, and on the 2d of August began obstinately to refuse all food or drink, and persisted in this resolution till the 24th August. During these twenty-two days he had absolutely taken neither food, drink, nor medicine, and had no evacuation from his bowels. He had now become very much emaciated, his belly was somewhat distended, he had violent pain in his loins, his thirst was excessive, and his febrile heat burning. His behaviour had also become timid. Having been promised his discharge unpunished, he was now prevailed upon to take some sustenance, but could not at first bear even weak soup and lukewarm drinks. Under proper treatment he continued to mend for eight days, and his strength was returning, when, on the 1st of September, he again refused food, and assumed a wild look. He took a little barley water every four or five days to the 8th; from that day to the 11th he took a little biscuit with wine; but again, from the 11th September to the 9th October, a period of twenty-eight days, he neither took food, drink, nor had any natural evacuation. From the 9th to the 11th he again took a little nourishment, and began to recruit; but, on the 11th, he finally renewed his resolution to starve himself, and persevered until his death, which took place on the 21st November, after a total abstinence of forty-two days.

On the other hand, the quantity of nourishment which can be devoured with impunity is often very great. Almost every person in good circumstances eats more than is necessary for supporting his body in a state of health, and many bring their stomachs to require a very excessive allowance as almost necessary. In some individuals an inordinate appetite seems constitutional. Charles Domery, aged twenty-one, six feet three inches high, and well made, but thin, when a prisoner of war at Liverpool, consumed in one day four pounds of cow's udder and ten pounds of beef, both raw, together with two pounds of tallow candles and five bottles of porter, and, although allowed the daily rations of ten men, he was not satisfied.[1] Baron Percy has recorded a still more extraordinary instance in a soldier of the name of Tarare, who, at the age of seventeen, being of moderate size, rather thin, and weighing only a hundred and seventy pounds, could devour, in the course of twenty-four hours, a leg of beef twenty-four pounds in weight, and thought nothing of swallowing the dinner prepared for fifteen German boors.[2] But these men were remarkable, not only for the quantity they consumed, but also for its quality, giving a preference to raw meat, and even living flesh and blood. Domery in one year eat 174 cats, dead and alive; and Tarare was strongly suspected of having devoured an infant, which disappeared mysteriously. Many other histories of the same kind are preserved; and although some of the individuals were men of large stature and great strength, others were of ordinary size. The excess of food may be taken either in the form of too much at one meal or of too many meals. It is either digested and furnishes an excess of nourishment, or it passes through the canal simply indigested, or it undergoes the fermentation natural to it. An excess of nourishment either produces a great or rapid increase of the size of body generally, or of the fat and abdominal viscera in particular, or, by inducing great fulness of blood, produces diseases which sometimes counteract the effects of the plethora. When the excess passes simply indigested, it only occasionally proves hurtful as a mechanical irritation in the bowels, especially when it is of a hard substance, and has sharp angles. When it undergoes its natural fermentation this is either acid or putrid, as the substance is vegetable or animal, or rather as it is destitute of or contains a notable proportion of azote.

When diet errs in quality, it gives rise to a greater variety of cases. It may either produce a directly hurtful effect upon the constitution, in the manner of a poison or medicine, in its natural state, or after fermenting in the stomach; or it may prove injurious more indirectly by not supplying an element necessary for its healthy condition, or by supplying one in excessive proportion. The poisonous effects of alimentary substances are always occasional, and arise from a peculiarity in the aliment itself, as in the case of poisonous fishes, or in the individual, as in those persons who cannot eat particular kinds of food, which are to others wholesome and nutritious. The unpleasant effects of substances undergoing their natural fermentation in the stomach are much more frequently observed. They occur either from a very strong disposition in the food to ferment, so that the action of a healthy stomach is not able to restrain it, or from excess of the food, so that part of it is left to its natural changes, or from weakness of the stomach, which exerts little action upon it. Fermenting substances are hurtful, by acting as direct poisons, and by distending the stomach; in the non-azotized substances becoming acid and producing flatulencies, in the azotized substances becoming putrid and producing fetid eructations and flatus. Diet, which errs by supplying one of the elementary constituents of our body in excess, or in not supplying another, does not produce its full effects at once, but gradually changes the condition of the body. When an elementary principle is furnished in excess, it is thrown off by the various excretions, and hence we find that the urine of omnivorous animals, when confined to animal food, contains more urea, and their perspirations and stools are more fetid; while the urea disappears, and the stools and perspirations lose their fetor, when they are restricted to vegetables. The same observations have been made in regard to man. Also, when the supply of an elementary principle is deficient, it ceases to be thrown off by excretion, even after it has performed its functions in the body, but is re-absorbed, and thus the body, for a time, lives as it were upon itself.

The chief varieties of diet, in regard to quality, depend upon their immediate effects, and in this respect they may be divided into the simply nutritious and the stimulant. All animal flesh seems to be more or less stimulant, and, in general, the more so the darker its colour is; and upon this principle chiefly has Dr Darwin founded his classification of aliments, but he has erred in considering them as also more nutritious. Moor-game, pigeon, hare, and venison, are more stimulating, but perhaps not more nutritious, than the turkey or barn-door fowl, veal, or lamb. The effect upon the composition of our bodies is the secondary but most important effect. In this respect, food might be divided into the azotized, hydrogenous, carbonaceous, and oxygenous, or rather into those which supply abundantly azote, hydrogen, carbon, and oxygen. This view is, however, chiefly theoretical, as we are very far from possessing facts enough to establish it completely, or to overturn it; but yet there are some which favour it. We have already noticed Magendie's experiments on substances which do not contain azote, from which he inferred that a certain supply of it was absolutely necessary to the support of animal life. Other facts lead to the same conclusion, especially the effect of restriction to one kind of aliment in the generation and cure of disease.

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[1] Account of a Man who lives upon large quantities of Raw Flesh, by Dr Johnston; in the Medical and Physical Journal, by Drs Bradley, Beatty, and Nohden, vol. iii. 8vo, London, 1800.

[2] Mémoire sur la Polyphagie. See Journal de Médécine, Chirurgie, et Pharmacie, par MM. Corvisart, Leroux, et Boyer, tome ix. 8vo, Paris, An. xiii.

It is many years since Dr Rollo[1] was led, by the singular sweetness of diabetic urine, to conclude that, if he deprived the patient of all food which contained sugar, or the principles of sugar, he should be able to cure this hitherto untractable disease. He accordingly restricted his patients to the use of animal food, especially fat, and absolutely prohibited all vegetables, even bread, and all fermented liquors. The effects were very striking, and some patients were believed to be cured; at least the nature of their urine was completely altered from a morbid to a healthy state. As conducted by others, the same regimen has produced the same effects; but it is so disagreeable to the patients that they can seldom be prevailed upon to adhere to it, and unfortunately, notwithstanding the temporary removal of this prominent symptom, the disease generally continues its fatal course. We may, however, notice, that Rollo and others were guided in their choice of regimen by the principle of withholding the elements of sugar, and hence fat formed a chief part of it, and was a principal cause of the disgust it excited; but perhaps it would be better to select a highly azotized diet, in which point of view the muscular parts of dark-fleshed animals, such as game and old mutton, and those kinds of fish, such as skate, which contain much azote in a loose state of combination, should be selected; while wheaten bread, the want of which is so distressing to many, might be allowed, and fat, which contains no azote, should not be prescribed.

Magendie[2] ascribes the gravel to the superabundance of azote in our food, as the uric acid of which gravel consists is a highly azotized substance, and seems to be produced as a means of throwing off the excessive azote; and among the various causes with which gravel is connected, the most active in its agency is high living, or the use of animal food in excess. A Hanseatic citizen, who kept a good table previous to 1814, was afflicted with the gravel. He emigrated and lived very miserably in England, but his gravel completely left him. He re-established his affairs, and with his fortune his gravel returned. Again he was ruined, and went to France almost destitute, and his gravel disappeared. By industry he finally acquired a competency, and with it his old complaint, for which he then consulted Magendie. A Parisian lady of sixty, subject to gravel, read in a journal a short notice of Magendie's experiments, in which it was said that he had discovered in sugar a cure for the gravel. Without more advice she set about eating sugar, often to the extent of a pound daily, and in effect she removed the gravel, but disordered her stomach so much that she was obliged to resume her usual food, and with it the gravel returned.

The chemical theory of the scurvy is, that it is owing to the want of oxygenous food; and it cannot be denied that this theory has been very ingeniously supported by Dr Trotter, Dr Beddoes, and others. The rapidity with which those afflicted with it recover by the use of recent vegetables, especially the fresh citric acid, shows that it proceeds from an error in diet, but whether from a deficiency of nourishment in general, or from a deficiency of oxygenous aliment, is not quite so clear. When we compare the accounts of the ravages formerly committed by this dreadful disease, even during short voyages, with the almost total immunity which the British fleet has enjoyed since the time of Captain Cook, we have the strongest possible proof of the influence of diet upon the human frame, either as inducing or preventing disease.[3]

Hydrogenous food, such as the excessive indulgence in fat meat, butter, and oil, and still more especially in spirituous liquors, produces a change in the chemical constitution of our bodies, independently of the exhaustion of excitability by excess of stimulus. Bilious diseases, and a tendency to unwholesome fatness, are its most common effects; and it is only in the excessive hydrogenation of the system that we can find a rational explanation of that very singular phenomenon called the spontaneous combustion of the body; for even admitting that the clothes are accidentally set on fire in these cases, there appears no reason to doubt that the combustion is continued by the burning of the body itself. Now the greatest number of instances have occurred in old women addicted to the abuse of ardent spirits.[4]

The effects of oxygenous food, in imparting oxygen to the body, are not so well ascertained. Acids, and the subacid fruits, quench thirst, and are supposed to reduce animal heat; but their more obvious action is to affect the bowels and induce diarrhœa, and ultimately to render the body spare and thin. The new chemical pathology led to the exhibition of nitric acid for the cure of syphilis, as mercury was supposed to act by oxygenizing the system; and this acid has since been much employed also, from analogy, in the liver complaint. That the acid has excellent effects as a tonic, seems to be perfectly ascertained. It does not act upon the bowels like the vegetable acids, but there is no proof of its decomposition in the stomach, or of its imparting oxygen to the body. The oxygenizing of the system by means of the nitro-muriatic or oxymuriatic bath, now so fashionable in London, is a mere chimera. Pulmonary consumption was also, at one time, considered as a disease proceeding from superabundant oxygen, and the florid colour of the cheeks was adduced in proof of it.

No observations have yet been made on the effects of aliments containing an unusually large proportion of carbon, nor has any disease been ascribed to the carbonization of the system.

Peculiar species o regimen called *Training.*

It would extend this article much beyond the space we can allot to it, if we were even hastily to sketch the varieties of diet recommended in disease, and to explain their action; but it will not be superfluous to enter a little into the detail of that kind of regimen which has been found by experience to bring animals and man to the highest possible state of health, at least as measured by the amount of their physical force, and their power of continuing its exertions. It is to bring animals to this state that constitutes the business of *trainers*, as they are called. Cocks, greyhounds, race-horses, and men, are much more active and vigorous after being trained than in their ordinary condition. They are, in fact, in a higher state of health; and we are fully convinced that, by training, many diseases might be removed, and by living according to the same principles, general ill health might be commonly prevented. The public is very much indebted to Sir John Sinclair for having taken the pains to collect the fullest information on this subject.[1] He was assisted in his inquiries, we have reason to believe, by Mr John Bell, whose attention was directed to the subject by having the professional care of Captain Barclay during his great walking-match. From the answers procured to Mr Bell's inquiries, it appears that the whole secrets of training reduce themselves to principles which every man may practise, and ought to practise, as far as is consistent with his business and other duties; and, in particular, we think that they ought to be studied, thoroughly understood, and enforced, by all those to whom, in consequence of accidental circumstances, the care of the health and lives of many individuals are intrusted. We allude chiefly to military and naval officers, and the proprietors of large manufactories. In the British navy the importance of this subject has been long appreciated; and the comparative state of health of our fleets, in recent times, is as honourable to our naval commanders as the laurels of victory which encircle their brows. Soldiers are left more to themselves, and their officers have neither the same control nor responsibility; but we think that more might be done in keeping the troops, as well as the military horses, when at home or in garrison, always in a state fit for active service. The evil of not attending to this was very severely experienced during the Spanish campaigns. The artillery horses sent from Chatham were found to be unfit for the fatigues of service, and good cart-horses were at last substituted with great advantage. In garrison both men and horses are over-fed and under-worked. In manufactories the opposite evils sometimes occur; the workmen, and especially the children, are over-worked and under-fed. This subject has lately occupied the attention of parliament; and it is connected with some interesting inquiries, which belong properly to the science of political economy. In a medical point of view, the principle to be followed is, that the food and labour bear a just proportion to each other. When the quantity and quality of the food is not limited by its expense, the best possible condition of the individual is attainable, by attending to the principles upon which training is conducted, and which resolve themselves into temperance without abstemiousness, and regular exercise in the open air. Mr Jackson says, that a man properly trained feels himself light and *corky*, as the technical phrase is; and that, during a course of training, the skin always becomes clear, smooth, well coloured, and elastic; or that cleanness of skin is the best proof of a man being in good condition. Another very striking effect of training is upon the lungs. Trained men can draw a much fuller inspiration, and retain their breath longer, than others. But it is not only on the state of bodily health that the good effects of training are conspicuous; for Mr Jackson distinctly, and we believe correctly, states, that the mental faculties are always improved, the attention is more ready, and the perceptions are more acute. From these observations some valuable hints may be derived by physicians, for the cure of many cutaneous and pulmonary affections, which obstinately resist the power of medicines.

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[1] An Account of two Cases of Diabetes Mellitus. By John Rollo, M. D. 2 vols. 8vo, London, 1747.

[2] Recherches Physiologiques et Médicales sur les Causes, les Symptomes, et le Traitement de la Gravelle, 8vo, Paris, 1818.

[3] Observations on the Scurvy. By Thomas Trotter, M. D. 8vo, Lond. 1792. Observations on the Nature and Cure of Calculus, Sea Scurvy, Consumption, Catarrh, and Fever; together with Conjectures upon several other subjects of Physiology and Pathology. By Thomas Beddoes, M. D. 8vo, London, 1793.

[4] An Essay, Medical, Philosophical, and Chemical, on Drunkenness, and its Effects on the Human Body. By T. Trotter, M. D. 8vo, London, 1804. Essai sur les Combustions Humaines produits par une long abus des liqueurs spiritueuses. Par Pierre-Aimé Lair, 12mo, Paris, 1801.

Cookery.

Cookery is strictly a branch of dietetics, and one of the most important. Only a small part of our food is consumed as it is furnished by nature. Many alimentary substances are disagreeable, and some even poisonous, until they have undergone certain preparations. Few of them are to be had at all seasons of the year, although produced at others in greater quantity than can be consumed; and all of them occur of very different qualities. Hence the selection, preservation, and preparation of alimentary substances, are arts of primary importance in life.

We hold the contempt with which cookery is very generally spoken of to be downright affectation, we had almost said hypocrisy; for, in the practice of life, every individual who is not perfectly imbecile and devoid of understanding is an epicure in his own way. The epicures in the boiling of potatoes even are innumerable; and every school-boy in Scotland passes a judgment on the culinary skill of the servant who makes his porridge. Cookery only becomes truly degrading when it occupies an undue proportion of attention; and that epicurism is to be utterly condemned which produces more pain than pleasure. Boswell, the biographer of Johnson, has defined man to be a cooking animal; and, in fact, man is the only animal which does not consume his food as presented to him by nature. We are not from this to conclude that man in cooking deviates from the ordinary course of nature; but that the appetite for cooked food is given to him for wise and useful ends. Count Rumford has not considered the pleasure of eating, and the means that may be employed for increasing it, as unworthy the attention of a philosopher.

"The enjoyments which fall to the lot of the bulk of mankind are not so numerous as to render an attempt to increase them superfluous. And even in regard to those who have it in their power to gratify their appetites to the utmost extent of their wishes, it is surely rendering them a very important service to show them how they may increase their pleasures without destroying their health.

"If a glutton can be made to gormandize two hours upon two ounces of meat, it is certainly much better for him, than to give himself an indigestion by eating two pounds in the same time.

"The pleasure enjoyed in eating depends first upon the agreeableness of the taste of the food; and, secondly, upon its powers to affect the palate. Now there are many substances extremely cheap, by which very agreeable tastes may be given to food, particularly when the basis or nutritive substance of the food is tasteless; and the effect of any kind of palatable solid food (of meat, for instance) upon the organs of taste, may be increased almost indefinitely, by reducing the size of the particles of such food, and causing it to act upon the palate by a larger surface. And if means be used to prevent its being swallowed too soon, which may be easily done by mixing with it some hard and tasteless substance, such as crumbs of bread rendered hard by toasting, or any thing else of that kind, by which a long mastication is rendered necessary, the enjoyment of eating may be greatly increased and prolonged.

"The idea of occupying a person a great while, and affording him much pleasure at the same time, in eating a small quantity of food, may perhaps appear ridiculous to some; but those who consider the matter attentively will perceive that it is very important. It is, perhaps, as much so as any thing that can employ the attention of the philosopher."

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[1] The Code of Health and Longevity, vol. ii. Appendix, No. IV. 8vo, Edinburgh, 1807.

But we shall consider cookery in another point of view, and that one, the importance of which will not be denied by the most austere philosopher. The political economists have extolled agriculture above all other arts, and have obtained the assent of mankind to their dogma, that he who makes two blades of grass grow where only one grew before, is a benefactor to his race. And why? Truly because he thus increases the quantity of food, and enables the world to support a larger population. And is not he who by his skill enables the raw material, whether corn or flesh, furnished to him by the agriculturist, to feed a larger population, or who renders articles alimentary which were formerly rejected, equally a benefactor of his race? Again, every country has its own favourite articles of food, and modes of preparing them; and there is perhaps no subject in regard to which local prejudices are so strong. Now, by bringing these to the test of comparison upon scientific principles, much good would ultimately arise by the gradual introduction into each country of whatever was worthy of imitation in the practice of other nations.

The learned Krunitz, in his voluminous *Economico-Technologic Encyclopedia*, has anticipated many of our views of the subject. "The preparation of good food, and the directions for this purpose contained in cookery books, are commonly very much despised, or rather altogether neglected, by literary men. But in itself cookery does not deserve this contempt, for it is an important part of domestic economy. Upon its due practice depend the health and comfort of families, which must inevitably suffer from errors committed in it. The reason of this contempt is to be found in the manner in which it has hitherto been treated in cookery books, which have been prepared by common cooks, as they are accustomed to dress a ragout. Since the economical arts in general have been discussed scientifically, it is now time that the same attention should be paid to cookery, which is so generally useful, and which is capable of being considered in so many points of view. But then a totally different course from that commonly followed must be pursued. A man of much knowledge, especially physical, chemical, and dietetical, must condescend to apply to the making experiments on vulgar and refined cookery, and collect the whole into a system, as has been done long since in regard to the knowledge and preparation of medicines. What has been written upon dietetics by Zückert, Bergius, Lorry, Plenk, and others, must be compared with the practices in different countries, and a general view of the whole must be drawn up and arranged in systematic order. In regard to the preparations themselves, certain fixed processes and principles are to be determined, general operations to be accurately described, and new improvements to be brought forward. After this the subject might be treated in detail, and a variety, first of simple, then of more compound articles, with the best modes of preparing each as to palatableness, and in relation to effect upon the health, should be perspicuously and thoroughly described. Lastly, their combination into bills of fare, adapted to different ranks in society, modes of life, various tastes, the season of the year, &c. should be pointed out particularly, and with a due regard to good economical arrangements." (z.)

DIEU ET MON DROIT, *God and my Right*, the motto of the royal arms of England, first assumed by King Richard I. to intimate that he did not hold his empire in vassalage of any mortal. It was afterwards assumed by Edward III. and was continued without interruption to the time of King William, who used the motto *Je maintiendray*, though the former was still retained upon the great seal. After him Queen Anne used the motto *Semper eadem*, which had been before used by Queen Elizabeth; but ever since the time of Queen Anne. *Dieu et mon Droit* continues to be the royal motto.

DIEY, an arrondissement of the department of Vosges, in France, extending over 530 square miles, divided into nine cantons, and containing a population of 83,712 persons, in 109 communes.

DIEY, *St*, a city in the department of the Vosges, in France, the capital of the arrondissement, and situated in a mountainous and woody district on the banks of the Meurthe. It contains 830 houses and 5346 inhabitants. Long. 7. 1. E. Lat. 48. 20. N.

DIEZ, a bailiwick in the duchy of Nassau, in Germany, extending over about 35,000 English acres, and containing a population of 11,487 inhabitants, in two cities and thirty-eight villages. The capital is a city of the same name, situated on the river Lahn, with an industrious population of 2300 persons.

DIFF is the name of an instrument of music among the Arabs, serving chiefly to beat time to the voice; it is a hoop, sometimes with pieces of brass fixed to it to make a jingling, over which a piece of parchment is distended. It is beat with the fingers, and is the true *tympanum* of the ancients.

DIFFARREATION, among the Romans, a ceremony by which the divorce of their priests was solemnized. The word comes from the preposition *dis*, which is used, in composition, for *division* or *separation*, and *farreatio*, a ceremony with wheat, from *far*, wheat or corn.

Diffarreation was properly the dissolving of marriages contracted by confarreation, which were those of the pontifices or priests. Festus says it was performed with a wheaten cake; but Vigenère maintains that confarreation and diffarreation are the same thing.

DIFFERENCE, in *Mathematics*, is the remainder, when one number or quantity is subtracted from another.

DIFFERENCE, in *Logic*, an essential attribute, belonging to some species, and not found in the genus; being the idea that defines the species. Thus body and spirit are the two species of substance, which in their ideas include something more than is included in the idea of substance. In body, for instance, are found impenetrability and extension; and in spirit, a power of thinking and reasoning; so that the difference of body is impenetrable extension, and the difference of spirit is cogitation.

DIFFERENCE, in *Heraldry*, a term given to a certain figure added to coats of arms, serving to distinguish one family from another, and to show how distant younger branches are from the elder or principal branch.

DIFFERENTIAL, in the higher geometry, an infinitely small quantity, or a particle of quantity so small as to be less than any assignable one. It is called a *differential*, or *differential quantity*, because frequently considered as the difference of two quantities; and, as such, it is the foundation of *differential calculus*. Sir Isaac Newton and the English call it a *moment*, from its being considered as the momentary increase of quantity. See FLUXIONS.

DIFFERENTIAL *Equation* is an equation involving or containing differential quantities, as the equation $3x^2dx - 2axdx + aydx + axdy = 0$. Some mathematicians have also applied the term differential equation in another sense, to certain equations defining the nature of facts.

Differential Calculus, or *Method*, a method of finding quantities by means of their successive differences. See Fluxions.

DIFFORM, *Difformis* (from *dis*, asunder, and *forma*, shape), is a word used in opposition to uniform, and signifies that there is no regularity in the form or appearance of a thing. The botanists use it as a distinction of the flowers of several species of plants.

DIFFUSE, an epithet applied to such writings as are written in a prolix manner. Among historians, Sallust is reckoned sententious, and Livy diffuse. Thus also, among the orators, Demosthenes is close and concise; but Cicero, on the other hand, is diffuse.

DIFFUSION, the dispersion of the subtile effluvia of bodies into a kind of atmosphere all round them. Thus the light diffused by the rays of the sun issues all round from that amazing body of fire.

DIGBY, Sir Kenelm, an English philosopher, was born at Gothurst, in Buckinghamshire, in 1603, and became very illustrious for his virtue and learning. He was descended of an ancient family. His great-grandfather, accompanied by six of his brothers, fought valiantly at Bosworth Field on the side of Henry VII. against the usurper Richard III. His father, Sir Everard Digby, was engaged in the gunpowder plot against King James I., and for that crime was beheaded; but his son was restored to his estate. King Charles I. made him gentleman of the bed-chamber, commissioner of the navy, and governor of the Trinity House; and also granted him letters of reprisal against the Venetians, by virtue of which he took several prizes with a small fleet under his command. He fought the Venetians near the port of Scanderoon, and bravely made his way through their ships with his booty. He was a great lover of learning, and translated several authors into English; and his *Treatise of the Nature of Bodies and the Immortality of the Soul* discovers great penetration and extensive knowledge. He applied to chemistry, and found out several useful medicines, which he gave freely away to people of all sorts, especially to the poor. His sympathetic powder for the cure of wounds at a distance made a great noise for a time, but, like other absurd fancies, it soon fell into discredit. He had conferences with Descartes about the nature of the soul.

In the beginning of the civil wars he exerted himself vigorously in the king's cause; but he was afterwards imprisoned by order of the parliament in Winchester House, and had leave to depart thence in 1643. He afterwards compounded for his estate, but was ordered to leave the nation; when he went to France, and was sent on two embassies to Pope Innocent X. from the queen, widow to Charles I., whose chancellor he then was. On the restoration of Charles II. he returned to London, where he died in 1663, at the age of sixty.

This eminent person, on account of his early talents and great proficiency in learning, was compared to the celebrated Pico de Mirandola, and accounted a prodigy of erudition. But his knowledge, though various and extensive, appeared to be greater than it really was, as he had all the powers of elocution and address to recommend it. He knew how to shine in a circle of ladies or philosophers; and was as much attended to when he spoke on the most trivial subjects, as when he conversed on the most important.

DIGEST (*Digestum*), a collection of the Roman laws, arranged and digested under proper titles, by order of the Emperor Justinian. See Civil Law.

DIGESTION, in the animal economy, is the dissolution of the aliments into such minute parts as are fit to enter the lacteal vessels, and to circulate with the mass of blood.

Digestion, in *Chemistry*, is an operation which consists in exposing bodies to a gentle heat in proper vessels, and during a certain time. This operation is very useful in favouring the action of certain substances upon each other; as, for example, of well calcined, dry, fixed alkali upon rectified spirit of wine. When these two substances are digested together in a matrass, with a gentle sand-bath heat, the spirit of wine acquires a reddish-yellow colour and an alkaline quality. The spirit would not so well acquire these qualities by a stronger and shorter heat.

DIGESTIVE, in *Medicine*, such remedies as strengthen and increase the tone of the stomach, and assist in the digestion of foods.

DIGGES, Leonard, an eminent mathematician in the sixteenth century, was descended from an ancient family, and born at Digges Court, in the parish of Barham in Kent, but in what year is not known. He was educated at Oxford, where he laid a good foundation of learning; and having retired from thence, he prosecuted his studies, and became an excellent mathematician, a skilful architect, and an expert surveyor of land. He composed several works, as, 1. *Tectonicum*, briefly showing the exact Measuring and speedy Reckoning of all manner of Lands, Squares, Timber, Stones, Steeples, &c. 1556, 4to; 2. A Geometrical Practical Treatise, named *Pantometria*, in three books, which he left in manuscript, but which after his death was published by his son in 1591, folio; 3. Prognostication Everlasting of right good effect, or Choice Rules to judge the weather by the Sun, Moon, and Stars, &c. in 4to, 1555, 1556, and 1564; corrected and augmented by his son, with divers general tables, and many compendious rules, in 4to, 1592. He died about the year 1574.

Digges, *Thomas*, only son of Leonard Digges, having received a liberal education from his tenderest years, went and studied for a time at Oxford; and by the improvement which he made there, and the subsequent instructions of his learned father, he became one of the best mathematicians of his age. When Queen Elizabeth sent some forces in order to assist the oppressed inhabitants of the Netherlands, Mr Digges was appointed their muster-master-general; by which he became well skilled in military affairs, as his writings afterwards showed. He died in 1595.

Mr Digges, besides revising, correcting, and enlarging some pieces of his father's already mentioned, wrote and published the following learned works, viz. 1. *Alæ sive Scalæ Mathematicæ*, or Mathematical Wings or Ladders, 1573, 4to; 2. An Arithmetical Military Treatise, containing so much of Arithmetic as is necessary towards military discipline, 1579, 4to; 3. A Geometrical Treatise, named *Stratioticos*, requisite for the perfection of Soldiers, 1579, 4to, which was begun by his father, but finished by himself; 4. A perfect Description of the Celestial Orbs, according to the most ancient doctrine of the Pythagoreans, &c. placed at the end of his father's "Prognostication Everlasting," printed in 1592, 4to; 5. A humble motive for association to maintain the religion established, 1601, 8vo, to which is added, his Letter to the same purpose to the archbishops and bishops of England; 6. England's Defence, or, a Treatise concerning Invasion, a tract of the same nature with that printed at the end of his Stratioticos, and called a briefe Discourse, &c. but not published till 1686; 7. A Letter printed before Dr John Dee's *Parallaticæ Commentationis praxeosque nucleus quidam*, 1573, 4to. Besides these and his *Nova Corpora*, he left several mathematical treatises ready for the press, which, by reason of law-suits and other avocations, he was prevented from publishing.

DIGGING, among miners, is appropriated to the operation of freeing any kind of ore from the bed or stratum in which it lies, where every stroke of their tools turns to account; in contradistinction to the openings made in search of ore, which are called *hatches*, or *essay-hatches*, and the operation itself, named *tracing of mines*, or *hatching*. When a bed of ore is discovered, the beele-men, so called from the instrument they use, which is a kind of pickaxe, free the ore from the fossils around it; and the shovelmen throw it up from one shamble to another, till it reaches the mouth of the hatch. In some mines, to save the expense as well as fatigue of the shovel-men, they raise the ore by means of a winder and two buckets, one of which ascends as the other descends.

DIGIT, in *Astronomy*, the twelfth part of the diameter of the sun and moon, used to express the quantity of an eclipse. Thus an eclipse is said to be of six digits when six of these parts are hid.

Digits, or *Monades*, in *Arithmetic*, signify any integer under ten; as, 1, 2, 3, 4, 5, 6, 7, 8, 9, and by means of which all numbers are expressed.

Digit is also a measure taken from the breadth of the finger. It is properly three fourths of an inch, and contains the measure of four barleycorns laid breadthwise.

DIGLIGGY NEUR, a town in the island of Ceylon, situated among thick woods and mountains ten or twelve miles to the eastward of Candy, in the direction of Battacolo. When the king was driven out of Candy in 1803 he retreated to this place, to which the European army could not penetrate.

DIGLYPH, in *Architecture*, a kind of imperfect triglyph, console, or the like, with two channels or engravings, either circular or angular.

DIGNE, an arrondissement of the department of the Mouths of the Rhone, in France, 1146 square miles in extent. It is divided into nine cantons and two hundred and sixty communes, containing 49,141 inhabitants. The chief place, of the same name, is situated on the river Bleone, in a neighbourhood covered with fruit gardens, vineyards, and olive woods, the exportation of the products of which forms the chief occupation of the 3487 inhabitants. Long. 5. 58. 59. E. Lat. 44. 5. 18. N.

DIGNITARY, in the canon law, a person who holds a dignity, that is, a benefice which gives him some pre-eminence over mere priests and canons; as a bishop, dean, archdeacon, prebendary, &c.

DIGNITY, as applied to the titles of noblemen, signifies honour and authority. Dignity may be divided into superior and inferior; as the titles of duke, earl, baron, &c. which are the highest names of dignity; and those of baronet, knight, serjeant-at-law, &c. which are the lowest. Nobility only can give so high a name of dignity as to supply the want of a surname in legal proceedings; and as the omission of a name of dignity may be pleaded in abatement of a writ, so it may also be where a peer who has more than one name of dignity is not named by the most noble. No temporal dignity of any foreign nation can give a man a higher title here than that of esquire.

Dignity, in the human character, the opposite of meanness.

Man is endowed with a sense of the worth and excellence of his nature. He deems it more perfect than that of the other beings around him; and he perceives that the perfection of his nature consists in virtue, particularly in virtue of the highest rank. To express that sense, the term *dignity* is appropriated. Further, to behave with dignity, and to refrain from all mean actions, is felt to be not only a virtue, but a duty: it is a duty which every man owes to himself. By acting in this manner, he attracts love and esteem; by acting meanly, or below himself, he is discommended and contemned.

This sense of the dignity of human nature reaches even our pleasures and amusements. If they enlarge the mind by raising grand or elevated emotions, or if they humanize the mind by exercising our sympathy, they are approved as suited to the dignity of our nature; but if they contract the mind by fixing it on trivial objects, they are contemned as not suited to the dignity of our nature. Hence in general every occupation, whether of use or amusement, that corresponds to the dignity of man, is termed manly; and every occupation below his nature is termed childish or puerile.

To those who make a study of human nature, there is a point which has always appeared intricate. How comes it that generosity and courage are more esteemed, and bestow more dignity, than good nature or even justice, though the latter contribute more than the former to private as well as to public happiness? This question, bluntly proposed, might puzzle even a philosopher; but, by means of the foregoing observations, it will be easily solved. Human virtues, like other objects, obtain a rank in our estimation, not from their utility, which is a subject of reflection, but from the direct impression which they make on us. Justice and good nature are a sort of negative virtues, which scarcely make any impression except when they are transgressed. Courage and generosity, on the contrary, producing elevated emotions, enliven the great sense of a man's dignity, both in himself and in others; and for this reason courage and generosity are in higher esteem than the other virtues mentioned; we describe them as grand and elevated, as of greater dignity, and more praiseworthy.

This leads us to examine more directly emotions and passions with respect to the present subject; and it will not be difficult to form a scale of them, beginning with the meanest, and ascending gradually to those of the highest rank and dignity. Pleasure felt as at the organ of sense, in other words, corporeal pleasure, is perceived to be low, and when indulged to excess, is perceived also to be mean; for which reason, persons of any delicacy dissemble the pleasure they take in eating and drinking. The pleasures of the eye and ear having no organic feeling, and being free from any sense of meanness, are indulged without any shame; and they even rise to a certain degree of dignity when their objects are grand or elevated. The case is the same with the sympathetic passions; a virtuous person behaving with fortitude and dignity under cruel misfortunes makes a capital figure, and the sympathizing spectator feels in himself the same dignity. Sympathetic distress, at the same time, is never mean; on the contrary, it is agreeable to the nature of a social being, and excites general approbation. The rank which love possesses in the scale depends in a great measure on its objects. It possesses a low place when founded on external properties merely, and is mean when bestowed on a person of inferior rank, without any extraordinary qualification; but when founded on the more elevated internal properties, it assumes a considerable degree of dignity. The case is the same with friendship. When gratitude is warm it animates the mind; but it scarcely rises to dignity. Joy bestows dignity when it proceeds from an elevated cause.

If we can depend upon induction, dignity is not a property of any disagreeable passion; one is slight, another severe; one depresses the mind, another animates it. But there is no elevation, far less dignity, in any of them. Revenge, in particular, though it inflames and swells the mind, is not accompanied with dignity, not even with elevation. It is not however felt as mean or grovelling, unless when it takes indirect or cowardly measures for gratification. Shame and remorse, though they sink the spirits, are not mean. Pride, a disagreeable passion, bestows no dignity in the eye of a spectator; but vanity always appears mean, and extremely so where founded, as commonly happens, on trivial qualifications.

The pleasures of the understanding possess a high rank in point of dignity. Of this every one must be sensible, when he considers the important truths which have been laid open by science; such as general theorems, and the laws which govern the material and moral worlds. The pleasures of the understanding are suited to man as a rational and contemplative being, and they tend not a little to ennoble his nature; even to the Deity he stretches his contemplations, which, in the discovery of infinite power, wisdom, and benevolence, afford delight of the most exalted kind. Hence it appears that the fine arts, studied as a rational pursuit, afford entertainment of great dignity, superior far to what they afford as a subject of taste merely. But contemplation, however in itself valuable, is chiefly respected as subservient to action; for man is intended to be more an active than a contemplative being. He accordingly shows more dignity in action than in contemplation. Generosity, magnanimity, heroism, raise his character to the highest pitch; these best express the dignity of his nature, and advance him nearer to divinity than any other of his attributes.

Having endeavoured to assign the true cause of dignity and meanness, by unfolding the principle on which they are founded, we proceed to explain the final cause of the dignity or meanness bestowed upon the several particulars above mentioned, beginning with corporeal pleasures. These, as far as useful, are, like justice, fenced with sufficient sanctions to prevent their being neglected. Hunger and thirst are painful sensations; and we are incited to animal love by a vigorous propensity. Were corporeal pleasures over and above dignified with a place in a high class, they would infallibly overturn the balance of the mind, by outweighing the social affections. This is a satisfactory final cause for refusing to these pleasures any degree of dignity; and the final cause is not less evident of their meanness when they are indulged to excess. The more refined pleasures of external sense, conveyed by the eye and the ear from natural objects and from the fine arts, deserve a high place in our esteem, because of their singular and extensive utility. In some cases they rise to a considerable dignity; and the very lowest pleasures of the kind are never esteemed mean nor grovelling. The pleasure arising from wit, humour, ridicule, or from what is simply ludicrous, is useful, by relaxing the mind after the fatigue of more manly occupations; but the mind, when it surrenders itself to pleasure of that kind, loses its vigour, and sinks gradually into sloth. The place which this pleasure occupies in point of dignity is adjusted to these views. To make it useful as a relaxation, it is not branded with meanness; to prevent its usurpation, it is removed from that place but a single degree. No man values himself for that pleasure even during gratification; and if it have engrossed more of his time than is requisite for relaxation, he looks back on the circumstance with some degree of shame.

In point of dignity, the social emotions rise above the selfish, and much above those of the eye and ear. Man is by his nature a social being; and to qualify him for society, it is wisely contrived that he should value himself more on being social than selfish. The excellency of man is chiefly discernible in the great improvements he is susceptible of in society. These, by perseverance, may be carried on progressively, beyond any assignable limits; and even abstracting from revelation, there is a very great probability that the progress begun here will be completed in some future state. Now, as all valuable improvements proceed from the exercise of our rational faculties, the Author of our nature, in order to excite us to a due use of these faculties, has assigned a high rank to the pleasures of the understanding. Their utility, with respect to this life as well as a future one, entitles them to that rank.

But as action is the aim of all our improvements, virtuous actions justly possess the highest of all ranks. These, we find, are by nature distributed into different classes, and the first place in point of dignity is assigned to actions which appear not the first in point of use. Generosity, for example, in the sense of mankind, is more respected than justice, though the latter is undoubtedly more essential to society; and magnanimity, heroism, and undaunted courage, rise still higher in our esteem, for the reason which has been already explained.

DIGNY, a market-town of the department of the Eure and Loire, in France, containing 378 houses and 2160 inhabitants, in the neighbourhood of which are some mines of iron extensively worked.

DIGON, a market-town of the department of the Upper Soane and Loire, in France, with 2508 inhabitants. It is situated near the Loire, at the point where the central canal commences.

DII, the divinities of the ancient inhabitants of the earth, which were very numerous. Every object which caused terror, inspired gratitude, or bestowed affluence, received the tribute of veneration. Man saw a superior agent in the stars, the elements, or the trees; and supposed that the waters which communicated fertility to his fields and possessions were under the influence and direction of some invisible power inclined to favour and to benefit mankind. Thus arose a train of divinities, which imagination arrayed in different forms, and armed with different powers. They were endowed with understanding, and were actuated by the same passions which daily afflict the human race; and those creations of superstition were appeased or provoked in the same manner as the imperfect being who gave them birth. Their wrath was mitigated by sacrifices and incense, and sometimes human victims bled to expiate a crime which superstition alone supposed to exist. The sun, from his powerful influence and animating nature, first attracted the notice and claimed the adoration of the uncivilized inhabitants of the earth. The moon also was honoured with sacrifices and addressed in prayers; and after immortality had been liberally bestowed on all the heavenly bodies, mankind classed amongst their deities the brute creation, and the cat and the sow shared equally with Jupiter himself, the father of gods and men, the devout veneration of their votaries. This immense number of deities has been divided into different classes, according to the will and pleasure of the mythologists. The Romans, generally speaking, reckoned two classes of the gods, the *dii majorum gentium* or *dii consentes*, and the *dii minorum gentium*. The former were twelve in number, namely, six males and six females. (*Vid.* CONSENTES.) In the class of the latter were ranked all the gods who were worshipped in different parts of the earth. Besides these, there were divinities called *dii selecti*, sometimes classed with the twelve greater gods; these were Janus, Saturn, the Genius, the Moon, Pluto, and Bacchus. There were also some called demigods, that is, persons who deserved immortality by the greatness of their exploits, and for their uncommon services to mankind. Amongst these were Priapus, Vertumnus, Hercules, and those whose parents were some of the immortal gods. Besides, all the passions and the moral virtues were reckoned as powerful deities, and temples were raised to a goddess of concord, of peace, and the like. According to Hesiod, there were no less than thirty thousand gods that inhabited the earth, and were guardians of men, all subservient to the power of Jupiter. To these succeeding ages added an almost equal number; and indeed they were so numerous, and their functions so various, that we find temples erected, and sacrifices offered, to unknown gods. It is observable that all the gods of the ancients had lived upon earth as mere mortals; nay even Jupiter, who was the ruler of heaven, is represented by the mythologists as a helpless child; and we are acquainted with all the particulars which attended the birth and education of Juno. In process of time not only good and virtuous men, who had been the patrons of learning and the supporters of liberty, but also thieves and pirates, were admitted amongst the gods; and the Roman senate courteously granted the apotheosis to the most cruel and abandoned of their emperors.

DIJAMBUS, in *Poetry*, the foot of a Latin verse of four syllables. It is compounded of two *iambics*, as *sĕvērĭtās*.

DIJON, an arrondissement of the department of Côte d'Or, in France, which extends over 1190 square miles. It is divided into fourteen cantons and 270 communes, and contains 124,034 inhabitants. The chief place is the city of the same name, the seat of a bishop, and of the several boards which conduct the internal, legal, political, and military affairs of the department. It is situated in a fine plain, watered by the river Ouche, and surrounded on all sides by picturesque hills, inclosing fertile meadows and corn fields. It is a well-built city, with straight and wide streets, and many magnificent buildings, but especially the palace of the ancient sovereigns of Burgundy. There is an academy and public library, and several learned establishments. The houses are 2900, and the inhabitants amounted in 1810 to 21,612; but they have since increased. There are manufactories for cloths, flannels, blankets, cotton goods, hosiery, hats, earthen-ware, vinegar, mustard, and other commodities. Long. 4. 56. 45. E. Lat. 47. 19. 25. N.

DIKE, a ditch or drain, made for the passage of waters. The word seems to have been formed from the verb *to dig;* though others choose to derive it from the Dutch *diik*, a dam, sea-bank, or wall.

Dike, or *Dyke*, also denotes a work of stone, timber, or fascines, raised to oppose the entrance or passage of the waters of the sea, a river, lake, or the like. The word comes from the Flemish *dyk*, or *diik*, a heap of earth to bound or stem the water. Junius and Ménage conceive the Flemish to have borrowed their word from the Greek *τειχος, wall;* but Guichard derives it from the Hebrew *daghah*. These dikes are usually elevations of earth, with hurdles of stakes, stones, and other matters.

DILAPIDATION, in *Law*, a wasteful destroying, or letting buildings run to decay, for want of necessary reparation. If the clergy neglect to repair the houses belonging to their benefices, the bishop may sequester the profits thereof for that purpose; and in such cases a prosecution may be brought, either in the spiritual court or at common law, against the incumbent himself, or against his executor or administrator.

DILATATION, in *Physics*, a motion of the parts of any body, by which it is so expanded as to occupy a greater space. This expansive motion depends upon the elastic power of the body; whence it appears that dilatation is different from rarefaction, which is produced by means of heat.

DILEMMA, in *Logic*, an argument equally conclusive by contrary suppositions.

DILLENBURG, a bailiwick in the duchy of Nassau, in Germany, extending over 42,500 English acres, and containing a population of 13,627 persons, in two cities and eighty-two villages. The capital is a city of the same name, situated on the Dille, which is surrounded with walls, and contains 2302 inhabitants.

DILLENIUS, John James, a distinguished botanist of the eighteenth century, who may be called the father of cryptogamic botany, was born at Darmstadt in 1687. He was educated as a physician in the university of Giessen; but his attention was very early diverted from medical studies to the observation and discrimination of plants; nor does he appear to have ever followed any branch of the practice of physic. In botany he was strictly a practical observer, having addicted himself but little to the principles of classification, and not at all to the physiology of vegetables. Some branches of zoology occasionally engaged him, which an assiduous collector of plants, in their native situations, can hardly escape, so closely are these studies, especially that of insects and the lower tribes of animated beings, connected with botany. Dillenius, whilst at Giessen, wrote several papers for the *Ephemerides Naturæ Curiosorum*, on American plants naturalized in Europe, on coffee, on opium obtained from poppies in Germany, with some minute critical remarks on *Spergula pentandra*, as well as on various cryptogamous plants. He published also a paper on leeches, and two species of *papilio*. He printed at Giessen in 1719 his *Catalogus Plantarum sponte circa Gissam nascentium*, a valuable little octavo volume, with figures drawn and engraved by his own hand, of the parts of fructification, particularly designed to illustrate the generic characters of plants, previously not well arranged or understood. In this work he established many new genera, which have for the most part kept their ground. His great merit as a general botanist consisted in a constant attention to the only sound principle of scientific botany, the discrimination of *genera* by the parts of the flower and fruit. This principle, first proposed by the great Conrad Gesner, Dillenius applied to practice, with a severer judgment and closer attention than perhaps any other person, from Gesner to Linnæus. The little book in question is arranged most inconveniently according to the times of the plants' flowering. Its preface, however, enters into the subject of classification, a subject to which young botanists are generally prone, but of which they as generally, after having embroiled it, take their leave, in proportion as they acquire more practical knowledge. Dillenius so far displayed his judgment, that he rather showed the faults of the systems of Tournefort, Knaut, and Rivinus, than offered any thing of his own. This led him into some controversies, from which he soon disengaged himself, and never subsequently took up the question at all.

The great William Sherard, while returning in 1718 from Smyrna through Germany, met with Dillenius, whose scientific merit could not have escaped so eminent a botanist. He brought him to England in 1721, and excited him to publish, in 1724, that valuable enlarged edition of Ray's *Synopsis* of British plants, which has ever since been in general use, and which the editor enriched with engravings of his own. In this publication, compared with the *Catalogus* of the plants of Giessen above mentioned, we cannot but perceive the difference between an author working upon his own original materials, and the commentator or illustrator of the labours of another. Though Dillenius made numerous and correct additions to Ray's work, in the cryptogamic tribes at least, he rather confused than improved the other parts of the book, especially with regard to synonyms, in which department he was never supremely accurate.

In 1732 Dillenius published his magnificent *Hortus Elthamensis*, in two volumes folio, containing 324 plates, engraved on pewter, with his own hand. Their merit consists in their very great precision and fidelity. The descriptions, and historical as well as botanical remarks, render this a classical book in botany. Its style is good, and the whole performance is worthy of the author, and of his eminent patron, whose brother, Dr James Sherard, was the owner of the garden at Eltham, which furnished the rich materials of this publication. Before this book appeared, its author was established at Oxford, in the new professorship founded there by the will of William Sherard, who died in August 1728, and who left L.3000 for the purpose, besides his own library, manuscripts, and ample herbarium. Dillenius took the degree of M.D. in this university in 1735, though he had previously obtained the same rank at Giessen; and he now devoted himself to the completion of the *Pinax*, or universal collection of synonyms, which was Sherard's chief object in this foundation. The work was never finished; for indeed neither Dillenius nor any one else could even at that time be competent to it: still less, as botanists and botanical works multiplied excessively, was this undertaking practicable. The publications of Linnæus soon rendered it unnecessary. That illustrious foreigner in 1736 visited Dillenius, who was desirous of fixing him here as his coadjutor; but to this scheme there were several impediments. Nevertheless these distinguished men continued ever after in correspondence, certainly to the advantage of their common study, except in one but too important instance. We allude to the theory of the fructification of mosses, in which Linnæus implicitly adopted the faulty opinion of the Oxford professor, contrary to his own better observation and judgment, taking the capsule for the anther. This leads us to mention the immortal work on which the fame of Dillenius rests, and which, in its way, will never be excelled, the *Historia Muscorum*, published in 1741, in one quarto volume, with eighty-five plates, drawn and engraved by the author. In this performance, laborious investigation, acute discrimination, supreme accuracy, and profound learning, are displayed beyond all example or comparison. Following inquirers, like the celebrated Hedwig, may, with better helps, have examined the same objects more deeply; but none has taken so complete a view of the subject, nor made so very few mistakes. No botanical book perhaps is so perfect in synonyms. Whether the labour of this undertaking was too much for the health of its author, or whether his sedentary mode of life was, on the whole, injurious, we have no particular information; but he began, soon after the publication of the *Historia Muscorum*, to complain of ill health and advancing age. He was of a short stature and corpulent habit, and died of an apoplexy on the 2d April 1747, in his sixtieth year. A picture of this distinguished botanist is preserved in the picture-gallery at Oxford, from which a print has been published in Sim's and Konig's *Annals of Botany*, vol. ii. Dillenius is said to have been amiable and respectable in his private character. He never married. His books, collection of mosses referring to his great work, with many drawings, especially of *Fungi*, were bought by his successor Dr Humphrey Sibthorp, and added to the Sherardian Museum, where they still remain. (x. x.)

DILLINGEN, a bailiwick in the circle of Upper Danube, of the kingdom of Bavaria. It extends over seventy square miles, or 44,800 acres, and contains one city, one town, and twenty-two villages, with 10,804 inhabitants. The capital, of the same name, situated on the Danube, contains 550 houses, and 3118 inhabitants, who are chiefly employed in iron-works, but some in making paper.

DILUTE. To dilute a body is to render it liquid, or if liquid before, to render it more so by the addition of a thinner fluid. The fluids thus added are called *diluents*.

DIMACHE (from δις, *double*, and μαχω, *I fight*), in *Antiquity*, a kind of horsemen first instituted by Alexander. Their armour was lighter than that of the infantry, and at the same time heavier than that used by cavalry, so that they could act as horse or foot as occasion required.

DIMENSION, in *Geometry*, is either length, breadth, or thickness. Hence a line has one dimension, or length; a superficies two, or length and breadth; and a body or solid has three, or length, breadth, and thickness.

DIMINUTION, in *Architecture*, a contraction of the upper part of a column, by which its diameter is made less than that of the lower part.

Diminution, in *Music*, is the abating something of the full value or quantity of any note.

DIMINUTIVE, in *Grammar*, a word formed from some other, to soften or diminish the force of it, or to signify that a thing is little in its kind. Thus, *cellule* is a diminutive of *cell*, *globule* of *globe*, *hillock* of *hill*.

DIMISSORY Letters (*Literæ Dimissoriæ*), in the canon law, a letter given by a bishop to a candidate for holy orders, having a title in his diocese, directed to some other bishop, and giving permission for the ordination of the bearer thereof.

When a person produces letters of ordination or tonsure conferred by any other than his own diocesan, he must at the same time, on pain of nullity, produce the letters dimissory given by his own bishop. Letters dimissory cannot be given by the chapter, *sede vacante;* this being deemed an act of voluntary jurisdiction, which ought to be reserved to the successor.

DIMŒRITÆ, a name given to the Apollinarists, who at first held that the Word only assumed a human body, without taking a reasonable soul; but being at length convinced by formal texts of Scripture, they allowed that he did assume a soul, though without understanding, the Word supplying the want of that faculty. From this way of separating the understanding from the soul, they came to be denominated *dimœrites*, that is, *dividers*, *separators*, from δια, and μοιραω, *I divide*.

DIMOTIKA, a city in the Turkish province of Gallipoli, where the rivers Moritza and Kisilnehr join. It contains about 8000 inhabitants, partly Greeks. The chief employment consists in making silk and cotton goods. The citadel served as a residence for the grand signior before the conquest of Constantinople.

DIMSDALE, Thomas, Baron, greatly distinguished by his practice of inoculation for the small-pox, was the son of a surgeon and apothecary at Theydon-Gernon, in Essex, and was born in the year 1712. His family belonged to the society of Quakers; and his grandfather accompanied William Penn to America, but soon afterwards returned and settled in his native village. Thomas was brought up to his profession, first under his father, and afterwards in St Thomas Hospital, London. He commenced his practice at Hertford about 1734, and married the only daughter of Nathaniel Brassey, of Roxford, near that town, an eminent banker in London, and representative of Hertford in four successive parliaments. But this lady died in 1744, leaving no children. To relieve his mind under the loss of his wife, he voluntarily offered his assistance to the physicians and surgeons in the army under the Duke of Cumberland, and continued with it until after the surrender of Carlisle to the king's forces, when he received the duke's thanks, and returned to Hertford. In 1746 he married Anne Iles, a relation of his first wife, and by her fortune, and that which he had acquired by the death of the widow of Sir John Dimsdale of Hertford, he retired from practice; but his family becoming numerous, and seven of his ten children being living, he resumed it, and took the degree of doctor of medicine in 1761. Having fully satisfied himself concerning the new method of treating persons under inoculation for the small-pox, he published his treatise on this subject in 1776, and it was soon circulated all over the Continent, and translated into all the modern languages, not excepting the Russian. He concludes with saying that, "although the whole process may have some share in the success, it, in my opinion, consists chiefly in the method of inoculating with recent fluid matter, and the management of the patients at the time of eruption." This proof of his professional knowledge occasioned his being invited to inoculate the Empress Catherine and her son in 1768, of which he gives a particular account in his Tracts on Innoculation, 1781. His reward for this was an appointment of actual counsellor of state and physician to her imperial majesty, with an annuity of L.500; the rank of a baron of the Russian empire, to be borne by his eldest lawful descendant in succession, and a black wing of the Russian eagle in a gold shield in the middle of his arms, with the customary helmet, adorned with the baron's coronet, over the shield: he also received immediately L.10,000, and L.2000 for travelling charges, besides miniature pictures of the empress and her son, and the same title to his son, to whom the grand duke gave a gold snuff-box, richly set with diamonds. The baron inoculated numbers of people at Moscow; and, resisting the empress's invitation to reside as her physician in Russia, he and his son were admitted to a private audience of Frederick II. king of Prussia, at Sans Souci, and thence returned to England. In 1779 he lost his second wife, who left him seven children. But he afterwards married Elizabeth, daughter of William Dimsdale of Bishops-Stortford, who survived him. He was elected representative of the borough of Hertford in 1780; and declined all practice, except for the relief of the poor. He went to Russia once more in 1781, in order to inoculate the late emperor and his brother Constantine, sons of the grand duke; and as he passed through Brussels, the Emperor Joseph received him in private, and wrote in his presence a letter, which he was to convey to the Empress of Russia. In 1790, his son, Baron Nathaniel, was elected member for the borough of Hertford, on his resignation and retirement to Bath for several winters; but at last he fixed altogether at Hertford, and died, at the age of eighty-nine, on the 30th December 1800, after an illness of about three weeks. About seventeen years before his death he felt the sight of one eye declining, having before lost that of the other, but recovered both by the operation of the cataract, by Wenzel.

DINAGEPORE, a district of Bengal, situated chiefly between the 25th and 26th degrees of N. lat. On the north it is bounded by Rungpoor and Purneah; on the south by Raujeshy; and on the east by Rungpoor, Purneah, and Rajemal. This district possesses a soil much diversified; and the face of the country has a waving appearance, being divided into small valleys, each about two or three miles broad. These valleys are watered by small rivers, which in the rainy season overflow the low lands, and swell into large lakes fifty or sixty miles in length, which, while the Ganges is in flood, have no outlet. They are thus not only prevented from running off, but are so much increased as to be navigable for vessels of considerable burden. After the inundation runs off, these low lands are covered with a luxuriant pasture, on which are fed numerous buffaloes, and large herds of other cattle, or with rich crops of rice, which is the great staple of agriculture; besides tobacco, indigo, and hemp. The land does not answer for wheat or barley. The soil of the elevated portions of the country is in general a stiff clay, in some places black and porous, in others stiff and tenacious. Many sorts of fibrous plants for cordage and sackloth are sown in April, May, and June; several sorts of pulse are also sown at the commencement of the cold season; and, where the soil is good, the sugar cane is planted in February and March. The inhabitants are in general extremely poor, and their farming utensils are therefore proportionally rude. They are in the proportion of four Hindus to one Mahommedan. The population, according to the best statistical information that could be procured in answer to queries circulated in 1801 by the Marquis Wellesley, then governor-general, amounted to 600,000. The capital, Dinagepore, is situated on an island formed by the Pernabubah river. It is the residence of a rajah, and a place of considerable trade. It is 162 miles north-north-east of Moorshedabad. Long. 89. 40. E. Lat. 25. 37. N.

DINAN, an arrondissement in the department of the Coté du Nord, in France. It extends over 576 square miles, is divided into eight cantons and ninety-two communes, and contains 100,690 inhabitants. The chief place, a city of the same name, strongly fortified, is situated on a hill, at the foot of which the river Rance flows. It is built in an antiquated style, containing 6820 inhabitants, who are employed in making linen from the excellent flax which grows in its vicinity. Long. 2. 8. 25. W. Lat. 48. 27. 16. N.

DINANT, a city, the capital of a circle of the same name, in the province of Namur, in the Netherlands. The circle is divided into six cantons, and contains 92,756 inhabitants. The city is situated on the right bank of the Maas, enclosed by steep hills. It contains 3631 inhabitants, who are occupied with coppersmiths' and ironmongery wares.

DINAPOOR, a town of Hindustan, in the province of Bahar, on the southern bank of the Ganges, two miles west from Patna. Here is a military cantonment belonging to the British, consisting of two handsome squares, built of brick, and capable of containing 1200 European soldiers, and the European officers of the native corps. Long. 85. 3. E. Lat 25. 38. N.

DINAZZANO, a town of Italy, in the province of Reggio, in the duchy of Modena, situated on the Tessone. It contains 1800 inhabitants.

DINDIGUL, a district in the south of India, situated between the 10th and 11th degrees of N. lat. To the north it has Coimbetoor and Kistnagherry; to the south Travancore and Madura; on the east the Polygar territory and Madura; and on the west Travancore, Cochin, and Malabar. The principal rivers are the Noil and the Amravati; and the chief towns Dindigul, Balny, and Palapetty. This district was conquered by the Mysore government in 1757. It was taken possession of by the British in 1783, and subsequently restored to Tippoo Sultan. In 1792 it was again ceded to the British, and is now included in the collectorship of Madura. The capital is of the same name; it is a place of considerable consequence, and possesses a strong fortress, situated on a rock. Long. 78. 5. E. Lat. 10. 22. N.

DINDING, a small island in the Straits of Malacca, at the entrance of the river Pera, about twenty miles in circumference. Long. 100. 36. E. Lat. 4. 15. N.

DINGWALL, a royal burgh of Scotland, and capital of the county of Ross. It lies in a low situation at the mouth of a glen opening into the north side of the Cromarty Frith, near the western extremity of that estuary. The town is rather neatly built, and consists of one main street, from which several smaller ones branch off. The town-house is a curious old building, and stands in the centre of the place. The church is a plain edifice, on the north side of the town, with an obelisk in its neighbourhood, fifty-seven feet in height, erected to the memory of the first Earl of Cromarty, who was buried here. This place possesses a small harbour, near which formerly stood the mansion of the powerful family of Ross; but of this princely structure only a few fragments remain. Dingwall was created a royal burgh by Alexander II.; and its charter was renewed by James IV. Its civic governors are a provost, two bailies, a dean of guild, treasurer, and ten counsellors. There is a weekly market held on Friday, and two yearly fairs. It is distant 178 miles north-west from Edinburgh. The population of the town and parish amounted in 1821 to 2031, and in 1831 to 2124.

DINKELSBUHL, a city of the kingdom of Bavaria, in the circle of Rezat, the chief place of a bailiwick. It is situated on the river Wernitz, is fortified, and contains 900 houses, and 6450 inhabitants, who carry on manufactures of woollen cloth, hats, stockings, and leather. The bailiwick, of the same name, extends over 902 square miles, or 577,280 English acres, and contains 10,350 inhabitants.

DINNER, the principal meal of the day. The word is derived from the French *disner*, which Du Cange derives from the barbarous Latin *disnare;* but Henry Stephens derives it from the Greek δειπνειν, and contends that it should be written *dipner.* Ménage deduces it from the Italian *desinare*, to dine; and that from the Latin *desinere*, to leave off work.

DINOCRATES, a celebrated architect of Macedonia, who rebuilt the temple of Ephesus, when burnt by Erostratus, with much more magnificence than before. Vitruvius informs us that Dinocrates proposed to Alexander the Great to convert Mount Athos into the figure of a man, whose left hand should contain a walled city, whilst all the rivers of the mount should flow into his right, and thence into the sea. He also conceived a scheme for building the dome of the temple of Arsinoë at Alexandria of loadstone, that by its attraction it should hold her iron image in the centre, suspended in the air; projects which at least showed great boldness and conception.

DINSLAKEN, a circle in the Prussian province of Westphalia, a part of the ancient duchy of Cleves. It extends over 201 square miles, or 128,640 English acres, and comprehends five cities, one town, and thirty-one villages, with 26,876 inhabitants. The chief place is a town of the same name, situated on the Misine, and containing 1063 inhabitants.

DIO CHRYSOSTOM, that is, *Golden Mouth*, a celebrated orator and philosopher of Greece, in the first century, was born at Prusa in Bithynia. He attempted to persuade Vespasian to renounce the empire; and he was hated by Domitian, but acquired the esteem of Trajan. This last prince took pleasure in conversing with him, and made Dio ride with him in his triumphal chariot. There are still extant eighty of his orations, and some other of his works; the best edition of which is that of Hermand Samuel Raimarus, in 1750, folio.

DIOCESE, or DIOCESS, the circuit or extent of the jurisdiction of a bishop. The word is formed from the Greek διοικησις, *government, administration*, derived from διοικεω, which the ancient glossaries render *administro, moderor, ordino;* and hence διοικησις της πολεως, the *administration* or *government of a city.*

DIOCESE is also used in ancient authors for the province of a metropolitan.

Diocæsis (διοικησις) was originally a civil government, or prefecture, composed of different provinces.

The first division of the empire into dioceses is ordinarily ascribed to Constantine, who distributed the whole Roman world into four, namely, the diocese of Italy, the diocese of Illyria, that of the East, and that of Africa. And yet long before the time of Constantine, Strabo, who wrote under Tiberius, takes notice (lib. xiii. p. 432), that the Romans had divided Asia into dioceses; and he complains of the confusion which such a division occasioned in geography, Asia being no longer divided by people, but by dioceses, each of which had a tribunal or court, where justice was administered. Constantine, therefore, was only the institutor of those large dioceses, which comprehended several metropolises and governments; the former dioceses only comprehending one jurisdiction or district, or the country which had resort to one judge, as appears from the above passage in Strabo, and also from two in Cicero (lib. iii. *epist. ad Famil.* 9, and lib. xiii. *ep.* 67).

Thus at first a province included different dioceses, and afterwards a diocese came to comprehend different provinces. In after times the Roman empire became divided into thirteen dioceses or prefectures; though, including Rome and the suburbic regions, there were fourteen. These fourteen dioceses comprehended a hundred and twenty provinces; each province had a proconsul, who resided in the capital or metropolis; and each diocese of the empire had a consul, who presided in the principal city of the district.

On this civil constitution the ecclesiastical one was afterwards regulated; and each diocese had an ecclesiastical vicar or primate, who judged finally of all the concerns of the church within his territory. At present, however, diocese does not signify an assemblage of different provinces, but is limited to a single province under a metropolitan, or more commonly to the single jurisdiction of a bishop.

Brito affirms that diocese is properly the territory and extent of a baptismal or parochial church; and hence various authors use the word to signify a simple parish. See PARISH.

DIOCLEIA (Διοκλεια), in *Antiquity*, a solemnity observed during spring at Megara, in memory of the Athenian hero, who died in defence of the youth he loved.

DIOCLETIANUS, CAIUS VALERIUS JOVIUS, a celebrated Roman emperor, born of an obscure family in Dalmatia in the year 245. Although originally a common soldier, yet by merit and success he gradually rose to the rank of general; and at the death of Numerian in 284 he was invested with the imperial purple. In this high station he rewarded the virtues and fidelity of Maximian, who had shared with him all the subordinate offices in the army, by making him his colleague on the throne. He created two subordinate emperors, Constantius and Galerius, whom he called Cæsars, whilst he claimed for himself and his colleague the superior title of Augustus. Diocletian has been celebrated for his military virtues; and although he was naturally unpolished by education and study, yet he was the friend and patron of learning and true genius. He was bold and resolute, active and diligent, and well acquainted with the arts, which endear a sovereign to his people, and make him respectable even in the eyes of his enemies. His cruelty, however, against the followers of Christianity, has been deservedly branded with infamy. After he had reigned twenty-two years in the greatest prosperity, he publicly abdicated the crown at Nicomedia in 305, and retired to a private station at Salona. Maximian his colleague followed his example, but not from choice; and when he some time afterwards endeavoured to rouse the ambition of Diocletian, and to persuade him to re-assume the purple, he received for answer, that Diocletian took now more delight in cultivating his little garden than he had formerly enjoyed in a palace, when his power extended over all the Roman world. He lived nine years after his abdication, in the greatest security and enjoyment, at Salona, and died in 314, in the sixty-eighth year of his age. Diocletian is the first sovereign who voluntarily resigned his power. His bloody persecution of the Christians forms a chronological era, called the *era of Diocletian*, or of the martyrs. It was for a long time in use in theological writings, and is still preserved by the Copts and Abyssinians. It commenced on the 29th August 284.

DIODATI, JOHN, a famous minister, and professor of theology at Geneva, was born at Lucca in 1579, and died at Geneva in 1652. He is distinguished by translations, 1. Of the Bible into Italian, with notes, Geneva, 1607, 4to. The best edition is that of Geneva in 1641, folio. This is said to be more a paraphrase than a translation, and the notes are rather divine meditations than critical reflections. 2. Of the Bible into French, Geneva, 1644; 3. Of Father Paul's History of the Council of Trent into French.

DIODORUS, an historian, surnamed *Siculus*, because he was born at Argyra, in Sicily. He wrote a history of Egypt, Persia, Syria, Media, Greece, Rome, and Carthage; and it is said that he visited all the places of which he has made mention in his history, which occupied the labour of thirty years. He is, however, too credulous in some of his narrations, and frequently wanders far from the truth. He often dwells too long upon fabulous reports and trifling incidents; whilst events of the greatest importance to history are treated with brevity, and sometimes passed over in silence. He lived in the age of Julius Cæsar and Augustus; and spent much time at Rome in order to procure information, and authenticate his historical narrations. This important work, which he composed in Greek, contained forty books, of which there are only fifteen remaining. The style is clear and neat, and very suitable to history. The best edition is that of Wesseling, Amsterdam, 1745, in 2 vols. folio, with very learned and judicious remarks. It has been reprinted with important additions by the society of Deux-Ponts, 1793–1801, in 11 vols. 8vo. The Latin translation of Poggio, Bologna, 1742, folio, is very incomplete, and only sought after by reason of its scarcity. Diodorus Siculus has been translated into French by Terrasson, Paris, 1737, in 7 vols. 12mo.

DIOGENES of Apollonia, in the island of Crete, held a considerable rank among the philosophers who taught in Ionia before Socrates appeared at Athens. He was the scholar and successor of Anaximenes, and in some measure rectified his master's opinion concerning air being the cause of all things. It is said that he was the first who observed that air was capable of condensation and rarefaction. He passed for an excellent philosopher, and died about the 450th year before the Christian era.

DIOGENES *the Cynic*, a famous philosopher, was the son of a banker of Sinope, in Pontus. Being banished with his father for coining false money, he retired to Athens, where he studied philosophy under Antisthenes. He added new austerity to the sect of the Cynics, and never did any philosopher carry so far a contempt for the conveniences of life. He was one of those men who push every thing to excess, without excepting even reason itself; and who confirm the saying, that there is no great genius without a tincture of madness. He lodged in a tub; and had no other moveables besides his staff, wallet, and wooden bowl, which last he threw away on seeing a boy drink out of the hollow of his hand. He used to call himself a vagabond, who had neither house, home, nor country; he was obliged to beg, was ill clothed, and lived from hand to mouth, and yet, says Ælian, he took as much pride in these things as Alexander could in the conquest of the world. He was not indeed a jot more humble than those who are clothed in rich apparel, and fare sumptuously every day. He looked down on all the rest of the world with scorn; he magisterially censured all mankind, and thought himself unquestionably superior to all other philosophers. Alexander one day paid him a visit, and made him an offer of riches, or any thing else; but all that the philosopher requested of him was, to stand from betwixt him and the sun. The conqueror was so affected with the vigour and elevation of his soul, as to declare that, "if he were not Alexander, he would choose to be Diogenes;" that is, if he were not in possession of all that was pompous and splendid in life, he would, like Diogenes, heroically despise it. Diogenes had great presence of mind, as appears from his sharp sayings and quick repartees; and Plato seems to have hit off his true character when he called him a Socrates run mad. He spent a great part of his life at Corinth. The reason of his living there was curious and characteristic. As he was going over to the island Ægina, he was taken by pirates, who carried him into Crete, and there exposed him to sale. He answered the crier, who asked him what he could do, that "he knew how to command men;" and perceiving a Corinthian who was passing by, he showed him to the crier, and said, "Sell me to that gentleman, for he wants a master." Xeniades, for that was the Corinthian's name, bought Diogenes, and carried him to Corinth, where he appointed him tutor to his children, and intrusted him also with the management of his house. Diogenes's friends being desirous to redeem him, "You are fools," said he; "the lions are not the slaves of those who feed them, but they are the servants of the lions." He therefore plainly told Xeniades that he ought to obey him, as people obey their governors and physicians. Some say that Diogenes spent the remainder of his life in Xeniades's family; but Dion Chrysostom asserts that he passed the winter at Athens and the summer at Corinth. He died at Corinth when he was about ninety years old; but authors are not agreed either as to the time or the manner of his death. The following account, Jerome says, is the true one. As he was going to the Olympic games, a fever seized him by the way; upon which he lay down under a tree, and refused the assistance of those who accompanied him, and who offered him either a horse or a chariot. "Go you to the games," said he, "and leave me to contend with my illness. If I conquer, I will follow you; if I am conquered, I shall go to the shades below." He dispatched himself that very night; saying, that "he did not so properly die, as get rid of his fever." He had for his disciples Onesicritus, Phocion, Stilpo of Megara, and several other great men. His works are lost.

DIOGENES *Laertius*, so called from Laertia, in Cilicia, where he was born, an ancient Greek author, who wrote ten books of the Lives of the Philosophers, still extant. In what year he flourished it is not easy to determine. The oldest writers who mention him are Sopater Alexandrinus, who lived in the time of Constantine the Great, and Hesychius Milesius, who lived under Justinian. Diogenes often speaks in terms of approbation of Plutarch and Phavorinus; and therefore, as Plutarch lived under Trajan, and Phavorinus under Hadrian, it is certain that he could not flourish before the reigns of those emperors. Ménage has fixed him as contemporary with Severus, that is, about the year of Christ 200. From certain expressions of his, some have fancied him to have been a Christian; but, as Ménage observes, the immoderate praises he bestows upon Epicurus will not permit us to believe this, but must incline us rather to suppose that he was an Epicurean. He divided his Lives into books, and inscribed them to a learned lady of the Platonic school, as he himself intimates in his life of Plato. Montaigne was so fond of this author, that, instead of one Laertius, he wishes we had a dozen; and Vossius says that his work is as precious as gold. Without doubt, we are greatly obliged to him for what we know of the ancient philosophers; and if he had been as exact in writing as he was judicious in the choice of his subject, we should have been still more obliged to him. Bishop Burnet, in the preface to his life of Sir Matthew Hale, speaks of him in the following proper manner; "There is no book the ancients have left us, which might have informed us more than Diogenes Laertius's Lives of the Philosophers, if he had had the art of writing equal to that great subject which he undertook; for if he had given the world such an account of them as

Gassendus has done of Peiresc, how great a stock of knowledge might we have had, which by his unskilfulness is in a great measure lost, since we must now depend only on him, because we have no other and better author who has written on that subject." There have been several editions of his Lives of the Philosophers; but the best is that printed in two volumes 4to, at Amsterdam, 1693. This contains the advantages of all the former, besides some which are peculiar to itself; such as the Greek text and the Latin version corrected and amended by Meibomius; the entire notes of Henry Stephens, of both the Casaubons, and of Ménage; and twenty-four copperplates of philosophers, elegantly engraved; to which is added, The History of the Female Philosophers, written by Ménage, and dedicated to Madame Dacier. Besides this, Laertius wrote a book of Epigrams upon illustrious Men, called Pammetrus, from its various kinds of metre; but this is not now extant.

DIOMEDES, son of Tydeus and Diephyle, was king of Ætolia, and one of the bravest of the Grecian chiefs in the Trojan war. He often engaged Hector and Æneas, and obtained much military glory. He went with Ulysses to steal the Palladium from the temple of Minerva in Troy; and assisted in murdering Rhesus, king of Thrace, and in carrying away his horses. On his return from the siege of Troy he lost his way in the darkness of night, and landed in Attica, where his companions plundered the country, and lost the Trojan Palladium. During his long absence, his wife Ægiale forgot her marriage vows, and prostituted herself to Cometes, one of her servants. This lasciviousness of the queen was attributed by some to the resentment of Venus, whom Diomedes had severely wounded in a battle before Troy. The infidelity of Ægiale proved highly displeasing to Diomedes. He resolved to abandon his native country, which was the seat of his disgrace; and the attempts of his wife to take away his life contributed, according to some accounts, to hasten his departure. He proceeded to that part of Italy afterwards named Magna Græcia, where he built a city, which he called Argyrippa, and married the daughter of Daunus, the king of the country; and he died there in extreme old age, or, according to a certain tradition, he perished by the hand of his father-in-law. His death was greatly lamented by his companions, who in the excess of their grief were changed into birds resembling swans, which took flight into a neighbouring island in the Adriatic, and became remarkable no less for the tameness with which they approached the Greeks, than for the horror with which they shunned all other nations. They were called the birds of Diomed. Altars were raised to Diomedes as to a god, one of which Strabo mentions at Timavus.

DION, a Syracusan, son of Hipparinus, famous for his power and abilities. He was related to Dionysius, and often, along with the philosopher Plato, who had come to reside at the tyrant's court, advised him to lay aside the supreme power. But his great popularity rendered him odious in the eyes of the tyrant, who banished him to Greece. There, however, he collected a numerous force, and resolved to free his country from tyranny; an achievement which he easily effected, on account of his uncommon popularity. He entered the port of Syracuse with only two ships, and in three days reduced under his power an empire which had already subsisted for fifty years, and which was guarded by five hundred ships of war, and above a hundred thousand troops. The tyrant fled to Corinth, and Dion kept the power in his own hands, fearful of the aspiring ambition of some of the friends of Dionysius; but he was shamefully betrayed and murdered by one of his familiar friends, called Callicrates or Callipus, 354 years before the Christian era.

DION *Cassius*, a native of Nicæa, in Bithynia, whose father's name was Apronianus. He was raised to the greatest offices of state in the Roman empire by Pertinax and his three successors. Being naturally fond of study, he improved himself by unwearied application, and spent ten years in collecting materials for a history of Rome, which he published in eighty books, after a laborious employment of twelve years in composing it. This valuable history commenced with the arrival of Æneas in Italy, and extended to the reign of the Emperor Alexander Severus. The first thirty-four books are totally lost; the twenty following, that is, from the thirty-fifth to the fifty-fourth, remain entire; the six following are mutilated; and fragments are all that we possess of the last twenty. In the compilation of this extensive history, Dion proposed to himself Thucydides as a model, but he is not perfectly happy in his imitation. His style is pure and elegant, his narrations are judiciously managed, and his reflections are generally learned; but, upon the whole, he is credulous, and the bigoted slave of partiality, satire, and flattery. He inveighs against the republican principles of Brutus and Cicero, and extols the cause of Cæsar. Seneca is the object of his satire, and is represented by the historian as debauched and licentious in his morals.

DIONIS, Peter, born at Paris, was one of the greatest surgeons of the eighteenth century. In the time of Louis XIV. he was appointed anatomical and chirurgical demonstrator in the Garden of Plants, and he was the first who held that place. He was surgeon in ordinary to Maria Theresa of Austria, queen of France, and to two dauphinesses and the royal children. He was the author of several works, both on anatomical and surgical subjects. One of the first of his publications is entitled *Anatomie de l'Homme, suivant la circulation du sang, et les nouvelles découvertes*, 8vo, which appeared in 1690, and has been frequently reprinted, and translated into different languages. It was translated into the Tartar dialect, by a Jesuit, for the use of Kang-hi, emperor of China. This work has been considered as a useful compendium of anatomy. In another work which he published in 1698, entitled *Dissertation Historique et Physique sur la Génération de l'Homme*, he supports the ovarian hypothesis. In 1707 he published a work on surgery, entitled *Cours d'Opérations de Chirurgerie*, 8vo, which was several times reprinted; and latterly it was edited with notes by Lafaye, in two vols. This treatise was long received as a standard book on the subject. It contains many useful and pertinent observations, detailed in plain, unaffected language. Dionis is the author of two other works; the first, *Dissertation sur la Mort Subite*, 12mo, published in 1709, and the other *Traité Générale des Accouchements* in 1718, 8vo. But the last is little else than an abridgment of Mauriceau's work on the same subject. Dionis died at Paris on the 11th December 1718.

DIONYSIA, in Grecian antiquity, solemnities in honour of Bacchus, sometimes called by the general name of *Orgia*, and by the Romans *Bacchanalia* and *Liberalia*.

DIONYSIACA, in *Antiquity*, was a designation given to plays and all manner of sports acted on the stage; because playhouses were dedicated to Dionysius or Bacchus, and Venus, as being the deities of sports and pleasure.

DIONYSIUS I. from a private secretary became general and tyrant of Syracuse and all Sicily. He was likewise a poet; and having, by bribes, gained the tragic prize at Athens, he indulged himself so immoderately at table from excess of joy, that he died of the debauch, 368 B. C.; but some authors assert that he was poisoned by his physicians.

Dionysius II. his son and successor, was a greater tyrant than his father. His subjects were obliged to apply to the Corinthians for succour; and Timoleon, their general, having conquered the tyrant, forced him to flee to Corinth, where, it is said, he was obliged to keep a school for his subsistence. He died 343 B. C.

Dionysius *Halicarnassensis*, a celebrated historian, and one of the most judicious critics of antiquity, was born at Halicarnassus. After the battle of Actium he went to Rome, where he staid twenty-two years under the reign of Augustus, and there composed in Greek his History of the Roman Antiquities, in twenty books, of which the first eleven only are now remaining. There are also still extant several of his critical works. The best edition of the works of this author is that of Dr Hudson, Oxford, 1704, in Greek and Latin, 2 vols folio. It has been reprinted more correctly, with notes by Reiske, Leipzig, 1774–1777, in six vols. 8vo.

Dionysius, a learned geographer, to whom is attributed a Periegesis, or Survey of the Earth, in Greek verse. Some suppose that he lived in the time of Augustus; but Scaliger and Salmasius place him under the reign of Severus, or of Marcus Aurelius. He wrote many other works, but his Periegesis is the only one we have remaining, the best and most useful edition of which is that improved with notes and illustrations by Hill.

Dionysius *Areopagita* was born at Athens, and educated there. He went afterwards to Heliopolis, in Egypt, where, if we may credit some writers of his life, he beheld that wonderful eclipse which happened at our Saviour's passion, and was urged by some extraordinary impulse to cry out, *Aut Deus patitur, aut cum patiente dolet*, either God himself suffers, or sympathises with him who does. At his return to Athens he was elected into the court of Areopagus, from which circumstance he derived his name of *Areopagite*. About the year 50 he embraced Christianity; and, as some say, was appointed first bishop of Athens by St Paul. Of his conversion we have an account in the 17th chapter of the Acts of the Apostles. He is supposed to have suffered martyrdom, but whether under Domitian, Trajan, or Hadrian, is not certain. We have nothing remaining under his name except what there is every reason to believe spurious.

Dionysius *the Lesser*, a Scythian, who became abbot of a monastery at Rome. He was the first who computed time from the birth of Dionysius to Christ, and fixed that great event according to the vulgar era. He was also a learned canon law writer, and died about the year 540.

DIOPHANTINE Problems, in *Mathematics*, certain questions relating to square and cube numbers, and right-angled triangles, the nature of which was determined by Diophantus, a mathematician of Alexandria, who is believed to have lived about the third century. The works of Diophantus were published with notes at Paris in 1621, by Bachet de Meziriac; and another edition appeared in 1670, with observations on every question by M. Fermat.

DIOPHANTUS, a celebrated mathematician of Alexandria, reputed to be the inventor of algebra. It is not certain when Diophantus lived; some have placed him before Christ, and some after, in the reigns of Nero and the Antonines, but all with equal uncertainty. It seems he is the same Diophantus who wrote the *Canon Astronomicus*, which, Suidas says, was commented on by the celebrated Hypatia, daughter of Theon of Alexandria. His reputation must have been very high among the ancients, since they ranked him with Pythagoras and Euclid in mathematical learning. Bachet, in his notes upon the fifth book *De Arithmeticis*, has collected, from Diophantus's epitaph in the Anthologia, the following circumstances of his life, namely, that he was married when he was thirty-three years old, and had a son born five years thereafter; that this son died when he was forty-two years of age, and that his father did not survive him above four years. From this it appears that Diophantus was eighty-four years old when he died.

DIOPTASE of *Haüy*; the rhombohedral emerald malachite of *Mohs*. This is a very rare mineral; it occurs in crystals of small dimensions, of a brilliant emerald green colour, disposed in limestone, and is only found in the Kirghese steppes, Siberia. See Mineralogy, *Index*.

DIOPTER, or Dioptra, the same with the index or alhidade of an astrolabe, or other such instrument.

Dioptra was an instrument invented by Hipparchus, which served several purposes, as to level water courses, to take the height of towers or places at a distance, to determine the places, magnitudes, and distances of the planets, and the like.

DIOPTRICS, that part of optics which treats of the laws of refraction, and the effects which the refraction of light has in vision. See Optics.

DIOSCORIDES, a physician of Cilicia, who lived, as some suppose, in the age of Nero. He was originally a soldier, but afterwards applied himself to study, and wrote a book upon medicinal herbs.

DIOSCURIA (*διοσκουρια*, from Διος, *Jupiter*, and *κουροι*, *infants*), in *Antiquity*, a festival in honour of the Διοσκουροι, or Castor and Pollux, who were reputed to be the sons of Jupiter. It was observed by the Cyreneans, but especially by the Spartans, whose country was believed to have been honoured by the birth of these heroes. The solemnity was full of mirth, being a time in which they shared plentifully of the gifts of Bacchus, and diverted themselves with sports, of which wrestling matches always formed a part.

DIOSZEG, a market-town of Hungary, in the province of Farther Theis, in the circle Grosswardein. It contains a reformed and a Greek church, and 3500 inhabitants, who are chiefly employed in the cultivation of vines and of tobacco. Long. 21. 54. 5. E. Lat. 47. 31. 40. N.

DIPHTHONG, in *Grammar*, a double vowel, or the mixture of two vowels pronounced together so as to make one syllable.

The Latins pronounced the two vowels in their diphthong ae or æ, and oe or œ, much as we do, only that the one was heard much weaker than the other, though the division was made with all the delicacy imaginable. Diphthongs with reference to sight, are distinguished from those with reference to sound. In the former, either the particular sound of each vowel is heard in the pronunciation; or the sound of one of them is drowned; or, lastly, a new sound, different from either, results from both; but the first of these only are real diphthongs, as being such both to the eye and ear. Diphthongs with regard to the ear are either formed of two vowels meeting in the same syllable, or of two vowels whose sounds are severally heard; or of three vowels in the same syllable, which only afford two sounds in the pronunciation.

English diphthongs, with regard to the eye and ear, are *ai, au, ea, ee, ei, oo, ou.* Improper English diphthongs, with regard to the eye only, are *aa, ae, eo, eu, ie, ei, oe, ue, ui.*

DIPLOMA, in a peculiar sense, is used for an instrument or license given by colleges, societies, and such like bodies, to a clergyman to exercise the ministerial function, or to a physician to practise the profession, after passing examination, or admitting him to a degree.

DIPLOMATICS, the science of diplomas, or of ancient literary monuments, public documents, and the like. It does not, however, nor can it, absolutely extend its researches to antiquity, but is chiefly confined to the middle age and the first centuries of modern times. For although the ancients were accustomed to reduce their contracts and treaties into writing, yet they engraved them on tablets of brass, copper, stone, or wood; and all that in the first ages were not traced on brass or marble has perished by the length of time and the number of destructive events.

1. The word *diploma* signifies properly a letter or epistle which is folded in the middle, and which consequently is not open. But in more modern times the title has been given to all ancient epistles, letters, literary monuments, and public documents, and to all those pieces of writing which the ancients called *Syngrapha, Chirographa, Codicilli*, and the like. In the middle ages, and in the diplomas themselves, these writings are called *Litteræ, Præcepta, Placita, Chartæ indiculæ, Sigilla*, and *Bullæ*; as also *Panchartæ, Pantochartæ, Tractoriæ, Descriptiones*, and so forth. The originals of these pieces are named *Examplaria* or *Autographa, Chartæ authenticæ, Originalia*, &c. and the copies, *Apographa, Copiæ, Particulæ*, and so on. The collections which have been made of them are called *Chartaria* and *Chartulia*. The place where these papers and documents were kept the ancients named *Scrinia, Tabularium*, or *Ærarium*, words which were derived from the tablets of brass, and, according to the Greek idiom, *Archeium* or *Archivum*.

2. In order to understand the nature of these ancient papers, diplomas, and manuscripts, and to distinguish the authentic from the counterfeit, it is necessary to know that the paper of the ancients came from Egypt, and was formed of thin leaves or membranes taken from the branches of a tree named *Papyrus Biblum*, or *Ægyptiacum*, and which were pasted one over the other with the slime of the Nile, and pressed and polished with a pumice stone. This paper was very scarce, and it was of various qualities, forms, and prices, which they distinguished by the name of *charta hieratica, luria, augusta, amphitheatrica, saïtica, tanirica, emporetica*. They cut this paper into square leaves, which they pasted one to the other in order to make rolls of them, whence an entire book was called *volumen*, from *volvere*, to roll, and the leaves of which it consisted *paginæ*. Sometimes, also, they pasted the leaves all together by one of their extremities, as is now practised in binding; by this method they formed the back of a book, and these the learned called *codices*. They rolled the volume round a stick, which they named *umbilicus*, and the two ends which protruded beyond the paper were called *cornua*. The title, written on parchment in purple characters, was joined to the last sheet, and served it as a cover. They made use of all sorts of strings or ribands, and even sometimes of locks, to close the book; and sometimes also it was put into a case. But there is not now to be found, in any library or cabinet whatsoever, any one of these volumes. We have been assured, however, by a traveller, that he had seen several of them in the ruins of Herculaneum, but so damaged, and the paper so stiff and brittle, by length of time, that it was impossible to unrol them, and, consequently, to make use of any of them; for on the first touch they fell into tatters.

3. We are ignorant of the precise time when our modern paper was invented, and when people began to make use of pens in writing instead of the stalks of reeds. The ink which the ancients used was not made of vitriol and galls, like the modern, but of soot. Sometimes also they wrote with red ink made of vermilion, or in letters of gold on purple or violet parchment. It is not difficult for those who apply themselves to this study, to distinguish the parchment of the ancients from that of the moderns, as well as the ink; but that which best distinguishes the original from the counterfeit is the writing or character itself, which is so different in different centuries, that we may tell with certainty, within about forty or fifty years, when any diploma was written. There are two works which furnish the clearest lights on this matter, and which may serve as sure guides in the judgments we may have occasion to form as to what are called *ancient diplomas*. The one is the celebrated treatise on Diplomatics, by Mabillon, and the other the first volume of the *Chronicon Gotvicense*. We there find specimens of all the characters, the flourishes, and different methods of writing, of every age. For these matters, therefore, we must refer our readers to the works just mentioned.

4. All the diplomas are written in Latin, and consequently the letters and characters have a resemblance to each other; but there are certain strokes of the pen which distinguish not only the ages, but also the different nations, as the writings of the Lombards, French, Saxons, and so on. The letters in the diplomas also are usually longer and less decided than those of manuscripts. There has also been introduced a kind of court hand, of a very disproportionate length, and the letters of which are called *exiles litteræ crispæ, ac protractiores*. The first line of the diploma, the signature of the sovereign, that of the chancellor, notary, &c. are usually written in this character.

5. The signature of a diploma consists either of the sign of the cross, or of a monogram or cipher, composed of the letters of the names of those who subscribed it. The initial letters of the name, and sometimes also the titles, were placed about this cross. By degrees the custom changed, and they invented other marks, as, for example, the sign of Charlemagne, which was thus written:

R
K—A—S
V
L

They sometimes also added the dates and epoch of the signature, the feasts of the church, the days of the calendar, and other like matters. The successive corruption of the Latin language; the style and orthography of each age, as well as their different titles and forms; the abbreviations, accentuation, and punctuation, and the various methods of writing the diphthongs; all these matters united form so many characters and marks by which the authenticity of a diploma may be known.

6. The seal annexed to a diploma was anciently of white wax, and was artfully imprinted on the parchment itself. It was afterwards pendant from the paper, and inclosed in a box or case, which was called *bulla*. There are also some which have been stamped on metal, and even on pure gold. When a diploma bears all the characters which are requisite to the time and place where it is supposed to be written, its authenticity is not to be doubted; but at the same time we cannot examine these too scrupulously, seeing that the monks and priests of former ages were very adroit in making counterfeits, the more so as they enjoyed the confidence of princes and statesmen, and were even sometimes in possession of their rings or seals.

7. With regard to manuscripts which were written before the invention of printing, it is necessary to know their nature, their essential qualities, and matter; to be able to read them freely, and without error; to judge of their antiquity by those characters which we have just mentioned with reference to the diplomas; and to render them of use in the sciences. As there are scarcely any of the ancient codes now remaining written on the Egyptian paper, or on wood, ivory, &c. we have only to consider those which are written on parchment or vellum (*membraneos*), and such as are written on our paper (*chartaceos*). The former of these are in most esteem. With regard

to the character, these codices are written either in square and capital letters, or in half square or round and small letters. Those of the first kind are the most ancient. There are no intervals between the words, no letters different from the others at the beginning of any word, no points, nor any other distinction. The codices which are written in half square letters resemble those we have in Gothic characters, as well for the age as the form of the letters. Such as are written in round letters are not so ancient as the former, and do not go higher than the ninth or tenth century. These have spaces between the words, and some punctuation; but they are not so well written as the preceding, and are frequently disfigured with comments. The codices are divided, according to the country, into Lombard, Italian, Gaelic, Franco-Gaelic, Saxon, Anglo-Saxon, and so forth.

8. In the ancient Greek books they frequently terminated the periods of a discourse, instead of all other divisions, by lines, and these divisions were called, in Latin, *versus, a vertendo;* for which reason these lines are still more properly named *versus* than *lineæ*. At the end of a work the number of verses of which it consisted was put down, in order that the copies might be more easily collated; and it is in this sense that we are to understand Tribonius, when he says that the Pandects contain 150,000 *pæne versuum*. These codices were likewise *vel probæ vel deterioris notæ*, more or less perfect, not only with regard to the calligraphy or beauty of the character, but also with reference to the correctness of the text.

9. It is likewise necessary to observe, in ancient codices, the abbreviations as they have been used in different centuries. Thus, for example, A. C. D. signifies Aulus Caius Decimus; Ap. Cn. Appius Cneius; Aug. Imp. Augustus Imperator. The characters which are called *notæ* are such as are not to be found in the alphabet; but which, notwithstanding, signify certain words. Lastly, the learned divide all the ancient codices into *codices minus raros, rariores, editos, et anecdotos*. The critical art is here indispensably necessary; its researches, moreover, have no bounds, and the more as the use of it augments every day, by the discoveries which are made in languages, and by the increase of erudition. The curious reader will find much learned and valuable information on all these matters in the work entitled *Nouveau Traité de Diplomatique, par deux Religieux de la Congrégation de Saint Maur*, 6 tom. 4to, Paris, 1750–1765.

DIPONDIUS, in the language of Scripture, is used by St Luke to signify a certain coin which was of very little value. Our translation of the passage is, "Are not two sparrows sold for two farthings?" In St Matthew, who relates the same thing, we read "Are not two sparrows sold for a farthing?" The Greek reads *assarion* instead of *as*. Now *assarion*, according to some, was worth half an *as*, that is to say, four French deniers and $\frac{1}{8}$th; and, according to others, two deniers and $\frac{1}{16}$th. *Dipondius* seems rather to signify half an *as*. See Calmet, *Diction. Bibl.;* Luke, xii. 6; Matt. x. 29. But Dr Arbuthnot differs in opinion from the author last quoted. He says that this coin was at first *libralis*, or of a pound weight; and that even when diminished, it retained the name of *libella*. So that *dipondius* denotes two asses.

DIPPING, among miners, signifies the interruption or breaking off the veins of ore; an accident which gives them a great deal of trouble before they can discover the ore again. See MINING.

DIPPING *Needle*, an instrument used for observing the quantity of inclination towards the earth, assumed by any needle or other body after it has acquired the magnetic virtue. This was first observed by one Robert Norman, an Englishman, and a maker of compasses for mariners, in the end of the sixteenth century, who finding that he was always obliged to counterbalance that end which turns to the north by a bit of wax or such other substance, though the balance had been ever so exact before, published an account of his discovery as a matter of importance. The subject was instantly attended to; and instruments were not only contrived for ascertaining the quantity of the dip, but various speculations were formed concerning the cause of so surprising a phenomenon.

The general phenomena of the dipping needle are, that about the equatorial parts of the earth it remains in a horizontal position, but depresses one end as we recede from these; the north end if we go towards the north, and the south end if we proceed towards the south pole. The farther north or south that we go the inclination becomes the greater; but there is no part of the globe hitherto discovered where it points directly downwards, though it is supposed that it would do so in some part very near the pole. Its inclination is likewise found to vary very considerably at different times in different places of the earth, and by some changes of situation, in such a manner as must appear at first sight very unaccountable. Of all those who have attempted the investigation of this obscure subject, none has been more successful than M. Cavallo, who in his *Treatise on Magnetism* has paid particular attention to all the phenomena, and accounted for them upon plain and rational principles. The voyages to the arctic regions, in search of a north-west passage, have led to a great accumulation of observations by means of the dipping-needle. See MAGNETISM.

DIPPOLDISWALDE, a bailiwick in the kingdom of Saxony, in the circle of Meissen, extending over fifty-five square miles, or 35,200 acres, and containing 9800 inhabitants. The chief place, of the same name, is situated on the river Weisseritz, and contains 246 houses and 1400 inhabitants, occupied in distilleries, in weaving cloth, and in bleaching linen yarn.

DIPSAS, a sort of serpent, the bite of which produces such a thirst as proves mortal; and hence its name *dipsas*, which signifies thirsty. In Latin it is called *situla*, a pail.

DIPTERA (from δις, and πτερον, *wing*), in *Zoology*, an order of insects which have only two wings, and under each wing a style, or oblong body, terminated by a protuberance or head, and called a *balancer*. See ENTOMOLOGY, *Index*.

DIPTOTES, in *Grammar*, are such nouns as have only two cases, as *suppetiæ*, *suppetias*, and so on.

DIPTYCHA, in *Antiquity*, a public register, wherein were written the names of the consuls and other magistrates, among the heathens; and of bishops, and defunct as well as surviving brethren, among the Christians.

The word is formed from the Greek διπτυχων, or διπτυχα, and that from διπτυξ, a masculine noun derived from πτυσσω, *I fold* or *plait*. From its future πτυξω is formed πτυξ, a *fold* or *plait*, to which adding δις, *twice*, we have διπτυξ, in the genitive διπτυχος, whence comes the nominative neuter διπτυχον, *a book folded in two leaves;* though there were some in three, and others in four or five leaves. An ingenious author imagines this name to have been first given them in order to distinguish these leaves from the books which were rolled, and hence called *volumina*.

It is certain there were profane diptycha in the Greek empire, as well as sacred ones in the Greek church. The former were the matricula or registers, wherein the names of the magistrates were entered; in which sense diptycha is a term in the Greek chancery.

Sacred DIPTYCHA. The word is plural; diptycha being a double catalogue, in one part of which were written the names of the living, and in the other those of the dead, which were to be rehearsed during the office. We meet with something not unlike the sacred diptycha of the Greeks in the canon of the mass according to the Latin usage, where the people are enjoined to pray once for the living and once for the dead, and where several saints are invoked in different times. In such diptycha were entered the names of bishops, who had governed their flock aright; and these were never expunged, unless they were convicted of heresy or some other gross crime. In the diptycha were likewise entered the names of such as had done any signal service to the church, whether they were living or dead; and mention was made of them in the celebration of the liturgy.

Casaubon, in his observations on Athenæus (lib. vi. cap. 14), supposes the Christians to have borrowed the custom of writing names in a book, and rehearsing them at mass, from the heathens, who entered the names of persons to whom they wished to do any signal honour, in the verses of the Salii, as was done in the case of Germanicus and Verus, sons of the emperor Marcus Aurelius, and a long time before, during the age of the republic; in that of Mamercus Veturius and Lucia Volumnia, as we are told by Tacitus, Spartian, Ovid, Festus, Plutarch, and others. But Rosweyd does not approve of this notion of Casaubon; and the pretended St Dionysius, a very ancient author, asserts that this usage was originally founded on Scripture (2 Tim. ii. 19; Psal. cxvi. 15). Rosweyd adds Ecclesiasticus (xliv. 1), and takes these to have been the passages the ancient church had a view to, rather than the Salian verses.

The profane diptycha were frequently sent as presents to princes and others, on which occasions they were finely gilded and embellished; as appears from Symmachus (lib. ii. ep. 81). Those presented were usually of ivory. The first law, *De Expens. Ludor.* in *C. Theod.* forbids all magistrates below the rank of consuls to make presents of diptycha of ivory in the public ceremonies.

DIRÆ, the general name of the three furies in the Pagan system of mythology. They were so called, as being *quasi deorum iræ*, the ministers of divine vengeance in punishing guilty souls after death. They were accounted the daughters of *Night* and *Acheron*.

DIRECT, in *Arithmetic*, is when the proportion of any terms or quantities is in the natural or direct order in which they stand, being the opposite inverse, which considers the proportion in the inverted order of the terms. So, 3 : 4 :: 6 : 8 directly; or 3 : 4 :: 8 : 6 inversely.

DIRECTION, in *Mechanics*, signifies the line or path of a body's motion, along which it endeavours to proceed according to the force impressed upon it.

Direction, in *Astronomy*, the motion and other phenomena of a planet when direct.

Direction, in *Astrology*, is a kind of calculus, by which it is pretended to find the time in which any notable accident shall befal the person whose horoscope is drawn.

DIRECTOR, in commercial policy, a person who has the management of the affairs of a trading company. Thus we say, the directors of the India Company.

DIRIBITORES, among the Romans, officers appointed to distribute tablets to the people at the comitia.

DIRIGENT, or Directrix, a term in geometry, signifying the line of motion along which the describing line or surface is carried in the genesis of any plane or solid figure.

DIS, an inseparable article prefixed to various words, the effect of which is either to give them a signification contrary to what the simple words have, as *disoblige, disobey*; or to signify a separation or detachment, as *disposing, distributing*.

Dis, a god of the Gauls, the same as Pluto the god of hell. The inhabitants of Gaul supposed themselves descended from that deity.

DISABILITY, in *Law*, is when a man is disabled, or made incapable to inherit any lands, or take that benefit which otherwise he might have done; and this may happen four ways; by the act of an ancestor, or of the party himself, by the act of God, or by that of the law. 1. Disability by the act of the ancestor is where the ancestor is attainted of high treason, which corrupts the blood of his children, so that they may not inherit his estate. 2. Disability by the act of the party is where a man binds himself by an obligation, that, upon surrender of a lease, he will grant a new estate to a lessee; and afterwards he grants over the reversion to another, which puts it out of his power to perform it. 3. Disability by the act of God is where a man is *non sanæ memoriæ*, by which he is incapable of making any grant, &c.; so that, if he pass an estate out of him, it may after his death be made void: but it is a maxim in law, "that a man of full age shall never be received to disable his own person." 4. Disability by the act of the law, is where a man by the law, without any thing by him done, is rendered incapable of the benefit of the law; as an alien born, or the like.

DISAPPOINTMENT, Islands of, a cluster of islands in the Southern Pacific Ocean, so named by Commodore Byron, who discovered them in 1765. The island seen by Lord Byron had a beautiful appearance. The middle of this cluster of islands lies in long. 145. 4. W. lat. 14. 5. S.

DISC, in *Antiquity*, a quoit made of stone, iron, or copper, five or six fingers broad, and more than a foot long, inclining to an oval figure, which they hurled in form of a bowl to a vast distance, by the help of a leathern thong tied round the person's hand who threw it, and put through a hole in the middle. Homer has made Ajax and Ulysses great artists at this sport.

Disc, in *Astronomy*, the body and face of the sun and moon, such as they appear to us on the earth; or the body and face of the earth, such as it appears to a spectator in the moon.

Disc, in *Optics*, is the width of the aperture of telescope glasses, whatever their form be, whether plane, convex, concave, &c.

DISCIPLE, one who learns any thing from another; and hence the followers of any teacher, philosopher, &c. are called *disciples*. In the Christian sense, they were followers of Jesus Christ in general; but in a more restrained sense, the disciples denote those alone who were the immediate followers and attendants on his person, of which there were seventy or seventy-two. The names *disciples* and *apostles* are often used synonymously in the gospel history; but sometimes the apostles are distinguished from disciples, or persons selected out of the number of disciples, to be the principal ministers of his religion. Of these last there were only twelve. The Latins kept the festival of the seventy or seventy-two disciples on the 15th July, and the Greeks on the 4th January.

DISCIPLINE, in a general sense, denotes instruction and government, as military discipline, ecclesiastical discipline, and the like.

Ecclesiastical discipline consists in putting those laws in execution by which the church is governed, and inflicting the penalties enjoined by them against the several sorts of offenders who profess the religion of Jesus. The primitive church never pretended to exercise discipline upon any but such as were within her pale, in the largest sense, by some act of their own profession; and even upon these she never pretended to exercise her discipline so far as to cancel or disannul their baptism;—all that she pretended to was to deprive men of the benefits of external communion, such as public prayer, receiving the eucharist, and other acts of divine worship. The church discipline was only confined to the admonition of the party, and to the lesser and greater excommunication. As to the objects of ecclesiastical discipline, they were all such delinquents as fell into great and scandalous crimes after baptism.

Discipline, in a more peculiar sense, is used to signify the chastisements or bodily punishments inflicted on a religious person of the Roman Catholic church who has been found a delinquent; or even to indicate that which religious persons voluntarily undergo or inflict on themselves by way of mortification.

Book of Discipline, in the history of the church of Scotland, is a common order, drawn up by the assembly of ministers in 1650, for the reformation and uniformity to be observed in the discipline and policy of the church. In this book the government of the church by prelates is set aside; church sessions are established; the superstitious observation of fast days and saints' days is condemned; and other regulations for the government of the church are determined. This book was approved by the privy council, and is called the *First Book of Discipline.*

DISCORD, in general, signifies disagreement or opposition between different persons or things.

Discord, in *Music*, is every sound which, joined with another, forms an assemblage disagreeable to the ear; or rather, every interval whose extremes do not coalesce. Now, as there are no other concords or consonances, excepting those which form amongst themselves, and with their fundamental sound, perfect chords, it follows that every interval must be a real dissonance or discord; even the third and sixth were reckoned such among the ancients, who excluded them from the number of consonant chords.

The term *dissonance*, which is synonymous with discord, is compounded of two words, namely, the inseparable preposition *dis* and the verb *sonare;* which, both in a literal and metaphorical sense, signifies *disagreement* or *disunion.* In reality, that which renders dissonances grating, is, that the sounds which form them, so far from uniting in the ear, seem to repel each other, and are heard each by itself as two distinct sounds, though produced at the same time.

This repulsion or violent oscillation of sounds is heard more or less, as the vibrations which produce it are more or less frequently coincident. When two vocal strings are gradually tuned till they approach a consonant interval, the pulsations become slower as the chord grows more just, till at last they are scarcely heard, if heard at all; and hence it appears certain, that the pleasure produced in us by harmony results from the more or less exact and frequent coincidence or vibration; though the reason why this coincidence should afford pleasure, more than any other modification or combination of sounds, appears to us inscrutable. The agreeable effects of dissonance in harmony are no objection to this theory; since it is allowed that the sensations excited by discord are not in themselves immediately and necessarily pleasing, but only please by auricular deception. The ear is surprised with the shock it receives, without being able to imagine how it should have happened; and in proportion as it is harsh and grating, we feel the pleasure of returning harmony enhanced, and the disappointment of being artfully and insensibly extricated more agreeable.

The name of *dissonance* is given sometimes to the interval, and sometimes also to each of the two sounds which form it. But though two sounds equally form a dissonance between themselves, this term is most frequently applied to that sound in particular which is most extraneous to the chord.

The number of possible dissonances is indefinite; but as in music we exclude all intervals which are not found in the system received, the number of dissonances is reduced to a very few; besides, in practice we can only select from those few such as are agreeable to the species, and the mode in which we compose; and from this last number we must exclude such as cannot be used consistently with the rules prescribed. But what, it may be asked, are these rules? Have they any foundation in nature, or are they merely arbitrary? This is what Rousseau, whom in this article we have followed or abandoned as his observations appeared useful or frivolous, purposes to investigate as its principal object.

But where does his scrutiny terminate? Not in the abolition of the rules prescribed. These have still subsisted, and will continue to subsist, while the frame of man, and the nature of music, remain what they are. If, then, the rules be permanent and universal, the principle upon which they are founded may be latent or ambiguous; but the rules themselves can never be purely arbitrary. How else could it happen that Rameau, D'Alembert, and Rousseau should admit the force and effect of these rules, whilst each of these masters exerted his whole genius to give a different account of their cause and origin? Rousseau himself, as we have seen in a former article, inculcates the necessity of dissonances for the completion of harmony. (See Chord.) Now, if this be true, the easiest methods of introducing and dismissing these discords must be the most eligible, and of consequence the rules for using them must be established. It is not then upon the subsistence or demolition of any particular theory that they depend. Were we to attend to the particular objections which may be urged against any system whatever, where is the theory which will be found proof against the efforts of scepticism? After all, the objections of Rousseau to Rameau's theory, as applied by D'Alembert to the origin of consonances, appear to be much more frivolous than the analogies from which he pretends that this origin was deduced. It appears from D'Alembert's exposition of this theory, that, if not for all, it affords a solution for the most material and essential phenomena in harmony, which is sufficient for its establishment, until another can be found which will give a rational and consistent account of the whole; a discovery which has not yet been made. But whilst we acknowledge the futility of Rousseau's objections against D'Alembert's explication of dissonances, we must at the same time admire the ingenuity with which he has deduced them from principles purely mechanical, without departing from the system of Rameau. This mechanical explication will be found in his Musical Dictionary, under the article *Dissonance.*

Discord, the goddess of, in Pagan theology. She is represented by Aristides with fiery eyes, a pale countenance, livid lips, and wearing a dagger in her bosom. It was she who at the marriage of Peleus and Thetis threw in the golden apple, on which was written "To the fairest," and which occasioned a contention between the goddesses Juno, Minerva, and Venus, each pretending a title to the apple. She was likewise called *Ate* and *Eris.*

DISCOUNT, in commerce, a term among traders, merchants, and bankers. It is used by the two former on occasion of their buying commodities on the usual term of credit, with a condition that the seller shall allow the buyer a certain discount at the rate of so much per cent. per annum for the time for which the credit is generally given, upon condition that the buyer pays ready money for such commodities, instead of taking the ordinary credit. Traders and merchants also frequently take promissory notes for monies due payable to them or their order at a certain time, and, sometimes having occasion for money before the time is elapsed, get these notes discounted or cashed by bankers before the time of payment. Bills of exchange are also discounted by bankers; and in this consists one article of the profits of banking.

DISCRETE or DISJUNCT PROPORTION is when the ratio of two or more pairs of numbers or quantities is the same, but when there is not the same proportion between all the four numbers. Thus, if the numbers 3 : 6 :: 8 : 16 be considered, the ratio between 3 : 6 is the same as that between 8 : 16, and therefore the numbers are proportional; but it is only discretely or disjunctly, for 3 is not to 6 as 6 to 8; that is, the proportion is broken off between 8 and 3, and is not continued as in the following continual proportionals, 3 : 6 :: 12 : 24.

DISCRETE Quantity is such as is not continued and joined together. Such, for instance, is any number.

DISCRETION, the prudence or knowledge necessary to govern one's self properly.

There are many more shining qualities in the mind of man, but there is none so useful as discretion. It is this indeed which gives a value to all the rest, which sets them at work in their proper times and places, and turns them to the advantage of the person who is possessed of them. Without discretion learning is pedantry, and wit impertinence; virtue itself looks like weakness; and the best parts only qualify a man to be more sprightly in errors, and active to his own prejudice.

Nor does discretion only make a man master of his own parts, but of other men's. The discreet man finds out the talents of those he converses with, and knows how to apply them to proper uses. Accordingly, if we look into particular communities and divisions of men, we may observe that it is the discreet man, not the witty, nor the learned, nor the brave, who guides the conversation, and prescribes measures to the society. A man with great talents, but void of discretion, is, like Polyphemus in the fable, strong and blind, endued with an irresistible force, which for want of sight is of no use to him. Though a man have all other perfections, and yet want discretion, he will be of no great consequence in the world; but if he have this single talent in perfection, and but a common share of other endowments, he may do what he pleases in his particular station of life.

It is proper, however, to distinguish between *discretion* and *cunning*; the latter being the accomplishment only of little, mean, ungenerous minds. Discretion points out the noblest end to us, and pursues the most proper and laudable methods of attaining them; cunning has only private and selfish aims, and it sticks at nothing which may make them succeed. Discretion has large and extensive views, and, like a well-formed eye, commands a whole horizon; cunning is a kind of short-sightedness, which discovers the minutest objects that are near at hand, but is not able to discern things at a distance. Discretion, the more it is discovered, gives the greater authority to the person who possesses it; cunning, when it is once detected, loses its whole force, and makes a man incapable of bringing about even those events which he might have done had he passed only for a plain man. Discretion is the perfection of reason, and a guide to us in all the duties of life; cunning is a kind of instinct, which only looks out after our immediate interest and welfare. Discretion is only found in men of strong sense and good understanding; cunning is often to be met with even in brutes themselves, and in persons who are but few removes from them. In short, cunning is only the mimic of discretion, and may pass upon weak men for that which it imitates; in the same manner as vivacity is often mistaken for wit, and gravity for wisdom.

DISCUSSION, in matters of literature, signifies the clear treating or handling of any particular point or problem, so as to shake off the difficulties with which it is embarrassed. Thus we say, *such a point was well discussed*, when it was properly treated and cleared up.

DISCUTIENTS, in *Medicine*, are such remedies as, by their subtilty, dissolve a stagnating or coagulate fluid, and dissipate the same without an external solution of continuity.

DISDIACLASTIC CRYSTAL, in *Natural History*, a name given by Bartholine and some others to a mineral substance, more usually called, from the place whence it was first brought, *Iceland crystal*. See MINERALOGY.

DISDIAPASON, or BISDIAPASON, in *Music*, a compound concord, described by Parran, in the quadruple ratio of 4 : 1, or 8 : 2.

DISDIAPASON Diapente, a concord in a sextuple ratio of 1 : 6.

DISDIAPSON Semi-Diapente, a compound concord in the proportion of 16 : 3.

DISDIAPASON Ditone, a compound consonance in the proportion of 10 : 2.

DISDIAPASON Semi-Ditone, a compound concord in the proportion of 24 : 5.

DISEASE has been variously defined by physicians, almost every founder of a new system having given a definition of it, differing in some respects from his predecessors. See MEDICINE.

DISEMBOGUE. When a ship passes out of the mouth of some great gulf or bay, this is called *disemboguing*. It is usual also to say of a river, that at such a place, or after it has run so many leagues, it disembogues itself into the sea.

DISFRANCHIZING, among civilians, signifies the depriving a person of the rights and privileges of a free citizen or subject.

DISGUISE, a counterfeit habit. Persons doing unlawful acts in disguise are by our statutes sometimes subjected to severe penalties, and even declared felons. Thus, by an act commonly called the *black act*, persons appearing disguised and armed in a forest or grounds enclosed, or hunting deer, or robbing a warren or a fish-pond, are declared felons.

DISH, in mining, is a trough made of wood, about twenty-eight inches long, four inches deep, and six inches wide, by which all miners measure their ore. If any be taken selling their ore, not having first measured it by the bar-master's dish, and paid the king's duty, the seller forfeits his ore, and the buyer forfeits for every such offence forty shillings to the lord of the field or farmer.

DISJUNCTIVE, something which separates or disjoins. Thus, *or*, *neither*, &c. which, in connecting a discourse, yet separate the parts of it, are called *disjunctive conjunctions*.

DISLOCATION, the putting a bone out of joint by some violence, usually called by the physicians *luxation*.

DISNA, a circle of the Russian government of Minsk. The river Düna affords the means of conveying wood, which is its chief produce, to Riga. It grows corn for its consumption, and some flax, which is also sent to Riga. The chief town, of the same name, stands at the junction of the river Dina with the Düna. Long. 27. 35. E. Lat. 54. 34. N.

DISPART, in *Gunnery*, is the setting a mark upon the muzzle ring, or thereabouts, of a piece of ordnance, so that a sight-line taken upon the top of the base ring against the touch-hole, by the mark set on or near the muzzle, may be parallel to the axis of the concave cylinder. The common way of doing this is to take the two diameters of the base ring, and of the place where the dispart is to stand, and divide the difference between them into two equal parts, one of which will be the length of the dispart which is set on the gun with wax or pitch, or fastened there with a piece of twine or marlin. By means of an instrument it may be done with all possible nicety.

DISPATCH, a letter on some affair of state or other business of importance, sent with care and expedition, by a courier express. The business of dispatches is conducted by the secretaries of state and their clerks. The king gives directions to his ministers abroad by dispatches. The word is also used for the packet or mail containing such letters. The French, during the reign of Louis XIV., had a *conseil des dépêches*, or council of dispatches, held in the king's presence, at which the dauphin, the Duke of Orleans, the chancellor, and four secretaries of state, assisted.

DISPAUPER. A person suing *in forma pauperis* is said to be dispaupered, if, before the suit be ended, he have any lands or other estate fallen to him, or if he have done any thing to make him lose his privilege.

DISPENSARY, or Dispensatory, denotes a book containing the method of preparing the various kinds of medicines used in pharmacy. Such are those of Bauderon, Querectan, Zwelfer, Charas, Bate, Mesue, Salmon, Lemery, Quincy, and others; but the latest and most esteemed, besides the London and Edinburgh pharmacopœias, is the Edinburgh New Dispensatory, being an improvement upon that of Dr Lewis.

Dispensary, or *Dispensatory*, is likewise a magazine or office for selling medicines at prime cost to the poor. The College of Physicians maintain three of these in London; one at the College itself in Warwick Lane, another in St Peter's Alley, Cornhill, and a third in St Martin's Lane. Dispensaries have also been established in several of the principal towns in Scotland and England.

DISPERSION, in general, signifies the scattering or dissipating something. Hence

Dispersion, in *Optics*, is the same with the divergency of the rays of light.

Point of Dispersion is the point from which refracted rays begin to diverge, where their refraction renders them divergent.

Dispersion *of Mankind*, in the history of the world, was occasioned by the confusion of tongues, and took place in consequence of the overthrow of Babel at the birth of Peleg (whence he derived his name); and by the account given of his ancestors (Gen. chap. xi. 10–16) this appears to have happened in the 101st year after the Flood, according to the Hebrew chronology, and by the Samaritan computation in the 401st. However, various difficulties have been suggested by chronologists concerning the true era of this event. Sir John Marsham and others, in order to reconcile the Hebrew and Egyptian chronologies, maintain a dispersion of mankind before the birth of Peleg; whilst others, unable to find numbers sufficient for the plantation of colonies in the space of 101 years, according to the Hebrew computation, fix the dispersion towards the end of Peleg's life, thus following the computation of the Jews. Petavius assigns the 153d year after the Flood; Cumberland the 180th; and Usher, though he generally refers it to the time of Peleg's birth, in one place assigns the 131st after the Flood for this event. Mr Shuckford supposes the dispersion to have been gradual, and to have commenced with the separation of some companies at the birth of Peleg, and to have been completed thirty-one years afterwards. According to the calculation of Petavius, the number of inhabitants on the earth at the birth of Peleg amounted to 32,768; but Cumberland makes them 30,000; Mr Mede states them at only 7000 men, besides women and children; and Mr Whiston, who supposes that mankind now double themselves in about 400 years, and that they doubled themselves between the deluge and the time of David in sixty years at a medium, when their lives were six or seven times as long as they have been since, by his computation produces about 2389; a number much too inconsiderable for the purposes of separating and forming distinct nations. This difficulty induced Mr Whiston to reject the Hebrew and to adopt the Samaritan chronology, as many others have done; which, by allowing an interval of 401 years between the Flood and the birth of Peleg, furnishes, by the last-mentioned mode of computation, more than 240,000 persons.

As to the manner of the dispersion of the posterity of Noah from the plain of Shinar, it was undoubtedly conducted with the utmost regularity and order. The sacred historian informs us that they were divided in their lands, every one according to his tongue, according to his family, and according to his nation (Gen. x. 5, 20, 31); and thus, as Mr Mede observes, they were ranged according to their nations, and every nation was ranged by its families, so that each nation had a separate lot, and each family a separate share in what fell to every nation. The following abstract will serve to give a general idea of their respective settlements. Japhet, Noah's eldest son, had seven sons. Of these, Gomer was he whose descendants inhabited those parts of Asia which lie upon the Ægean Sea and Hellespont northward, containing Phrygia, Pontus, Bithynia, and a great part of Galatia. The Galatians, according to Josephus, were called *Gomercæi;* while the Cimmerii, according to Herodotus, occupied this track of country; and from these Gomerians, Cimmerii, or Celts, Mr Camden derives our ancient Britons, who still retain the name *Cymru* or *Cymri.* Magog, the second son of Japhet, was probably the father of the Scythians on the east and north-east of the Euxine Sea. Madai planted Media, though Mr Mede assigns Macedonia to his share. Javan was the father of the Grecians about Ionia, whose country lies along the coast of the Mediterranean Sea; the radices of Javan and Ionia being the same. To Tubal and Meshech belonged Cappadocia and the country which lies on the borders of the Euxine Sea; and from them, migrating over Caucasus, it is supposed the Russians and Muscovites are descended. Tiras occupied Thrace. The sons of Shem were five: Elam, whose country lay between the Medes and Mesopotamians, and was called by the Gentile writers *Elemais* (Josephus calls the Elamites the founders of the Persians); Ashur, who was driven out of Shinar by Nimrod, afterwards settled in Assyria, and there built Nineveh and other cities; Arphaxad, who gave name to the country which Ptolemy calls *Arraphacitis*, a province of Assyria, though Josephus makes him the father of the Chaldees; Lud, who inhabited and gave name to the country of Lydia, about the river Mæander, remarkable for its windings, in Asia Minor; and Aram, the father of the Syrians. Ham, the youngest son of Noah, had four sons: Cush, whose posterity spread into the several parts of Arabia over the borders of the land of Edom, into Arabia Felix, up to Midian and Egypt; Mizraim, the father of them who inhabited Egypt and other parts of Africa; Phut, to whom Bochart assigns the remaining part of Africa, from the Lake of Tritonides to the Atlantic Ocean, called *Libya;* and Canaan, to whom belonged the land of Canaan, whence the Phœnicians derived their origin.

Dr Bryant has advanced a new hypothesis on this subject, and supported it with his usual acuteness and learning. He maintains that the dispersion as well as the confusion of tongues was local, and limited to the inhabitants of the province of Babel; that the separation and distribution recorded to have taken place in the days of Peleg (Gen. x. 25, 31, 32), which was the result of divine appointment, occasioned a general migration; and that all the families amongst the sons of men were concerned in it. The house of Shem, from which the Messiah was to spring, was particularly regarded in this distribution. The portion of his children was near the place of separation; they in general had Asia to their share, as Japhet had Europe, and Ham the large continent of Africa. But the sons of Cush would not submit to the divine dispensation. They went off under the conduct of Nimrod, and seem to have been for a long time in a roving state. However, at last they arrived at the plains of Shinar; and having ejected Ashur and his sons, who were placed there by divine appointment, seized his dominions, and there laid the foundation of a great monarchy. But afterwards fearing lest they should be divided and scattered abroad, they built the tower of Babel as a land-mark to which they might repair, and probably to answer the purposes of an idolatrous temple, or high altar, dedicated to the host of heaven, from which they were never long to be absent. They only, viz. the sons of Cush, or the Cushites, and their associates from other families, who had been guilty of rebellion against divine authority, and of wicked ambition and tyranny, were punished with the judgment of confounded speech through a failure in labial utterance, and of the dispersion recorded in Genesis; in consequence of which they were scattered abroad from this city and tower, without any certain place of destination. The Cushites invaded Egypt, or the land of Mizraim, in its infant state, seized the whole country, and held it for some ages in subjection; and they extended likewise to the Indies and Ganges, and still farther in China and Japan. From them the province of Cushan or Goshen in Egypt derived its name. Here they obtained the appellation of royal shepherds; and when they were by force driven out of the country, after having been in possession of it for 260 or 280 years, the land which they had been obliged to quit was given to the Israelites, who were also denominated "shepherds," but should not be confounded with the former, or the antecedent inhabitants of Goshen.

DISPLAYED, in *Heraldry*, is understood of the position of an eagle, or any other bird, when it is erect, with its wings expanded or spread forth.

DISPONDEE, in the Greek and Latin poetry, a double spondee or foot, consisting of four long syllables; as cōnclūdēntēs.

DISQUISITION (from *dis*, and *quæro*, I inquire), an inquiry into the nature, kinds, and circumstances of any problem, question, or topic; in order to gain a right notion of it, and to discourse clearly concerning it.

DISS, a market-town in the hundred of the same name, in the county of Norfolk, ninety miles from London. It is built on one of the upper branches of the river Wavency. There is a good market, which is held on Friday. The inhabitants amounted in 1801 to 2246, in 1811 to 2590, in 1821 to 2764, and in 1831 to 2934.

DISSECTION, in *Anatomy*, the cutting up a body with a view of examining the structure and use of the parts. Legendre observes that the dissection of a human body, even dead, was held as a sacrilege until the time of Francis I. And the same author assures us he has seen a consultation held by the divines of Salamanca, at the request of Charles V. in order to settle the question whether or not it were lawful in point of conscience to dissect a human body in order to learn the structure thereof.

DISSEISIN, in *Law*, an unlawful dispossessing a person of his lands or tenements.

DISSENTERS, separatists from the service and worship of any established church.

DISSIDENTS, a denomination applied in Poland to those of the Lutheran, Calvinistic, and Greek professions.

DISSIMULATION, the act of dissembling, by means of false appearances or pretensions.

DISSIPATION, in *Physics*, an insensible loss or consumption of the minute parts of the body, or that flux by which they escape and are lost.

Circle of Dissipation, in *Optics*, is used for that circular space upon the retina, which is taken up by one of the extreme pencils of rays issuing from an object.

DISSOLVENT, in general, whatever dissolves or reduces a solid body into such minute parts as to be sustained in a fluid.

DISSOLUTION, in *Physics*, a discontinuation or analysis of the structure of a mixed body, by which what was one and contiguous is divided into parts, either homogeneous or heterogeneous.

Dissolution, then, is a general name for all reductions of concrete bodies into their smallest parts, without any regard either to solidity or fluidity; though, in the usual acceptation of the word among authors, it is restricted to the reduction of solid bodies into a state of fluidity; but this is more properly expressed by *solution*, as a branch of *dissolution*.

DISSONANCE, in *Music*. See Discord.

DISSYLABLE, among grammarians, a word consisting of only two syllables; such as nature, sciences.

DISTAFF, an instrument about which flax is tied in order to be spun.

DISTANCE, in general, an interval between two things, with regard either to time or place.

Accessible Distances, in *Geometry*, are such as may be measured by the chain.

Inaccessible Distances are such as cannot be measured by the chain, by reason of some river, or the like, which obstructs the passage from one object to another.

Distance, in *Astronomy*. The distance of the sun, planets, and comets, is found only from their parallax, as it cannot be found either by eclipses or their different phases; for, from the theory of the motions of the earth and planets, we know, at any time, the proportion of the distances of the sun and planets from us; and the horizontal parallaxes are in a reciprocal proportion to these distances.

DISTASTE properly signifies an aversion or dislike to certain kinds of food, and may be either constitutional, or owing to some disorder of the stomach.

DISTEMPER, among *Physicians*, the same with Disease.

Distemper, in *Painting*, a term used for the working up of colours with something besides water or oil. If the colours are prepared with water, that kind of painting is called *limning;* and if with oil, it is called *painting in oil*, and simply *painting*. If the colours are mixed with size, whites of eggs, or any such glutinous or unctuous matter, and not with oil, then it is said to be done in *distemper*.

DISTENSION, in general, signifies the stretching or extending a thing to its full length or breadth.

DISTICH, a couplet of verses making complete sense. Thus hexameter and pentameter verses are disposed in distichs. There are excellent morals in Cato's distichs.

DISTICHIASIS, in *Surgery*, a disease of the eyelids, when under the ordinary eye-lashes there grows another extraordinary row of hairs, which frequently eradicates the former, and, pricking the membrane of the eye, excites pain, and brings on a defluxion. It is cured by pulling out the second row of hairs with nippers, and cauterizing the pores out of which they are extracted.

DISTILLATION.

THE preparation of ardent spirits constitutes a manufactory which is carried on in this country to a considerable extent, and deserves a particular investigation, as connected with one of the most curious and intricate departments of chemistry. We shall treat the subject as briefly as is compatible with perspicuity and utility.

It seems established by the experiments of chemists, that no other substance can be converted into ardent spirits, by fermentation, than sugar. Different species of sugar have been recognized by chemists. They are distinguished from each other by their sweetening power, and by the figure of their crystals. As far as the process of distillation is concerned, it seems only necessary to refer to three of these species; namely, *common sugar*, *sugar of grapes*, or *sugar of starch* and *manna*.

Common sugar is usually extracted from the sugar cane, but it exists likewise in beet, and in various other vegetable substances. Its colour is white, and it crystallizes in rhomboidal prisms. When it is dissolved in a sufficient quantity of water, and mixed with yeast, it ferments, and the liquid thus fermented yields, when distilled, an ardent spirit. It is from the refuse of common sugar that the ardent spirit well known by the name of *rum* is obtained in the West Indies.

Sugar of grapes is the substance to which that fruit is indebted for its sweet taste. It may be extracted from the juice of grapes, by nearly the same process as is followed by the manufacturers of common sugar. It is white, not so sweet as common sugar, and not so soluble in water. It usually crystallizes in spheres. These, when viewed with a glass, are found to consist of a congeries of small acicular crystals diverging from a centre. It is to the presence of this sugar that the juice of grapes owes its fermentability. The ardent spirits obtained by distilling *wine* are usually distinguished by the name of *brandy*. They are manufactured in great abundance in France and Spain, and other wine countries.

When starch is boiled with a large quantity of water and a little sulphuric acid for a considerable time, it is converted into a sugar, which possesses exactly the properties of sugar of grapes. From the experiments of M. Theodore de Saussure, it seems to follow that this sugar is nothing more than a combination of starch with water. During the process of malting, the starch which constitutes so great a portion of barley is converted into this sugar. If barley meal be mashed with water of the temperature 150°, and the mixture be well agitated for an hour or two, the barley starch gradually undergoes a process somewhat similar to mashing; for it becomes soluble in the water, and that liquid acquires a sweet taste. It is from this sugar that the ardent spirits known in this country by the names of *Geneva*, *Whisky*, *Gin*, are obtained.

Manna is a saccharine substance, which exudes spontaneously from the *Fraxinus ornus*, and several other species of ash. The fermented juice of the onion, melon, and carrot, likewise contains manna. Manna has a sweet taste like sugar. It is more soluble both in water and alcohol; it crystallizes very readily on cooling, in needles. But its most remarkable property is, that when dissolved in water, and mixed with yeast, it cannot be made to ferment like common or grape sugar. Hence it is incapable of yielding an ardent spirit. To the distiller, therefore, it is totally useless.

Milk likewise contains a peculiar species of saccharine matter, distinguished by the name of *sugar of milk*. In consequence of the presence of this substance, milk is capable of being fermented into an intoxicating liquor, which, of course, if distilled, would yield an ardent spirit. This liquor is made by the Tartars, from the milk of mares, and is known by the name of *koumiss*. It is made likewise in Shetland.

The liquid which exudes from the cocoa-nut tree also contains a saccharine matter, but of what species has not been ascertained. In consequence of the presence of this saccharine matter, it runs readily into fermentation, and when the fermented liquor is distilled, it yields an ardent spirit, well known in India by the name of *arrack*.

Thus the name of the ardent spirits differs according to the material employed in its manufacture. Every species of ardent spirit is distinguished by a peculiar flavour. The opinion entertained at present is, that the nature of the substance which produces intoxication is the same in all these ardent spirits, and is the substance to which chemists have given the name of *alcohol;* and that the flavour is owing to the presence of an essential oil, derived from the ingredient employed in the manufacture. Thus the sugar cane yields the oil that gives the peculiar flavour to rum; grapes contain the oil that gives the peculiar flavour to brandy, and so on. We do not know that this opinion, though sufficiently probable in itself, has ever been established by decisive experiments; that the oils to which these spirits owe their flavour have ever been obtained in a separate state; or that all of these spirits have been made to yield alcohol destitute of flavour. But the opinion is so very likely to be true, that we will be forgiven for adopting it, especially as we are not aware of any counter evidence that can be brought forward.

The processes of the distiller being essentially the same, whatever the substance be from which he procures his *ardent spirits*, we shall satisfy ourselves with a minute account of the processes followed by the distillers in Scotland in manufacturing whisky. We shall introduce, likewise, a few observations on the processes followed in manufacturing ardent spirits in other countries, such as Hollands and Rum; and we shall terminate the article by giving the present state of our knowledge of the theory of fermentation.

CHAP. I.—OF THE MANUFACTURE OF WHISKY.

The kind of grain employed in this country for manufacturing whisky is *barley*. The processes are easier, and the spirits produced have a more agreeable flavour, when the barley is *malted*. But, in consequence of the duty upon malt, a portion of unmalted grain has been introduced into the distilleries. This portion has been gradually increased, and amounts very commonly to four fifths, and in some cases, it is said, to nine tenths, of the whole mixture of raw grain and malt. It may be laid down as a general rule, that the labour bestowed, and the time requisite for brewing, increases in proportion to the quantity of raw grain employed.

The processes of the distiller may be reckoned four: namely, the mashing, the cooling, the fermenting, and the distilling. We shall take each of these processes in the order in which we have named them.

1. *The Mashing.*

The barley is previously ground to a fine meal, and the malt bruised by passing it between rollers. When the proportion of malt is very small, it is customary to add a quantity of the *seeds* of oats (the husk of oats separated during the grinding), to facilitate the separation of the water from the grains, after the process of mashing is over; for barley-meal parts with water with much greater difficulty than malt. When the proportion of raw grain to malt is as 2 to 1, or even as 3 to 1, this addition of oat seeds may be dispensed with. But it is probably essential when the proportions amount to 5 to 1, or, still more, when to 9 to 1.

The quantity of grain and malt employed at one time must be entirely regulated by the size of the distillery. But, that we may be able to give a precise notion of the proportion of the different substances employed, we shall suppose the quantity taken at once to be 60 bushels, and that it consists of a mixture of two parts raw grain and one part malt, or,

40 bushels barley,
20 bushels malt.

The mash-tun is a large circular or square vessel, which now-a-days is usually constructed of cast iron. It was formerly of wood; but a wooden mash-tun was found to last for so short a time, that iron has been substituted in several distilleries with which we are acquainted, and probably the substitution will soon become general. Into the mash-tun a quantity of water is let down of the temperature 150° Fahrenheit. The bulk of this water varies according to the fancy of the distiller; but from 700 to 800 wine gallons may be reckoned a good proportion for sixty bushels of grain. The mixture of meal and bruised malt is then put into the mash-tun, and very carefully mixed with the water by a number of men, who wield each a wooden instrument adapted for the purpose. All the dry clots of meal are broken, and every portion of it wetted with the water. This agitation of the meal in the water is what is technically called *mashing*. It is continued for at least an hour and a half, sometimes much longer; and the length of time must increase with the proportion of raw grain present, when compared with the malt; so that sometimes we have seen it continued for three or even four hours. As the liquor in the mash-tun would lose a great deal of its heat during this length of time, about 500 wine gallons of water are added at intervals, at a temperature varying from 190° to 205°, according to the fancy of the brewer. After the mashing is concluded, the whole mixture is allowed to remain at rest for about two hours, and this interval is technically called the *infusion*. During this interval the grains sink to the bottom, and the *wort*, still muddy, but quite liquid, remains at the surface.

If we have the curiosity to taste the wort every half hour from the commencement of the mashing to the end of the process, we shall find that at first it has little taste, but that it becomes sweeter and sweeter, till at last it acquires very nearly the luscious sweet taste of malt wort. This indicates clearly that the starch of the barley meal is gradually converted, during the mashing, into starch sugar. In what way this change is produced we have at present no experiments to determine; but if Theodore de Saussure's theory of the formation of starch sugar be accurate, we may conclude that the change is produced simply by the combination of a portion of water with the starch. The conversion, however, in the mash-tun, is never complete. A considerable portion of the starch still remains unaltered. The consequence is, that if we endeavour to make wort from raw grain, as strong as possible, to contain, for example, 200 lbs. of saccharine matter per barrel, we find ourselves unable to effect our object, because, long before it has reached 200 lbs. per barrel, the wort has lost its fluidity, and has assumed the form of a jelly. Our mode of trying this experiment was, to take the strongest raw grain wort which we could procure, and to concentrate it by boiling, till it became as strong as possible. We were never able, by this method, to obtain a wort much stronger than 150 lbs. per barrel. But malt wort may be easily boiled down to the strength of 200 lbs. per barrel, without losing its fluidity.

Probably the change of the starch into sugar continues during the process of fermentation. Hence, we conceive, the reason why distillers find it advantageous to put into the fermenting tuns all the solid starchy matter which had precipitated from the wort while in the coolers. Hence, also, the reason why the fermentation is conceived to go on best when it comes on gradually at first, and not with too much violence.

After the mashing and infusion is finished, the wort is drawn off from the grains. This is not done, as is the practice with the brewers, by opening a cock at the bottom of the mash-tun. It will not in this way pass through barley meal. But it is drawn off from the top of the mash-tun, after the grains have subsided, by means of a tube pierced full of holes, which rises at one of the corners of the mash-tun as high as the surface of that vessel.

The quantity of wort that runs off in this way does not exceed one third of the water which had been mashed with the meal. If 1200 gallons of hot water, for example, have been employed in all, the wort drawn off after the mashing will scarcely exceed 400 gallons. If the process were carried no farther, almost two thirds of the wort would be lost. To prevent this, about 500 gallons of water, of the temperature 190°, are let upon the grains. The whole is well mixed together for about twenty minutes, and then allowed to *infuse*, or to remain at rest, for an hour and a half. It is then drawn off in the same way as the first wort. In general, the amount of the second wort is greater than of the first, because the grains having been previously deprived of a great proportion of their starch, now part with their water more freely than before.

To carry off everything soluble from the grains as completely as possible, after the second worts have been drawn off, about 800 gallons of boiling hot water are let on the grains. The mashing or stirring is continued for twenty minutes, and the infusion for half an hour or forty minutes. This third wort is then drawn off. Being much weaker than the two preceding worts, some distillers are in the habit of reserving it, and employing it for mixing with the meal and malt in the succeeding brewing. Others boil it down to the requisite strength, and then mix it with the first and second worts in the fermenting vessel. It is impossible to lay down any rule respecting this part of the process, because, unfortunately, the distiller is not left at liberty to follow his own judgment. The legislature has interfered, and obliged him to produce a determinate quantity of spirits of a given strength from 100 gallons of the fermented wort. Till within these few years it was necessary in Scotland to produce from 100 gallons of fermented wort, 19 gallons of spirits of the strength one to ten over hydrometer proof, or of the specific gravity 0·90917. This law, we believe, still exists in England; but in Scotland the quantity of spirits from 100 gallons of fermented wort has been reduced to 14 gallons.[1] The Scotch distiller at present is under the necessity of producing this quantity of spirits from 100 gallons of fermented wort, or, at any rate, of paying the duty for that quantity, whether he produce it or not. This law, of course, regulates the strength of his wort. For, in order to produce that quantity, it is necessary that the wort should contain a certain proportion of saccharine matter. Accordingly, the wort must be at least of the strength 55⅓ lbs. per barrel when it is let down into the fermenting tun, and the law prohibits it from being stronger than 75 lbs. per barrel. If we suppose the whole saccharine matter contained in the wort to be decomposed during the fermentation, 100 wine gallons would produce 14 gallons of spirits of the specific gravity 0·90917, provided the original strength of the wort was 55⅓ lbs. per barrel. But this is a supposition which is never realized in practice. From a number of experiments, conducted with considerable care, we consider ourselves warranted in concluding, that, even when the fermentation is conducted with the greatest success, the quantity of saccharine matter which will remain undecomposed in a barrel of wort of the original strength of 55⅓ lbs. per barrel, cannot be less than 15 lbs. Hence a distiller can scarcely be expected to produce 14 gallons of spirits of the specific gravity 0·90917 from 100 gallons of wort, unless the original strength of his wort was at least 70⅓ lbs. per barrel. In general, indeed, a still greater strength than this will be requisite. Now, to produce wort of the strength 70⅓ lbs. per barrel from raw grain, without boiling, is by no means an easy task. Formerly, when the product necessary was 19 gallons of spirits from the 100 of wort, the distillers were accustomed to give their wort the requisite strength by the process which they termed *lobbing*. This consisted in making up a very strong infusion of saccharine matter from malt, raw grain, &c. and adding it to the wort till it acquired the requisite strength. This substance was likewise called *bub;* and every distiller had his own method of preparing it. Probably sugar, treacle, or other similar prohibited articles, often found their way into it. It was on this supposition that the addition of it to wort was entirely prohibited in the late act of parliament regarding the Scotch distilleries. And it was to prevent the secreting of the surplus spirits which might be produced above the 14 per cent. that the strength of the worts was limited to the maximum 75 lbs. per barrel.

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[1] Still more lately, an act of parliament has passed, reducing the product of spirits to thirteen gallons from the hundred gallons of wash, and the strength of the wort must not exceed 70 lbs. of saccharine matter per barrel. The excise regulations bind down the distiller to a particular mode of operating. All such restrictions are very injurious to the improvement of the process. How far they may have been provoked by the attempts of the manufacturer to evade the excise duties, we pretend not to say.

When the quantities of grain, malt, and water, above indicated, are employed, the first worts drawn off will be about the strength of 73 lbs. per barrel, and the second worts of the strength 50 lbs. per barrel; and the two, when mixed together, would constitute a wort of the strength of about 62 lbs. per barrel. Of course, the worts actually made by the Scotch distillers must exceed the strength of those which we have employed by way of illustration, by about eight lbs. per barrel. But we have reason to believe that 62 lbs. per barrel would be a better strength than that pitched upon by those who contrived the act of parliament by which the Scotch distilleries are regulated. Wort of such strength should yield about 12 per cent. of spirits of the strength one to ten over proof, or of the specific gravity 0·90917. The original strength of the wort from which Dutch Hollands is made is considerably less than this, and we believe that nobody will deny that the Dutch spirit is, in general, much preferable to the whisky manufactured in the lowlands of Scotland.

The whisky made by smugglers in Scotland is universally preferred by the inhabitants, and is purchased at a higher price, under the name of Highland whisky. This is partly owing to its being made entirely from malt; but the chief reason is, that, from the unfavourable circumstances under which they operate, their wort is necessarily much weaker than the wort of the legal distillers. Probably it is not much stronger at an average than the wort of the Dutch Hollands. It has been generally conceived that the superiority of the illicitly distilled, or Highland whisky as it is called, is owing to the mode of distillation. The smugglers distil in a much slower way than the legal distillers. But nothing can be more absurd than this opinion. The flavour of the spirits depends entirely upon the previous steps of the process. The slowness or rapidity of the distillation can make no difference whatever in the flavour, provided it be properly performed. Accordingly, we have seen spirits distilled by the very rapid mode of distillation that formerly was practised in Scotland, possessed of all the flavour of the best Highland whisky.

Great pains have been taken to put an end to the practice of illicit distillation in Scotland; and, by greatly diminishing the duty, this object, of late years, has been nearly attained. The smugglers formerly set the whole force of government at defiance, and carried on their processes in spite of all the attempts that were made to stop them. Many of them, indeed, were brought to absolute ruin, and few of them, we believe, were ever able to realize much money, or to rise to independence. But still a new race of smugglers rose up after another to carry on their illicit trade, to the great detriment of the revenue, and to an equal deterioration of the morals of the common people. Government do not seem to have been aware of the principal reason of the continuance of this evil. They bound down the legal distillers in such a manner by injurious restrictions, that it was not in their power to produce a spirit equal in flavour to that manufactured by the smugglers, who lie under none of those restrictions which bind down the ingenuity of the legal trader. This superiority induces a corresponding desire in the inhabitants of Scotland to possess themselves of smuggled whisky, even at a higher price than that for which they can purchase the same article from the licensed distillers. The smugglers, in consequence, are winked at, or rather encouraged, by a very considerable proportion of the inhabitants of the country. While this feeling existed it was impossible to put an end to smuggling in Scotland. But government of late has removed the restrictions by which the Scotch distillers were bound, so far as to allow them to distil from malt at nearly the same rate as they formerly did from raw grain. The consequence has been, that the high reputation of smuggled whisky has gradually sunk, and smuggling has been nearly discontinued.

The only reason that was alleged for continuing the restrictions under which the distillers were placed, was the allegation that they were necessary in order to ensure the payment of the duty upon the spirits actually distilled. But we conceive that this duty might be levied with as much accuracy, though all the restrictions on the strength of the wort were removed. From a number of experiments conducted upon a large scale, we conclude that the fermentation, however successful, is capable of decomposing only four fifths of the whole saccharine matter contained in the wort. Farther, we find, that for every pound of saccharine matter decomposed by the fermentation, there is formed half a pound of alcohol of the specific gravity 0·825. Now every gallon of spirits of the specific gravity 0·90917, or one to ten over proof, contains 4·6 lbs. of alcohol of the specific gravity 0·825. To form a gallon of spirits, then, of the specific gravity 0·90917, there is required the decomposition of 9·2 lbs. of saccharine matter. But as only four fifths of the saccharine matter present are decomposed, we must increase 9·2 by a fifth, which will raise it to 11½ lbs. The rule, therefore, for levying the duty on the distillers would be this. Ascertain, by the saccharometer, the strength of the wort, or the number of pounds avoirdupois of saccharine matter which it contains, and for every 11½ of these pounds charge the duty upon one gallon of spirits. This would be no hardship upon the distiller. If he is unable to produce a gallon of spirits from 11½ lbs. of saccharine matter, he is not sufficiently acquainted with his business, and the necessity of paying the duty would stimulate his ingenuity to acquire the requisite information. He would soon discover two facts which would probably regulate his conduct; namely, that the flavour, and consequently the value, of his spirits, increases as he diminishes the strength of his wort, and that the produce of spirits from the same quantity of grain increases also as he diminishes the strength of his wort.

It would be difficult, according to the method at present followed by the distillers, for the excisemen to determine the strength of the worts with the requisite degree of accuracy; but it would be easy, we conceive, to order matters so, that this information might be gained without in the least injuring the process of fermentation to which these worts are to be subjected.

Some distillers, not satisfied with three mashes, which they think insufficient to exhaust the grains of all the matter that may be useful in the formation of spirits, add a fourth quantity of boiling water, after the worts of the third mash are drawn off, and mash a fourth time. The worts of this fourth mash are always kept, to be employed instead of pure water during next day's brewing.

2. *The Cooling.*

Wort from raw grain has a much greater tendency to run into acidity than wort from malt. On that account the distillers endeavour to bring it down to the temperature requisite to begin fermentation as speedily as possible. As soon as the first worts have begun to run into the underback, they are made to pass into the coolers. The nature and disposition of the coolers vary so much, according to the size of the distillery, that a general description will by no means apply to them all. When the manufactory is of a moderate size, the coolers are a shallow wooden vessel, covering the floor of an apartment or suit of apartments, placed usually in the upper part of the distillery, and open as much as possible to the influence of the external air. Here the hot worts are pumped up, and left at a depth of one, two, or three inches, till they have acquired the requisite temperature.

When the distillery is on a large scale, it is usual to accelerate the cooling of the worts by agitation. Of late years a new contrivance has been fallen on, which answers much better than the old method, by bringing the worts almost instantly to the particular temperature which the distiller wishes them to acquire. This method is to pass the hot worts through a certain length of tin pipe, which is immersed in a running stream of water. By properly regulating the length of the pipe, the worts may be cooled down either to the temperature of the surrounding water, or to any other intermediate temperature required. As the worts in this case are cooled in close vessels, no evaporation goes on during the process. Hence their strength will not increase during the process, and the quantity will be precisely the same as in the underback, making allowance for the change of temperature. This probably would be a disadvantage to the distillers, while the present law obliges them to brew worts of a given strength. But if this restriction were removed, it would be rather an advantageous circumstance, because it would enable them to regulate the strength of their worts at pleasure, by the quantity of water employed during the mashing and infusion. To the excise officer it would also be a convenient circumstance, because it would afford an additional security for determining the strength with accuracy. He would have it in his power to try the strength of the worts while hot in the underback, and when newly let down into the fermenting tuns, before the yeast was added. This second trial ought to give nearly the same result as the first. We say nearly, because, when the worts are hot, it is not so easy to determine their strength with accuracy, as when they are cold.

During the cooling of the wort from raw grain, there is always a considerable deposit of flocky matter, which we conceive consists chiefly, if not entirely, of starch. This flocky matter is swept along with the wort into the fermenting tun. It is the opinion of distillers that it contributes materially to the formation of spirits during the fermentation. We have little doubt that the opinion is well founded. Probably during the fermentation it is converted first into saccharine matter, and then afterwards decomposed into alcohol and carbonic acid.

The temperature to which the wort is cooled before it is let down into the fermenting tuns differs a good deal in different distilleries, and even in the same distillery at different seasons of the year. Winter is the usual season for the distilleries, and it is the season which is considered as most advantageous for conducting the fermentation with success; for it is easy to raise the temperature of the fermenting room to the degree which is considered as best adapted for the process. But when the weather is hotter than that degree, it is a much more difficult matter to keep the fermenting room sufficiently cool. In winter the distillers usually let down the first worts at about 70°; the second worts are cooled down to 60° or 65°. We do not perceive any good reason for this distinction, though we have frequently seen it practised.

3. *The Fermentation.*

This is by far the most important part of the whole process. It is by the skill and success with which it is conducted that distillers excel each other. Upon it the profit and loss of the manufactory chiefly turn. Much pains have been bestowed in investigating it; but it is of so capricious a nature as occasionally to thwart the most skilful and experienced brewers. We shall describe the method of proceeding in this process usually followed by the Scotch distillers. In the article Brewing we stated the facts at present known respecting the saccharine matter of the wort and yeast of beer which is employed as a ferment. To that article, therefore, we refer those who wish for information on these subjects.

The yeast employed by the Scottish distillers is chiefly brought from the London porter breweries. Small quantities may be occasionally obtained from breweries in their neighbourhood; but never, we believe, a sufficient quantity to answer their purposes. The best yeast is that which is thrown off the top of the porter during its fermentation. But what is sold by the porter brewers consists chiefly of the slimy matter which remains at the bottom of the vessels when the clear porter is drawn off. Fresh yeast is better than stale; but the distillers being unable to procure a sufficient quantity of fresh yeast for their purposes, are under the necessity of using both fresh and stale.

As the quantity of yeast employed depends upon its quality, it is therefore impossible to lay down any very precise rules upon the subject. For the quantity of wort which we have supposed in the preceding part of this article, a Scotch distiller would probably employ about twenty-seven gallons of good yeast, and about thirty-six gallons if he considered the yeast of inferior quality. Only a portion of this yeast is mixed at first with the wort. The remainder is generally added on the second, third, and fourth day. Most commonly, indeed, the whole is added on the third day; but it is customary to make a farther addition at a later period, if the brewer is of opinion that the fermentation is not proceeding so well as it ought to do. We have seen yeast added on the sixth day of the fermentation.

The first portion of yeast mixed with the wort is always if possible fresh yeast, and it is a great object with the distiller to have it of as good a quality as possible. For our wort, the quantity of yeast first used may amount to nine gallons. On the second day nine gallons more may be added, and on the third day nine or eighteen gallons, according to its quality. Some distillers add nine gallons the first day, and twenty-seven the third. Some add nine gallons every day for four days. In short, there is considerable difference, and probably a good deal of caprice, in the practice followed in the various manufactories. At least we have never been able to obtain a satisfactory reason from any brewer why he followed one practice rather than another. In hot weather we should prefer the addition of nine gallons of yeast every day for four days. But in cold weather it would probably answer better to add the whole yeast at twice; and perhaps the third day is the most proper for making the great addition.

The fermentation lasts nine, ten, eleven, or twelve days, according to circumstances. Sometimes, though seldom, we have seen it last thirteen days. During the first five days the fermenting tuns are left open on the top, or only slightly covered; but on the sixth day they are shut up as closely as possible, so as to render the escape of the carbonic acid rather difficult. Two reasons have been alleged for this proceeding. 1. The carbonic acid gas is conceived to carry with it a portion of the alcohol, and by binding down the top it is supposed that the loss by this drain will be diminished. We do not lay much stress on this reason. The fermentation is almost at an end before the tuns are shut down. Of course, almost the whole of the alcohol abstracted by the carbonic acid has been already removed. 2. The presence of carbonic acid is conceived to promote the fermentation. Hence it is supposed that, by preventing that gas from escaping with facility, the attenuation will be greater than it otherwise would be. Perhaps there may be some foundation for this opinion. There is no doubt that carbonic acid gas may be substituted for yeast as a ferment, and that the fermentation of the wort, under such circumstances, will go on pretty well. We have seen the experiment tried by mixing yeast with wort in a close barrel, from which there proceeded a tin pipe that passed through another barrel filled with wort, and opened at the bottom of it. The gas was absorbed by the wort in this second barrel, and the wort was fermented by it. But the fermentation, as might have been expected, was not so complete as if it had been produced by the usual addition of yeast. The distillers do not collect any yeast from their fermenting vats, but beat it all into the liquid, being of opinion that any such collection would render the fermentation less complete, and, of course, diminish the proportion of spirits obtained.

The wort most commonly increases in temperature from 20° to 25° of the thermometer. Supposing it let down into the fermenting tun at 57°, its temperature, when at the highest, may amount to from 78° to 82°. It usually acquires the highest temperature on the fourth day of the fermentation, frequently upon the fifth day; sometimes upon the sixth, the third, or the seventh day; and we have seen it as late as the eighth, or even the eleventh day, before its temperature became a maximum.

The following table exhibits the number of cases on which the highest temperature took place in these respective days in seventy-six brewings, conducted upon a pretty large scale:

4th day	31 times
5th day	23
6th day	9
3d day	6
7th day	5
8th day	1
11th day	1

This diversity, no doubt, depends upon the goodness of the yeast employed; and, as we have no good criterion by which to determine the exact value of yeast as a ferment, it is impossible to be able to foretell the exact result in any particular case. Indeed we consider the uncertainty of the value of yeast as the great difficulty which the distiller has to encounter. Any person who could discover a method of estimating the exact value of any particular yeast as a ferment would greatly improve this difficult manufactory. We do not believe that such a discovery is impossible. Perhaps the specific gravity of the yeast, or the quantity of solid matter which is left behind when a given weight of the yeast is evaporated to dryness, might furnish very material information. We are rather surprised that no distiller has thought of subjecting yeast to a series of experiments, with a view to ascertain its real value as a ferment. The new information which he would acquire would more than compensate for the trouble, and would probably give him the means of improving his manufactory, or at least of forming some notion of the value of the yeast which he purchases.

As the fermentation proceeds, the specific gravity of the wort diminishes, owing to the decomposition of the saccharine matter, and its conversion into alcohol and carbonic acid. This diminution of specific gravity is called *attenuation* by distillers, and is employed by them as the measure of the success of the fermentation. They can easily foretell the quantity of spirits which their *wash* (the name by which their fermented wort is distinguished) will yield, if they know the attenuation which has taken place during the fermentation. This diminution of specific gravity is produced by two causes. 1. The destruction of the saccharine matter previously dissolved in the liquid, and which occasioned its specific gravity to be greater than that of water. If the whole of this saccharine matter were decomposed, it is obvious that the change of specific gravity from this cause would be exactly such as would sink the wash to the specific gravity of water. 2. The second cause of the diminished specific gravity of the fermented wort is the formation of a quantity of alcohol, which, being lighter than water, occasions, by its evolution, a corresponding diminution of the specific gravity of the liquid. The specific gravity of the purest alcohol which it has been hitherto possible to obtain, is 0·793 at the temperature of 60°. When mixed with water it enters into a chemical combination with that liquid. Hence the specific gravity is greater than the mean of that of the water and alcohol, though considerably less than that of water. It is obvious, if we were to add alcohol to the unfermented wort, we would diminish its specific gravity. We might even, by this means, render it as light, or even lighter, than water, though none of the saccharine matter were destroyed. It is obviously impossible, therefore, to determine how much saccharine matter has been decomposed by the fermentation from the attenuation alone. Suppose the original specific gravity of the wort to have been 1·060; and suppose that, after the fermentation, its specific gravity is reduced to 1·002. The first of these specific gravities indicates 55·8 lbs. of saccharine matter per barrel; the second 1·6 lbs. per barrel. It does not follow, as the distillers suppose, that 54·2 lbs. of saccharine matter per barrel have been decomposed and converted into alcohol and carbonic acid. A considerable portion of the saccharine matter still remains undecomposed, but the alcohol which has been formed counteracts the specific gravity of this saccharine matter, and prevents its presence from being correctly indicated by the saccharometer. But if we measure out a quantity of such wash, put it into a retort or still, and distil off about a third of it; if we then take the residual wash which remains in the retort or still, and add pure water to it till its original bulk be restored, the saccharometer being applied to it will indicate the quantity of saccharine matter which it still contains; and this quantity being subtracted from the original quantity of saccharine matter contained in the wort before the fermentation commenced, the remainder will be the saccharine matter decomposed by the process.

Alcohol is a substance which has a tendency to stop fermentation, and it stops that process completely when added to fermenting wort in sufficient quantity. It must be obvious from this, that very strong worts are injurious to the profits of the distiller; because the stronger the wort the greater will be the proportion of alcohol evolved, and, of course, the fermentation will ultimately be impeded or stopped altogether, before the whole saccharine matter is decomposed. Accordingly, the *spent wash* will always be found to contain a considerable proportion of saccharine matter, and it might be fermented again, and made to yield no inconsiderable quantity of spirit. The writer of this article made nine trials with malt worts, which were designedly made weak. They were fermented as thoroughly as possible, and the following table indicates the specific gravities to which they were reduced. The original specific gravity probably did not much exceed 1·045.

	Sp. Gravity.
1	1·0012
2	1·0045
3	1·0018
4	1·0000
5	1·0012
6	1·0045
7	1·0047
8	1·0007
9	1·0007

Upon examining the state of the wash after the fermentation was at an end, we found that 4·34 parts of the saccharine matter had been decomposed, and that one part remained unaltered. So that in these nine experiments, which were as favourable as possible to the fermentation, on account of the weakness of the worts, not much less than one fifth of the whole saccharine matter remained unaltered. Surely then we may lay it down as a fact, that, in all cases of fermentation in a Scotch distillery, at least one fifth of the whole saccharine matter is prevented from being decomposed by the antifermenting power of the alcohol evolved. The consideration of this circumstance renders it of more importance to allow the distiller to make his wort weak; for the weaker the original wort, the less will the quantity be of the saccharine matter which is prevented from being decomposed by the presence of the alcohol evolved.

When the heat has acquired its maximum, we may reckon, at an average, that nine tenths of the whole attenuation has been completed. No judgment can be formed of the ultimate attenuation, by the rapidity or slowness with which the heat reaches its maximum. We have seen the attenuation equally good when the maximum temperature happened on the third, fourth, fifth, or sixth day.

It is impossible to lay down any specific rule with respect to the length that attenuation ought to be carried. The object of the distiller is to render his wash, if possible at least, as light as water. This object they frequently accomplish. But it sometimes happens that the fermentation stops when the specific gravity has sunk to 1·013 or 1·008, and no addition of yeast will make it sink lower. Bad yeast is the most probable reason of this ill success. If the wash be allowed to remain in the fermenting tuns after the fermentation is at an end, its specific gravity will be found gradually to increase a little, and it will not yield so great a proportion of spirits. This is owing to the formation of vinegar in the wash, which takes place at the expense of the alcohol; and if the vinegar-forming process were allowed to go on long enough, the alcohol would disappear altogether.

Distillers always ferment their worts in tuns of a large size. This is attended with the advantage, that the artificial heat evolved by the fermentation is not so speedily dissipated as it would be if the process were conducted in small vessels. Some distillers fill the tuns only partly, leaving a portion of the upper part empty, that it may contain the froth formed when the wort is in full fermentation. Others fill the tuns almost to the top, and cover down the mouth with a lid, from which a tube passes to an open vessel placed above the tun. When the liquid swells by the fermentation, it passes up the tube into the open vessel, and runs down again when the fermenting process subsides. No regular set of experiments, that we know of, has been made to determine which of these two methods is the best.

We have already observed that every 9·2 lbs. of saccharine matter really decomposed by the fermenting process yield a gallon of spirits one to ten over hydrometer proof, or of the specific gravity 0·90917 (at the temperature of 60°). But as the distillers are not in possession of a good method of determining how much saccharine matter has been decomposed, the easiest rule will be to allow 11½lbs. of saccharine matter, estimated before the fermentation begins, to yield a gallon of spirits at 0·90917 specific gravity. If the original worts be very weak, perhaps we might take 11 lbs. of saccharine matter as producing that quantity of spirits; but while the present law respecting the strength of the worts continues, 11½ lbs. will be found, upon an average, to come very near the truth.

It does not seem to be possible to ferment wort from a mixture of raw grain and malt as completely as is required for the purposes of the distiller, without its becoming sour. There seems no reason to doubt that the acid formed is the acetic. Some are of opinion that the presence of this acid contributes to improve the flavour of the spirits. But the quantity of acetic acid usually present in wash is so small, that we do not see any reason for supposing that it can produce any sensible effect. It is important, therefore, that the acidity should be as small as possible, because the acid is formed at the expense of the alcohol in the wash. Hence the wash ought to be distilled as soon as the fermentation has come to a conclusion.

4. *The Distilling.*

The stills commonly used in other countries are of large dimension, and very deep, so that a great deal of time is necessary to finish one process. Once in the week, for example, is no uncommon period. The same kind of still was used in Scotland till about the year 1787, when the duty began to be levied on the distillers by a license paid at the commencement of the season upon every still according to its capacity. This was done to prevent that propensity to smuggling by which the generality of Scotch distillers were supposed to be actuated. The quantity of spirits which a still of given dimensions could produce in a year was calculated, and the license was laid on according to it. This saved the excise-officers all farther trouble, after gauging the stills and collecting the license-duty, excepting an occasional visit to be certain that no new still of larger dimensions was substituted for the old one. But about the year 1788 Messrs John and William Sligo, at that time rectifiers in Leith, made an important alteration in the shape of the still, at the suggestion of an Englishman, which greatly increased the rapidity of distillation. They diminished their height, and increased the diameter of their bottom. The consequence of this alteration was, that they were able to distil off the contents of the still in a few hours, instead of once a week, as had formerly been the practice. Thus they were enabled to produce a great quantity of spirits from a very small still, and, of course, paid in reality a much smaller duty than their brother manufacturers. This lucrative improvement they possessed exclusively for about a year; but a secret of such importance could not be long confined to a single house. It became gradually known to other distillers, and was soon imitated by all. The license-duty was increased year after year; but the ingenuity of the distillers enabled them to outstrip the acts of parliament; till, at last, a committee of the House of Commons was appointed to investigate the subject in 1799. A very bulky report was published by this committee, which contains a vast collection of curious facts respecting the mode of distillation at that time practised in Scotland. The license, in consequence of this report, was laid on the distiller, on the supposition that he could discharge his still every eight minutes, during the whole season that the manufactory was in activity. Since that time the time of discharging the still was considerably shortened. But the saving in point of time was attended with such an enormous waste of fuel, that it is rather doubtful whether it was attended with much additional profit to the distiller. In the year 1815, which was the last year of the license-duty, a still capable of holding 80 gallons could be completely distilled off, emptied, and ready for a new operation in 3½ minutes, or even, it is said, in some cases in 3 minutes; and a still of 40 gallons in 2½ minutes. At that time a change took place in the excise laws; the license-duty was abolished, and the whole duty was levied, as in England, on the wash and the spirits produced. There was, of course, no longer any necessity for continuing the rapid mode of distillation; and, as it was attended with a very considerable waste of fuel, and was in other respects much more expensive than the slow process, it has been, of course, discontinued. We conceive, however, that it will be worth while to give a short description of the still and furnace which the Scotch distillers employed during the existence of the license-duty. It would be a great pity indeed to allow the results of such a series of important experiments to be forgotten.

The stills were made of copper. Those capable of holding 44 gallons were about 44 inches in diameter at the bottom, and about 5 inches deep. Those capable of holding 80 gallons were 54 inches in diameter, and about 8 inches deep. The bottom was perfectly flat, and about three eighths of an inch thick. Within it there were a number of iron chains, which were turned round by machinery, and rubbing against the bottom prevented the thick matter, which the wash always contains, from adhering to the bottom of the still and catching fire. This would have almost immediately occasioned the destruction of the still; and the scorched starchy matter would have communicated a disagreeable flavour to the spirits, which could not have been got rid of afterwards. There was likewise a circular plate in the inside of the still, towards its top. The use of it was to break the bubbles that rise during rapid distillation; and, of course, lessen the risk of the still boiling over, or *running foul* as the distillers term it; and, consequently, the distiller was enabled to put a greater charge of wash into the still than it would have been in his power to do if the plate had been omitted.

These stills were supported by resting an inch and a half on the brick work all round the bulge. The furnace was quite level, and was placed at the distance of 15 inches below the bottom of the still. The inner end of the grating bars was placed 15 inches within a line falling vertically from the part of support of the bulge of the still. The bars were in two lengths, the inner length was 21 inches, the outer 30 inches, supported by a cross bar between them four inches square. In front of the bars was a dumb plate 10 inches broad. The bottom of the ash-pit was three feet below the grating bars, and on a level with the floor of the distillery. The bars were two inches thick, three inches deep, and three fourths of an inch apart. The brick work extended 21 inches beyond the dumb-plate, and was four feet wide and four inches higher outside than at the bulge of the still. The furnace doors were 30 inches wide. The bottom of the furnace beyond the grating bars was lined with fire-brick nine inches deep, and passed level backward into the chimney.

The chimney was 60 feet high, four feet square within from top to bottom, and consisted of a double wall. The inner wall of fire-bricks was nine inches thick. The outer wall was placed at three inches distance on all sides from the inner wall, and the space was left open at the top. The outer wall was 18 inches thick at bottom, diminishing regularly on the outside till reduced to nine inches at top. The two walls were tied together, at certain distances, by long fire-bricks. This separation of the two walls was found to prevent the rapid destruction of the chimney from the intensity of the fire, which always happened when the two walls were in contact.

Such was the construction of the furnace and the shape of the stills during the time that rapid distillation was practised in Scotland, when both had been brought to the greatest degree of perfection which the distillers were capable of giving them. The writer of this article has not had an opportunity of seeing the shape of the stills used by the Scotch distillers since the license-duty was abolished. But it is probable that the old shape will not have been entirely restored; but that the present stills, though much larger in size, imitate the late stills in the great diameter of their bottom, and their comparative shortness when compared with the stills employed by the English distillers.

The top of the still ends in a kind of tube, which is bent downwards, and connected with a tin tube, which makes a number of revolutions in a large vessel filled with cold water, and therefore called the worm. This large vessel is called the *refrigeratory*, and care is taken to keep the water in it always cool by means of a stream of water which is constantly flowing into it. The wash being put into the still, and the top being fixed down, heat is applied to the vessel till it is made to boil. The spirits being more volatile than the water, pass over first in the state of steam, and are condensed into a liquid as they pass through the worm. The first portions that come over are very strong; but the strength diminishes as the process proceeds. The distiller continues the distillation till the liquid which flows from the worm is as heavy as water, or at least so nearly so that the quantity of spirits remaining is not considered as a compensation for continuing the process any longer. The strength of the liquid proceeding from the worm is ascertained by a small hydrometer, with which it is tried every now and then; and whenever a certain mark on the instrument comes to coincide with the surface of the liquid, a cock at the bottom of the still is opened, and what remains in the still is let off. This liquor is called the *spent wash*. It is a muddy brown liquid, still containing a quantity of undecomposed saccharine matter. It is therefore used as food for cattle. These animals are fond of it, and soon fatten upon it.

To prevent the still from boiling over, which is apt to happen towards the commencement of the distillation, it is usual to throw a piece of soap into the vessel along with the wash. This substance is partly decomposed, and the oily matter which it contains spreading on the surface, forms a thin coat, which breaks the large bubbles when they reach it, and thus prevents the wash from swelling beyond the requisite bulk. Butter would answer equally well with soap, and would be less apt to give a disagreeable flavour to the spirits; but its high price prevents the possibility of using it for that purpose. We have some suspicion that hogs' lard would answer. If it were found to do so, it would be cheaper than soap, and less apt to give a bad flavour to the spirits. The supposition, however, that soap communicates a disagreeable flavour to spirits, though very generally entertained, is, we believe, a mistake. We have certainly met with spirits distinctly tainted with soap, and having in consequence a highly nauseous taste. But this was at a time when the rapid mode of distilling was only on its progress to perfection, and was owing, we believe, to little bits of the soap having been accidentally forced into the worm, and afterwards dissolved by the spirits.

It is impossible to lay down any rule with respect to the strength of the weak spirit obtained by this first distillation, and which is called *low wines* in Scotland. That strength must depend partly upon the original strength of the wort, partly on the attenuation which has taken place during the fermentation, but chiefly upon the attention of the distiller to distil off the whole of the spirituous portion of the wash. In a great number of cases in which we have had the curiosity to determine the strength of the low wines in distilleries, we have found the specific gravity at 60°, differing but little from 0·978; frequently a little weaker, and very rarely a little stronger. Low wines of this strength contain the fifth part of their weight of alcohol of the specific gravity 0·825; the remaining four fifths are water.

The low wines are put into the still and subjected to a second distillation, which in Scotland is called *doubling*. The first portion which comes over is a milky liquid, known by the name of *foreshot*. Its taste is disagreeable, and on that account it is received by itself, and returned back into the low wines to be subjected to another distillation. The properties of the foreshot are owing to an oil with which it is loaded. When the spirits begin to run transparent from the end of the worm, they are allowed to run into a receiver prepared for them. Whenever their specific gravity, determined by the hydrometer, has reached a certain point, they are no longer allowed to flow into the receiver containing the spirits, but into a place by themselves, and the distillation is continued till the liquid coming over has approached very nearly to the specific gravity of water. This third portion is called *faints*. It is mixed with the low wines and distilled again. Thus the distillation of the low wines is continued till the whole of their alcoholic part is brought to that degree of strength which fits them for the market. The strength at which the duty is levied on them is one to ten above hydrometer proof, which corresponds with the specific gravity 0·90917. They are prohibited from sending out of their manufactory spirits of greater strength than this, or of a strength under one in six below proof, or of the specific gravity 0·9385. Between these two intervals the specific gravity of their spirits may be considered as vibrating; for it is not to be expected that they should be able always to produce spirits of exactly the same specific gravity. We have found the spirits, as obtained by doubling, of a specific gravity as low as 0·908, and as high as 0·925. No doubt they might be obtained much stronger or much weaker than these two extremes, if there were any object in view to induce the distiller to alter his usual practice.

Such is the mode followed in Scotland in order to obtain whisky. The distillers are at pains to purchase the best English barley which they can procure. They are certainly in the right to select English barley for malting; for English barley, when malted, yields more spirits than in the state of raw grain. But for that portion of grain which they use in the distilleries without malting, it would be their interest to employ the best big which they can procure; for good big, while in the state of raw grain, yields rather more spirits than an equal quantity of the best English barley; and as it can be purchased at a cheaper rate than barley, it could obviously be employed with economy as a substitute for that grain. Big is greatly deteriorated by malting it; of course it would be improper to employ it in distilleries in that way; but the distillers might employ it in the state of raw grain with great advantage.

CHAP. II.—OF THE MODE OF MANUFACTURING OTHER KINDS OF SPIRITS.

In this chapter we shall merely make a few very short observations on the processes followed by the distillers in other countries.

1. *Dutch Geneva.*

The Dutch have long been famous for the manufacture of an excellent kind of spirits, known in Scotland by the name of *Gin*, in England by the name of *Hollands*, and sometimes by the name of *Geneva*. We have been told that the manufacture of it originated in the city of Geneva, and that this was the origin of the name Geneva, still applied to it in commerce; but we have no means of determining how far this statement may be depended on. We have not seen in print any accurate account of the mode of making Geneva practised by the Dutch; but the following account may, we believe, be relied on. We are indebted for it to a friend, who about forty years ago went over to Holland on purpose to make himself acquainted with the process. His object was to establish a similar manufactory in Scotland. But the severe laws by which the Scotch distillers were soon after bound put it out of his power to execute his plan.

112 lbs. of barley malt, and 228 lbs. of rye-meal, are mashed together with 460 gallons of water of the temperature 162°. After the infusion has stood a sufficient time, cold water is added till the strength of the wort is reduced to 45 lbs. per barrel. The whole is then put into a fermenting back, at the temperature of 80°. The vessel is capable of holding about 500 gallons. Half a gallon of yeast is added. The temperature rises to 90°, and the fermentation is over in forty-eight hours. The attenuation is such that the strength of the wash is not reduced lower than 12 or 15 lbs. per barrel. The wash is put into the still with the grains and all. The low wines, as usual, are distilled again, and the spirits of the second distillation are rectified; so that the Hollands pass thrice through the still. A few juniper berries and some hops are used to communicate a peculiar flavour to the spirits.

Now, 45 lbs. per barrel constitute a wort so weak that it will not yield above seven and a half per cent. of spirits of the usual strength; so that the produce which the Dutch obtain from their wort cannot amount to much more than half what the Scotch distillers are obliged to produce from theirs.

It is obvious, from the preceding account, that the fermentation is very imperfectly accomplished in the Dutch process. The small quantity of yeast employed, and the short time that the wort is allowed to ferment, necessarily imply imperfection in the fermentation. And this is obviously the case, for the original strength of 45 lbs. per barrel is only reduced to 15 lbs. per barrel. We have often seen the attenuation of the porter in the London breweries not much less complete. What advantage is gained by putting the grains into the still along with the wash we have not the means of determining. Such a practice can only be followed in distilleries upon a very small scale. We do not see how it could be practised in the Scotch distilleries. Indeed, we have no doubt whatever, that when the mashing is repeated a sufficient number of times, and the grains sufficiently washed with hot water, every thing likely to contribute to the formation of spirits will be carried off.

Every person acquainted with the flavour of Hollands and Lowland whisky, must admit that the former is greatly superior to the latter. Indeed the flavour of Hollands is equal to that of malt whisky. This is owing in part to the small proportion of raw grain used by the Dutch distillers. 112 lbs. of barley malt may be reckoned at three bushels. We do not know the average weight of a bushel of rye; but if we suppose it to be 50 lbs. 228 lbs. will amount to about 4½ bushels; so that, in the Dutch distilleries, the malt bears to the raw grain the proportion of two to three. We suspect that another reason of the superiority of the Dutch spirit over the Scotch, is the small quantity of yeast employed by the manufacturers of Hollands. The vast quantity of porter yeast used by the Scotch distillers, often in a state almost approaching to putrefaction, cannot but have an injurious effect upon the flavour of their spirits, and has undoubtedly contributed to the superior reputation of Highland over Lowland whisky; for the Highland distillers (especially the smugglers) have not the means of procuring yeast from London. Of course their wash is less perfectly fermented, but the flavour of their spirits is much more agreeable. We think, indeed, that the flavour communicated by the yeast to Scotch Lowland whisky may be distinctly perceived, and on that account are disposed to suspect that the flavour of the spirits always suffers in proportion as the fermentation is brought nearer a state of perfection. Any person who should find out a method of fermenting wort without the necessity of employing such quantities of porter yeast as the distillers use, would undoubtedly prodigiously improve the flavour of the spirits manufactured by the Scotch distillers. If government were to make such an alteration in the laws as would enable the distiller to employ a greater proportion of malt without any material increase of expense, the object might be considered as accomplished. In the present state of the manufactures of Great Britain, it would be impossible to confer a greater favour on the country than a thorough revisal of the excise laws, under the auspices of a set of individuals at once intimately acquainted with the most improved state of chemical science, and with the most liberal principles of political economy. Every thing that improves the quality and diminishes the price of our manufactures is of more value to the country than our legislators seem to be aware of.

We do not think that Hollands could be manufactured in Great Britain with any probability of success. The experiment was tried at Maidstone, in Kent, by a Mr Bishop, who had interest enough with Mr Pitt to get a special clause introduced into an act of parliament permitting him to manufacture Hollands according to the Dutch method; but the manufactory was never successful. The Maidstone Hollands never acquired much reputation. The distillery languished for some years, and then terminated in a bankruptcy. Some attempts have been lately made to revive the Maidstone establishment; but we may venture to predict that they will not be successful.

2. *Rum.*

This is the name given to a spirit manufactured in the West India islands, from the molasses, &c. which remain after the sugar is separated in small crystals from the boiled juice of the sugar cane. We do not know any thing about the origin of the word *rum*, or the time at which the manufacture of this spirit commenced; not, probably, till after the West Indies were colonized by Europeans. At present it is chiefly in the islands belonging to Great Britain that this spirit is made. The process, as we obtained it from a Dominica planter, who had for many years been in the habit of making this spirit, is as follows:

Twelve parts of sweets are dissolved in 100 parts of water, and fermented as completely as possible by means of yeast, which is chiefly obtained in the distillery itself by means of the fermentation of the rum wort, which gradually generates it. Fourteen gallons of spirits, one to ten over proof, are obtained from 100 gallons of wash. If this statement be correct, the produce of spirit from molasses exceeds considerably what can be obtained in this country from barley. A solution of 12 parts of sugar in 100 of water would make a wort containing about 44 lbs. of saccharine matter per barrel; from 100 gallons of which, in this country, we would not obtain more than 8 gallons of spirits of the above strength; but we suspect some mistake on the part of our informer, as he communicated the process to us in this country several years after he had given over the actual superintendence of his rum distillery.

The peculiar flavour which distinguishes rum, and makes it so agreeable to the taste, is undoubtedly owing to a peculiar oil contained in the sugar-cane; for when spirits are made in this country from sugar, they are entirely destitute of the peculiar flavour of rum, and resemble, in their properties, the common spirit made in this country from barley. The colour of rum is derived from the oak casks in which it comes to this country from the islands in which it is made.

CHAP. III.—ON THE NATURE OF THE VINOUS FERMENTATION.

In the article BREWING we have given a short sketch of the facts hitherto ascertained respecting the nature of the change which saccharine matter undergoes when fermented; and we have very little to add to the facts stated in that article. We shall merely enter a little more minutely into the detail of facts than we thought necessary under the article BREWING.

Common sugar has been analysed by Gay-Lussac and Thenard, by Berzelius, and by Dr Prout. The method followed by each differed a little from that of the others, and the results, though they do not quite tally, certainly approach considerably to each other. The following table exhibits the composition of 100 parts of sugar, according to each of these chemists:

	Gay-Lussac and Thenard.	Berzelius.	Prout.
Oxygen	50·63	49·083	53·33
Carbon	42·47	44·115	39·99
Hydrogen	6·90	6·802	6·66
	100·00	100·000	99·99

To be able to determine from these analyses the number of atoms of oxygen, carbon, and hydrogen, which are requisite to form a constituent particle of sugar, it would be requisite, in the first place, to be able to specify the weight of sugar capable of neutralizing a given weight of any solifiable base. Berzelius found, that when a solution of a given weight of sugar in water was digested over oxide of lead, the oxide was at first dissolved; but, after a certain interval of time, a light white powder makes its appearance. This powder is a compound of sugar and oxide of lead, and is composed, according to Berzelius's analysis, of

Sugar..................41·74.........10·03
Oxide of lead.........58·26.........14

100·00

Now the equivalent number for oxide of lead is 14. It follows from this, that if the white powder be a compound of an atom of sugar and an atom of oxide of lead, the weight of an atom of sugar is 10. But we have no evidence whatever for adopting one atom of sugar in this compound rather than two. And as one atom will not accord with the phenomena of fermentation, it is better to consider the white powder as a compound of one atom oxide of lead and two atoms of sugar. On that supposition an atom of sugar will weigh about five. Now, if we suppose it to be composed of

3 atoms oxygen........... = 3·
3 atoms carbon............ = 2·25
3 atoms hydrogen......... = 0·375

5·625

the weight of an atom of sugar will be 5·625, which does not differ very much from the weight, as resulting from Berzelius's analysis; not more, indeed, than might be expected from the extreme difficulty of analysing such a compound with precision. But if we suppose the weight of an atom of sugar to be as now stated, 100 parts of it will be composed of

Oxygen..........................= 53·31
Carbon..........................= 40·03
Hydrogen.......................= 6·66

100·00

Now, as these numbers are almost exactly the same with those of Dr Prout, we are disposed to consider them as representing the true constituents of sugar.

From the phenomena of fermentation, as described under the present article, and in the article BREWING, it appears that by the fermentation the sugar is decomposed and converted into alcohol and carbonic acid. Alcohol, according to the analysis of Theodore de Saussure, is composed of three atoms hydrogen, two atoms carbon, and one atom oxygen. Carbonic acid is composed of two atoms oxygen and one atom carbon. Hence the weight of an integrant particle of alcohol is 2·875. For

1 atom oxygen.............= 1
2 atoms carbon............= 1·5
3 atoms hydrogen.........= 0·375

2·875

And an integrant particle of carbonic acid weighs 2·75.

We see likewise that a particle of sugar is capable of being decomposed into an integrant particle of alcohol and an integrant particle of carbonic acid. For a particle of alcohol is composed of

	Oxygen.	Carbon.	Hydrogen.
	1 atom	+ 2 atoms	+ 3 atoms
Carbonic acid, of...	2	+ 1	+ 0
	3	+ 3	+ 3

both together, we see, corresponding to the number of atoms in a particle of sugar.

If fermentation then be merely the separation of sugar into an atom of alcohol and an atom of carbonic acid, there ought to be formed,

Of alcohol.......................2·875
Of carbonic acid................2·75

But alcohol of 0·825 contains about the fifth of its weight of water. Hence by fermentation sugar is converted into

Alcohol of 0·825	3·45 parts, or	55·6
Carbonic acid gas	2·75	44·4
	6·20	100·0

Now these proportions approach very nearly the results obtained by Lavoisier and Thenard. We are disposed therefore to consider the explanation which we have given as likely to be the true one.

In what way the yeast acts, if no portion of it enter into the composition of the alcohol or carbonic acid, as would appear from what we know of the subject, we have no means at present of forming a conception. It would be requisite, before we could reason on the subject, to be better acquainted with the composition of yeast than we are at present. (L.)

DISTINCTION, in *Logic*, is an assemblage of two or more words, by means of which disparate things or their conceptions are denoted.

DISTORTION, in *Medicine*, is when any part of the human body remarkably deviates from its natural shape or position. Distortions of different parts may arise either from a convulsion or a palsy; though sometimes distortion in the shape of the whole body has arisen merely from carelessness and ill habits.

DISTRESS, in its ordinary acceptation, denotes calamity, misery, or suffering.

The Contemplation of DISTRESS *a source of pleasure.* On this subject there is a very pleasing and ingenious essay by Dr Barnes, in the Memoirs of the Literary and Philosophical Society of Manchester. It is introduced with the following motto from Lucretius:

> Suave mari magno, turbantibus æquora ventis,
> E terrâ alterius magnum spectare periclum.
> Non quia vexari quenquam est jucunda voluptas;
> Sed quibus ipse malis careas, quia cernere suave est.

"The pleasure here described by the poet, and of which he has mentioned so striking and apposite an instance, may perhaps at first seem of so singular and astonishing a nature, that some may be disposed to doubt of its existence. But that it does exist in the case here referred to, and in many others of a similar kind, is an undoubted fact; and it may not appear an useless or disagreeable entertainment to trace its source in the human breast, together with the final cause for which it was implanted there by our benevolent Creator.

"Shall I, it may be said, feel complacency in beholding a scene in which many of my fellow-creatures are agonizing with terror, whilst I can neither diminish their danger, nor, by my sympathy, divide their anguish? At the sight of another's woe, does not my bosom naturally feel pain? Do I not share in his sensations? And is not this strong and exquisite sensibility intended by my Maker to urge me on to active and immediate assistance? These sensations are indeed attended with a noble pleasure, when I can, by friendly attention, or by benevolent communication, soothe the sorrows of the poor mourner, snatch him from impending danger, or supply his pressing wants. But in general, where my sympathy is of no avail to the wretched sufferer, I fly from the spectacle of his misery, unable or unwilling to endure a pain which is not allayed by the sweet satisfaction of doing good."

In answer to these objections, it will be necessary, in the first place to prove the reality of the feeling, the cause of which, in the human constitution, many have attempted to explore.

Mr Addison, in his beautiful papers on the pleasures of the imagination, has observed, "that objects or scenes, which, when real, give disgust or pain, in description often become beautiful and agreeable. Thus, even a dunghill may, by the charms of poetic imagery, excite pleasure and entertainment. Scenes of this nature, dignified by apt and striking description, we regard with something of the same feelings with which we look upon a dead monster.

> ....Informe cadaver
> Protrahitur: nequeunt expleri corda tuendo
> Terribiles oculos, vultum, villosaque setis
> Pectora semiferi, atque extinctos faucibus ignes.

"This," he observes, "is more particularly the case where the description raises a ferment in the mind, and works with violence upon the passions. One would wonder," he adds, "how it comes to pass, that passions, which are very unpleasant at all other times, are very agreeable when excited by proper description; such as terror, dejection, grief, &c. This pleasure arises from the reflection we make upon ourselves, whilst reading it, that we are not in danger from them. When we read of wounds, death, &c. our pleasure does not rise so properly from the grief which these melancholy descriptions give us, as from the secret comparison we make of ourselves with those who suffer. We should not feel the same kind of pleasure if we actually saw a person lying under the tortures that we meet with in a description."

And yet, upon the principle assigned by this amiable writer, we might feel the same, or even higher pleasure, from the actual view of distress, than from any description; because the comparison of ourselves with the sufferer would be more vivid, and consequently the feeling more intense. We would only observe, that the cause which he assigns for this pleasure is the very same with that assigned by Lucretius in our motto. Mr Addison applies it to the description, the poet to the actual contemplation, of affecting scenes. In both, the pleasure is supposed to originate in selfishness. But wherever the social passions are deeply interested, as they are here supposed to be, from the pathetic description, or the still more pathetic survey, of the sufferings of another, the sympathetic feelings will of themselves at once, and previously to all reflection, become a source of agreeable and tender emotions. They will thus dignify and enhance the satisfaction, if any such be felt, arising merely from the consideration of our own personal security. And the more entirely we enter into the scene, by losing all ideas of its being either past or fabulous—the more perfectly we forget ourselves, and are absorbed in the feeling—the more exquisite is the sensation.

But as our subsequent speculations will chiefly turn upon the pleasure derived from real scenes of calamity, and not from those which are imaginary, we may be expected to produce instances in proof of the proposition that such pleasure is actually felt by persons very different in their tastes and mental cultivation.

We shall not mention the horrid joy with which the savage feasts his eyes upon the agonies and contortions of his dying prisoner, expiring in all the pains which artificial cruelty can inflict. Nor will we recur to the almost equally savage sons of ancient Rome, when the majesty of the Roman people could rush with eagerness and transport to behold hundreds of gladiators contending in fatal conflict, and probably more than half the number extended, weltering in blood and writhing in agony upon the arena. Nor will we mention the Spanish bull feasts; nor the fervent acclamations of an English mob around their fellow-creatures when engaged in furious battle, in which it is possible that some of the combatants may receive a mortal blow, and be hurried into another world. Let us survey the multitudes which in every part of the kingdom always attend an execution. It may perhaps be said, that in every place the vulgar have little of the sensibility and tenderness of more polished minds. But in the last-mentioned instance, an execution, there is no exultation in the sufferings of the poor criminal. He is regarded by every spectator with the most melting compassion. The whole assembly sympathize with him in his unhappy situation; an awful stillness prevails at the dreadful moment; many are wrung with unutterable sensations; and prayer and silence declare, more loudly than any language could, the interest they feel in his distress. Should a reprieve come to rescue him from death, how great is the general triumph and congratulation. And probably in this multitude you will find not the mere vulgar herd alone, but men of superior knowledge and of more refined sensibility, who, led by some strong principle which we wish to explain, feel a pleasure greater than all the pain, great and exquisite as one should imagine it to be, in beholding such a spectacle.

The man who condemns many of the scenes we have already mentioned as barbarous and shocking, would probably run with the greatest eagerness to some high cliff overhanging the ocean, to see it swelled into a tempest, though a poor vessel, or even a fleet of vessels, were to appear as one part of the dreadful scenery, now lifted to the heavens on the foaming surge, now plunged deep into the fathomless abyss, and now dashed upon the rocks, where they are in a moment shivered into fragments, and, with all their mariners, entombed in the deep. Or, to vary the question a little, who would not be forward to stand safe on the top of some mountain or tower, adjoining to a field of battle, in which two armies meet in desperate conflict, though probably thousands may soon lie before him prostrate on the ground, and the whole field present the most horrid scenes of carnage and desolation? That in all these cases pleasure predominates in the compounded feeling is plain, because you continue to survey the scene; whereas, when pain became the stronger sensation, you would certainly retire.

Cultivation may indeed have produced some minuter differences in the taste and feelings of different minds; and those whose sensibilities have not been refined by education or science, may feel the pleasure in a more gross and brutal form. But do not the most polished natures feel a similar, a kindred pleasure, in the deep-wrought distresses of the well-imagined scene? Here the endeavour is to introduce whatever is dreadful or pathetic, whatever can harrow up the feelings or extort the tear. And the deeper and more tragical the scene becomes, the more it agitates the several passions of terror, grief, or pity, the more intensely it delights even the most polished minds. They seem to enjoy the various and vivid emotions of contending passions. They love to have the tear trembling in the eye, and to feel the whole soul as it were rapt in thrilling sensations. For that moment they seem to forget the fiction; and afterwards commend that exhibition most in which they most entirely lost sight of the author and of their own situation, and were alive to all the unutterable vibrations of strong or melting sensibility.

Taking it then for granted, that in the contemplation of many scenes of distress, both imaginary and real, a gratification is felt, let us endeavour to account for it by mentioning some of those principles, interwoven into the web of human nature by its benevolent Creator, on which that gratification depends.

Dr Akenside, in one of the most striking passages of his *Pleasures of the Imagination*, has endeavoured to show that the sympathetic feelings are virtuous, and therefore pleasant; and from the whole he deduces this important conclusion, that every virtuous emotion must be agreeable, and that this is the sanction and the reward of virtue. The thought is amiable, and the conclusion noble; but still the solution appears to us to be imperfect. We have already said, that the pleasure arising from the contemplation of distressful scenes is a compounded feeling arising from several distinct sources in the human breast. The kind and degree of the sensation must depend upon the various blendings of the several ingredients which enter into the composition. The cause assigned by Mr Addison, namely, the sense of our own security, may be supposed to have some share in the mass of feelings. That of Dr Akenside may be allowed to have a still larger proportion. Let us attempt to trace some of the rest.

There are few principles in human nature of more general and important influence than that of sympathy. An ingenious writer, led by the fashionable idea of simplifying all the springs of human nature into one source, has, in his beautiful Theory of Moral Sentiments, endeavoured to analyze a very large number of the feelings of the heart into sympathetic vibration. Though it appears to us most probable that the human mind, like the human body, possesses various and distinct springs of action and of happiness, yet he has shown, in an amazing diversity of instances, the operation and importance of this principle of human nature.

We naturally sympathize with the passions of others. But if the passions which they appear to feel be not those of mere distress alone; if, amidst the scenes of calamity, they display fortitude, generosity, and forgiveness; if "rising superior to the cloud of ills which covers them," they stand firm, collected, and patient; a still higher source of pleasure opens upon us, arising from complacent admiration, and that unutterable sympathy which the heart feels with virtuous and heroic minds. By the operation of this principle, we place ourselves in their situation; we feel, as it were, some share of that conscious integrity and peace which they must enjoy. Hence, as was before observed, the pleasure will vary, both as to its nature and degree, according to the scene and characters before us. The shock of contending armies in the field; the ocean wrought to tempest, and covered with the wrecks of shattered vessels; and a worthy family silently yet nobly bearing up against a multitude of surrounding sorrows; will excite very different emotions, because the component parts of the pleasurable sensation consist of very different materials. They all excite admiration; but admiration diversified both as to its degree and its cause. These several ingredients may doubtless be so blended together that the pleasure shall make but a very small part of the mixed sensation. The more agreeable tints may bear little proportion to the terrifying red or the gloomy black.

In many of the instances which have been mentioned, the pleasure must arise chiefly, if not solely, from the circumstances or accompaniments of the scene. The sublime feelings excited by the view of an agitated ocean, relieve and soften those occasioned by the shipwreck: and the awe excited by the presence of thousands of men, acting as if with one soul, and displaying magnanimity and firmness in the most solemn trial, tempers those sensations of horror and of pain which would arise from a view of the field of battle.

The gratification we are attempting to account for depends also, in a very considerable degree, upon a principle of human nature, implanted in it for the wisest ends; the exercise which it gives to the mind by rousing it to energy and feeling. Nothing is so insupportable as that languor and ennui, for the full expression of which our language does not afford a proper term. To show how agreeable it is to have the soul called forth to exertion and sensibility, we may cite the case of the gamester, who, unable to endure the lassitude and sameness of unanimated luxury, runs with eagerness to the place where probably there await him all the irritation and agony of the most tumultuous passions.

Again, it is a law in our nature, that opposite passions, when felt in succession, and, above all, when felt at the same moment, heighten and increase each other. Ease succeeding pain, certainty after suspense, friendship after aversion, are unspeakably stronger than if they had not been thus contrasted. In this conflict of feelings, the mind rises from passive to active energy. It is roused to intense sensation; and it enjoys that peculiar, exquisite, and complex feeling, in which, as in many articles of our table, the acid and the sweet, the pleasurable and painful pungencies, are so happily mixed together, as to render the united sensation amazingly more strong and delightful.

We have not yet mentioned the principle of curiosity, that busy and active power, which appears so early, continues unimpaired so long, and to which, for the wisest ends, is annexed so great a sense of enjoyment. To this principle, rather than to a love of cruelty, we would ascribe that pleasure which children sometimes seem to feel from torturing flies and lesser animals. They have not yet formed an idea of the pain which they inflict. It is indeed of unspeakable consequence that this practice should be checked as soon and as effectually as possible, because it is so important that they should learn to connect the ideas of pleasure and pain with the motions and actions of the animal creation. And to this principle may we also refer no small share of that pleasure in the contemplation of distressful scenes, the springs of which, in the human heart, we are now endeavouring to unfold.

To curiosity, then, to sympathy, to mental exertion, to the idea of our own security, and to the strong feelings occasioned by viewing the actions and passions of mankind in interesting situations, do we ascribe the gratification which the mind feels from the survey of many scenes of sorrow. We have called it a *pleasure;* but it approaches towards or recedes from pleasure, according to the nature and proportion of the ingredients of which the sensation is composed. In some cases pain predominates; in others there is exquisite enjoyment.

DISTRESS, in *Law*, the seizing or distraining of any thing for rent in arrear, or other duty unperformed.

The effect of this distress is to compel the party either to replevy the things distrained, and contest the taking in an action of trespass against the distrainer; or rather to oblige him to compound and pay the debt or duty for which he was so distrained.

There are likewise compulsory distresses in actions to cause a person to appear in court, of which kind there is a distress personal of one's moveable goods, and the profits of his lands, for contempt in not appearing after summons; and there is likewise real distress of a person's immoveable goods. In these cases none shall be distrained to answer for any thing touching their freeholds, except by the king's writ.

Distress may be either finite or infinite. Finite distress is that which is limited by law, in regard to the number of times it shall be made, in order to bring the party to a trial of the action. Infinite distress is that which is without any limitation, being made till the person appear; it is further applied to jurors who do not appear; as, upon a certificate of assize, the process is *venire facias, habeas corpora*, and distress infinite.

It is also divided into grand distress and ordinary distress. Of these, the former extends to all the goods and chattels which the party has within the county. A person, of common right, may distrain for rents and for all manner of services, and where a rent is reserved on a gift in tail, lease for life, or years, &c. though there be no clause of distress in the grant or lease, so as that he has the reversion; but on a feoffment made in fee, a distress may not be taken, unless it be expressly reserved in the deed.

DISTRIBUTION, in a general sense, the act of dividing a thing into several parts, in order to the disposing each in its proper place.

Distribution, in *Architecture*, the dividing and disposing of the several parts and pieces which compose a building, as the plan directs.

Distribution, in *Rhetoric*, a kind of description, by which an orderly division and enumeration is made of the principal qualities of the subject. David supplies us with an example of this kind, when, in the heat of his indignation against sinners, he gives a description of their iniquity: "Their throat is an open sepulchre; they flatter with their tongues; the poison of asps is under their lips; their mouth is full of cursing and lies; and their feet are swift to shed blood."

Distribution, in *Printing*, the taking a form asunder, separating the letters, and disposing them in the cases again, each in its proper cell.

DISTRICT, in *Geography*, a part of a province, distinguished by peculiar magistrates, or certain privileges; in which sense it is synonymous with hundred.

DISTRINGAS, in *Law*, a writ commanding the sheriff or other officer to distrain a person for debt to the king, &c. or for his appearance at a certain day.

Distringas *Juratores*, a writ directed to the sheriff, by which he is commanded to distrain upon a jury to appear and to return issues on their lands, &c. for non-appearance. This writ of *distringas juratores* issues for the sheriff to have their bodies in court at the return of the writ.

DITCH, a common fence or inclosure in marshes, or other wet land where there are no hedges.

Ditch, in *Fortification*, called also *fosse* and *moat*, a trench dug round the rampart or wall of a fortified place between the scarp and counterscarp.

DITHYRAMBUS, in ancient poetry, a hymn in honour of Bacchus, full of transport and poetical rage.

This poetry owes its birth to Greece, and to the transports of wine; and yet art is not quite exploded, but delicately applied to guide and restrain the dithyrambic impetuosity, which is indulged only in pleasing flights. Horace and Aristotle tell us that the ancients gave the name of dithyrambus to those verses in which none of the common rules or measures were observed. As we have now no remains of the dithyrambus of the ancients, we cannot say exactly what this measure was.

DITONE, in *Music*, an interval comprehending two tones. The proportion of the sounds which form the ditone is 4 : 5, and that of the semitone is 5 : 6.

DITRIHEDRIA, in *Mineralogy*, an old term expressive of crystals with twice three sides, or six planes, being formed of two trigonal pyramids joined base to base without any intermediate prism.

DITTFURT, a market-town of the Prussian province of Saxony, situated on the river Bode, with 1797 inhabitants, who cultivate much flax, and conduct some tanneries.

DITTEAH, a town and fortress of Hindustan, in the province of Bundelcund. It is populous and well built, about a mile and a half long, and nearly as much in breadth. The houses are chiefly constructed of stone covered with tiles. It is surrounded by a stone wall, and furnished with gates. Without the town is the rajah's palace, standing on an eminence, and commanding a very extensive prospect, including a handsome lake. It is an ancient place, having been in the rajah's family for several centuries. The surrounding district yields a revenue of between L.12,000 and L.15,000 sterling per annum. On the cession of Bundelcund by the peshwa to the British in 1804, the rajah of Ditteah joined the British standard, and a treaty was concluded with him, by which he was confirmed in the possession of his ancient inheritance. Long. 78. 32. E. Lat. 25. 43. N.

DITTO, in books of accounts, usually written D°, signifies the afore mentioned. The word is corrupted from the Italian *detto*, the said; as in our law phrase, "the said premises," meaning the same as were afore mentioned.

DITTON, Humphry, an eminent mathematician, was born at Salisbury on the 29th May 1675. Being an only son, his father, observing in him an extraordinary capacity, determined to cultivate it by means of a good education. For this purpose he placed him in a reputable private academy, upon quitting which he at the desire of his father, though against his own inclination, engaged in the profession of divinity, and began to exercise his profession at Tunbridge, in the county of Kent, where he continued to preach some years, during which time he married a lady of that place.

But a weak constitution and the death of his father induced Mr Ditton to quit that profession; and at the persuasion of Dr Harris and Mr Whiston, both eminent mathematicians, he engaged in the study of mathematics, a science to which he had always a strong inclination. In the prosecution of this science he was much encouraged by the success and applause he received, being greatly esteemed by the chief professors of it, and particularly by Sir Isaac Newton, by whose interest and recommendation he was elected master of the new mathematical school in Christ's Hospital, where he continued till his death, which happened in 1715, in the fortieth year of his age.

Mr Ditton published the following mathematical and other tracts: 1. Of the Tangents of Curves, &c. *Phil. Trans.* vol. xxiii. 2. A Treatise on Spherical Catoptrics, published in the *Phil. Trans.* for 1705, from which it was copied and reprinted in the *Acta Eruditorum* 1707, and also in the Memoirs of the Academy of Sciences at Paris. 3. General Laws of Nature and Motion, 8vo, 1705. Wolfius mentions this work, and says that it illustrates and renders easy the writings of Galileo, Huygens, and the *Principia* of Newton. It is also noticed by La Roche, in the *Mémoires de Litérature*, vol. viii. p. 46. 4. An Institution of Fluxions, containing the first Principles, Operations, and Applications of that admirable method, as invented by Sir Isaac Newton, 8vo, 1706. This work, with additions and alterations, was again published by Mr John Clarke in the year 1726. 5. In 1709 he published the *Synopsis Algebraica* of John Alexander, with many additions and corrections. 6. His Treatise on Perspective was published in 1712. In this work he explained the principles of that art mathematically; and, besides teaching the methods then generally practised, gave the first hints of the new method afterwards enlarged upon and improved by Dr Brook Taylor, and which was published in the year 1715. 7. In 1714 Mr Ditton published several pieces, both theological and mathematical, particularly his Discourse on the Resurrection of Jesus Christ; and The New Law of Fluids, or a Discourse concerning the Ascent of Liquids, in exact Geometrical Figures, between two nearly contiguous Surfaces. To this was annexed a tract to demonstrate the impossibility of thinking or perception being the result of any combination of the parts of matter and motion; a subject much agitated about that time. To this work also was added an advertisement from him and Mr Whiston concerning a method for discovering the longitude, which it seems they had published about half a year before. This attempt probably cost our author his life; for although it was approved and countenanced by Sir Isaac Newton before it was presented to the Board of Longitude, and the method had been successfully put in practice in finding the longitude between Paris and Vienna, yet that board then determined against it; so that the disappointment, together with some public ridicule, particularly in a poem written by Dean Swift, affected his health so that he died in the ensuing year, 1715.

In an account of Mr Ditton, prefixed to the German translation of his Discourse on the Resurrection, it is said that he had published, in his own name only, another method for finding the longitude, but which Mr Whiston denied. However, Raphael Levi, a learned Jew, who had studied under Leibnitz, informed the German editor that he well knew that Ditton and Leibnitz had corresponded upon the subject, and that Ditton had sent to Leibnitz a delineation of a machine he had invented for that purpose, which was a piece of mechanism constructed with many wheels like a clock, and which Leibnitz highly approved of for land use, but doubted whether it would answer on board of ship, on account of the motion.

DIU, a celebrated island and fortress of Hindustan, in the province of Gujerat. It is six and a half miles long by one and a half broad, is nearly barren, and contains no good water, excepting what is collected in ponds during the rainy weather. It owes its fame to a noted Hindu temple, which rose to great celebrity, and was reckoned one of the richest places of the East. In the year 1025, Sultan Mahmood of Ghizni having overrun the province, entered the island, which is separated from the main land by a narrow strait only fordable at low water, and having taken the temple, broke the image in pieces, and found in it jewels to an incredible amount, and immense treasures also in the temple. In 1815 the Portuguese gained possession of Diu. They immediately commenced fortifying it, and in ten years rendered it impregnable against all the powers of India. It soon became a place of great trade and commerce, and was the harbour in which the fleets were laid up in winter. But with the decline of the Portuguese power it fell into decay, and was finally plundered by the Arabs of Muscat in 1670. It has since dwindled into insignificance, and has now little or no commerce. Long. 71. E. Lat. 20. 43. N.

DIVAL, in *Heraldry*, the herb nightshade, used by such as blazon by flowers and herbs, instead of colours and metals, for sable or black.

DIVALIA, in *Antiquity*, a feast held among the ancient Romans, on the 21st day of December, in honour of the goddess Angerona; whence it is called *Angeronalia.* On the day of this feast, the pontifices performed sacrifice in the temple of Voluptia, or the goddess of joy and pleasure, who, some say, was the same with Angerona, and supposed to drive away all the sorrows and chagrins of life.

DIVAN, a council chamber or court of justice amongst the eastern nations, particularly the Turks. The word is Arabic, and signifies the same with *sofa* in the Turkish dialect.

The word is also used for a hall in the private houses of the orientals. The custom of China does not allow the receiving of visits in the inner parts of the house, but only at the entry, in a divan contrived on purpose for ceremonies.

DIVANDUROW, the name of seven islands which lie about a league north of the Maldives, and twenty-four from the coast of Malabar, almost opposite to Cananor.

DIVERGENT, or DIVERGING LINES, in *Geometry*, are those which constantly recede from each other.

DIVERGENT *Rays*, in *Optics*, are those which, going from a point of the visible object, are dispersed, and continually depart one from another in proportion as they are removed from the object; in which sense it is opposed to convergent.

DIVERSIFYING, in *Rhetoric*, is of infinite service to the orator; it is an accomplishment essential to his character, and may fitly be called the subject of all his tropes and figures. Vossius lays down six ways of diversifying a subject: 1. By enlarging on what was briefly mentioned before; 2. by a concise enumeration of what had been insisted on at length; 3. by adding something new to what is repeated; 4. by repeating only the principal heads of what had been said; 5. by transposing the words and periods; 6. by imitating them.

DIVERSION, in military affairs, is when an enemy is attacked in one place where they are weak and unprovided, in order to draw off their forces from another place where they have made, or intend to make, an irruption.

DIVESTING properly signifies undressing or stripping off one's garment, in contradistinction to investing. In law it is used for the act of surrendering or relinquishing one's effects. By a contract of donation or sale, the donor or seller is said to be disseised and divested of his property in such a commodity, and the donee or purchaser becomes invested therewith. A demise is a general divestiture which the fathers and mothers make of all their effects in favour of their children.

DIVINATION, the knowledge of things obscure or future, which cannot be attained by any natural means.

It was a received opinion amongst the heathens that the gods were wont to converse familiarly with some men, whom they endowed with extraordinary powers, and admitted to the knowledge of their councils and designs. Plato, Aristotle, Plutarch, Cicero, and others, divide divination into two sorts or species, viz. natural and artificial.

The former was so called, because not attained by any rules or precepts of art, but infused or inspired into the diviner, without his taking any further care about it than to purify and prepare himself for the reception of the divine afflatus. Of this kind were all those who delivered oracles, and foretold future events by inspiration, without observing external signs or accidents.

The second species of divination was called *artificial,* because it was not obtained by immediate inspiration, but proceeded upon certain experiments and observations arbitrarily instituted, and mostly superstitious. Of this sort there were various kinds, as by sacrifices, entrails, flame, cakes, flour, wine, water, birds, lots, verses, omens, and so on.

In holy Scripture we find mention made of nine different kinds of divination. The first was performed by the inspection of planets, stars, and clouds. It is supposed to be the practisers of this whom Moses calls מעונן, *meonen,* from אנן, *anan,* cloud (Deut. chap. xviii. ver. 10). 2. Those whom the prophet calls in the same place מנחש, *menacheseh,* which the Vulgate and the generality of interpreters render *augur.* 3. Those who in the same place are called

מכשף, *mecascheph*, which the Septuagint and Vulgate translate "a man given to ill practices." 4. Such others whom Moses in the same chapter, verse 11, calls חובר, *hhober.* 5. Those who consult the spirits called *Python;* or, as Moses expresses it in the same book, אוכ אשל, "those who ask questions of Python." 6. Witches or magicians, whom Moses calls ידעני, *judeoni.* 7. Those who consult the dead, *necromancers.* 8. The prophet Hosea (chap. iv. ver. 12), mentions such as consult staves, שאל מקלי; which kind of divination may be called *rhabdomancy.* 9. The last kind of divination mentioned in Scripture is *hepatascopy*, or the consideration of the liver.

Divination of all kinds was necessarily made an occult science, which naturally remained in the hands of the priests and priestesses, the magi, the soothsayers, the augurs, the visionaries, the priests of the oracles, the false prophets, and other like professors, till the time of the coming of Jesus Christ. The light of the gospel, it is true, has dissipated much of this darkness; but it is more difficult than is commonly conceived to eradicate from the human mind a deep-rooted superstition, even though the truth be set in the strongest light, especially when the error has been believed almost from the origin of the world; so that we still find existing among us the remains of this Pagan superstition in the chimeras which enthusiastic and designing men have formed into arts and sciences, though it must be owned, to the honour of the nineteenth century, that the pure doctrines of Christianity, and the spirit of philosophy, which become every day more diffused, equally concur in banishing these visionary opinions. The vogue for these pretended sciences and arts, moreover, is past, and they can no longer be named without exciting ridicule in all sensible people. By relating them here, therefore, and drawing them from their natural obscurity, we only mean to show their futility, and to mark those rocks against which the human mind, without the assistance of a pilot, might easily split.

For the attaining these supernatural qualifications, there are still existing in the world the remains of

1. *Astrology;* a conjectural science, which teaches to judge of the effects and influences of the stars, and to predict future events by the situation of the planets and their different aspects. It is divided into *natural astrology*, or *meteorology;* which is confined to the foretelling of natural effects, as the winds, rain, hail, and snow, frosts and tempests. In this consists one branch of the art of almanack-makers; and by merely confronting these predictions in the calendar with the weather which each day produces, every man of sense will see what regard is to be paid to this part of astrology. The other part, which is called *judicial astrology*, is still more illusive and absurd than the former; and having been at first the wonderful art of visionaries, it afterwards became that of impostors; a very common fate with all those chimerical sciences of which we are here treating. This art pretends to teach the method of predicting all sorts of events which shall happen upon the earth, as well such as relate to the public as those which concern private persons; and this by the same inspection of the stars and planets, and their different constellations. The *cabbala* signifies, in like manner, the knowledge of things which are above the moon, as the celestial bodies and their influences; and in this sense it is the same with judicial astrology, or forms part of it.

2. *Horoscopy*, which may also be considered as a part of astrology, is the art of drawing a figure, or celestial scheme, containing the twelve houses, in which are marked the disposition of the heavens at a certain moment; for example, that at which a man is born, in order to foretel his fortune, or the incidents of his future life. In a word, it is the disposition of the stars and planets at the moment of any person's birth. But as there cannot be any probable or possible relation between the constellations and the human race, all the principles they lay down, and the prophecies they draw from them, are chimerical, false, absurd, and a criminal imposition on mankind.

3. The art of *augury* consisted, amongst the ancient Romans, in observing the flight, the singing, and eating of birds, especially such as were held sacred. See AUGURY.

4. The equally deceitful art of *haruspicy* consisted, on the contrary, in the inspection of the entrails of animals, but principally of victims, and from these predicting grand incidents relative to the republic, and the good or bad events of its enterprises.

5. *Aeromancy* was the art of divining by the air. This vain science has also come to us from the Pagans; but it is rejected by reason as well as Christianity, as false and absurd.

6. *Pyromancy* is a divination made by the inspection of a flame, either by observing to which side it turns, or by throwing into it some combustible matter, or a bladder filled with wine, or any thing else from which it was imagined that predictions might be drawn.

7. *Hydromancy* is the supposed art of divining by water. The Persians, according to Varro, invented this art. Pythagoras and Numa Pompilius both made use of it.

8. *Geomancy* was a divination made by observing cracks or clefts in the earth. It was also performed by points made on paper, or any other substance, at a venture; and future events were judged of from the figures which thence resulted. This was certainly very ridiculous; but it is nothing less so to pretend to predict future events by the inspection of the grounds of a dish of tea or coffee, or by cards, and many other like matters. Thus have designing men made use of the four elements to deceive their credulous brethren.

9. *Chiromancy* is the art which teaches to know, by inspecting the hand, not only the inclinations of a man, but his future destiny also. The fools or impostors who practise this art pretend that the different parts or the lines of the hand have a relation to the internal parts of the body, as some to the heart, others to the liver, spleen, &c. On this false supposition, and on many others equally extravagant, the principles of chiromancy are founded; and on which, however, several authors, as Robert Flud an Englishman, Artemidorus, M. de la Chambre, John of Indagina, and many others, have written treatises.

10. *Physiognomy*, or *physiognomancy*, is a science that pretends to teach the nature, the temperament, the understanding, and the inclinations of men, by the inspection of their countenances, and is therefore very little less frivolous than chiromancy; though Aristotle, and a number of learned men after him, have written express treatises concerning it.

DIVINE, something relating to God. The word is also used figuratively for any thing that is excellent, extraordinary, and that seems to go beyond the power of nature and the capacity of mankind.

DIVING.

Diving is the art of descending under water to considerable depths, and of remaining there some time, so as to be able to collect valuable articles, such as pearls (see Pearl Fishing), sponges, coral, and other submarine productions, from the bottom of the sea or rivers, or property from the sunken wrecks of vessels.

fficulties o diving, f m want o air in th lungs.

This art is one of great utility, but is attended with peculiar difficulties, owing to the very limited powers which man naturally possesses within the liquid element. On the surface he may no doubt continue a long time floating or swimming, and hence arises the wonderful art of navigation. But the moment he plunges within the mass he is cut off from the vital air, and life is speedily extinguished. The necessity of a constant supply of air for the support of life is shown by simply attempting to withhold it by shutting the mouth and nostrils. No one can continue holding in the breath in this manner much longer than a minute or a minute and a half. If we begin to hold after having made an expiration, we cannot do it longer than a quarter of a minute; but if we take a large inspiration, and fill the lungs, this supply is found to last longer; so that we can readily hold breath a full minute, and, with practice and great exertion, some may even continue to do so two minutes. Now this is exactly what the diver must do to remain alive under water; and accordingly we find that in general a person cannot remain longer than half a minute without the danger of suffocation, and the most practised divers not above two minutes; such is the necessity for fresh air continually present in the lungs.

cessity o ir, cause o

The nature and cause of this necessity for air has been illustrated by the discoveries of modern chemistry. These have proved that it arises from a certain chemical action which the atmosphere exerts on the blood as it passes through the lungs, and which is continually going on, and cannot for a moment be intermitted. The nature of this action is not yet exactly understood, but the object of it undoubtedly is to purify the blood, as it becomes vitiated by circulating through the system. For this purpose, the air inspired into the lungs, and coming there into contact with the blood, imparts to it its oxygen, a small portion of which is supposed to combine with the blood, and to give it renewed vigour; but by far the greater portion combines with the carbonaceous matter of the blood, and carries off this impurity in the shape of carbonic acid at each expiration. This is proved by a very simple experiment. Let a person, for instance, respire by means of a pipe into a bag or bladder of air of the capacity of a gallon or more; he will breathe freely enough at first, but in a very short time with great difficulty, and at last will feel the sense of suffocation the same as in holding the breath in the ordinary way. If the air in the bladder be now examined, it will be found to have entirely changed its nature; it will no longer support the flame of a candle, but extinguish it the moment it is immersed, thus showing the loss of oxygen. Hence arises that sense of closeness and oppression which is felt in crowded assemblies, where, as generally happens, the ventilation is imperfect. The same air being breathed again and again, becomes unfit for respiration, and produces those unpleasant sensations which are usually felt. A very curious and interesting set of experiments on respiration were made by Messrs Allen and Pepys, and narrated in the *Philosophical Transactions* for 1808. The following bears particularly on the present subject.

"Three hundred cubic inches of common air contained in one of the mercurial gasometers were respired. In less than a minute it became necessary to take deeper and deeper inspirations, and at last the efforts were so violent that the glass was in danger of being broken. A great sense of oppression and suffocation was now felt in the chest, vision became indistinct, and after the second minute the attention of the operator seemed to be withdrawn from surrounding objects, and fixed upon the experiment. A buzzing in the ears took place, as in breathing nitrous oxide; and after the third minute there was left only sufficient recollection to close the gasometer after an expiration; after which he became insensible, having made thirty-five inspirations. The expired air contained ten per cent. of carbonic acid, four of oxygen, and eighty-six of azote."

Quantity of air necessary; mode of increasing.

With 300 cubic inches of air, then, in the gasometer, the operator began to be insensible in the space of two minutes; and if we suppose that the lungs, which were in their natural state at the commencement of the operation, contained 100 cubic inches of atmospheric air, then it would follow that 200 inches each minute would be necessary to support life, so as to remain at the same time quite sensible. Hence, supposing the lungs to contain, with a full inspiration, 250 cubic inches, which is a pretty large allowance, it would follow that a man might hold breath, or remain under water, a minute and a quarter, which agrees very well with what occurs in ordinary cases. But a very curious fact has been mentioned to us by Professor Faraday of the Royal Institution, London, and was first noticed to him by a gentleman connected with the Asiatic Society, a fact which may often be of great importance, not only in diving, but in cases of fire, and of accidents in brewers' vats, &c. The lungs in their natural state are charged with a large quantity of impure air, being a portion of the carbonic acid gas which is formed during respiration, but after each expiration still remains lodging among the involved passages of the pulmonary vessels. In proof of this, it is only necessary to breathe by a small pipe, or roll of paper, into a common water bottle, throwing away the first portion of the expiration, and propelling the last into the lower parts of the vessel. Then insert this over a taper, and it will be instantly extinguished. Now, by breathing hard for a short time, as one does after taking any violent exercise, this impure air is expelled, and its place is filled up with atmospheric air. The consequence is, that if we then take a full inspiration, the breath can easily be held for two minutes. This experiment any one can make. On trying it in the ordinary way, we could hold breath for about three quarters of a minute, but this with great difficulty. We then made eight to ten forced respirations, and on closing the mouth and nostrils felt no inconvenience even on the first trial, till after a minute and a half, but continued, however, to the end of the second minute. The knowledge of this fact might be of essential use in diving, and, we have no doubt, might often be the means of saving life; for if in the ordinary way we can only remain a single minute under water, of what importance is it to be capable of doubling the time? A single minute in these cases must be invaluable. Whether the professed divers are aware of this circumstance or not, we do not know; but it is probable, at any rate, that in many cases the exertion induced by swimming may have the effect of clearing the lungs. Another curious fact illustrative of the same principles occurred to Mr Brunell in descending to examine the breach which the river had made in the Tunnel under the Thames. Having lowered the diving-bell nearly thirty feet to the mouth of the opening, this was found too narrow to admit the bell, so that no further observation could be made on the state of the Shield and other works, which were perhaps eight or ten feet deeper. Brunell, therefore, laying hold of the end of a rope, left the bell, and dived himself down the opening; his companion in the bell being alarmed at the length of his stay, now about two minutes, gave the signal for pulling up; and the diver, unprepared for the signal, had hardly time to catch hold of the rope which he had let go, and was surprised on coming up to find that so much time had elapsed. On descending again, he found that he could with ease remain fully two minutes under water. The reason evidently was, that the atmosphere in the bell being condensed by a column of water nearly thirty feet in height, contained nearly double the quantity of air in the same bulk, and thus nearly a double supply in the lungs.

Difficulty from the pressure of the water.

Besides the difficulty of holding the breath, another arises in diving, particularly at considerable depths, from the external pressure of the fluid on the chest, and on every cavity of the body. On the chest this tends to compress it together, and to expel the air out of it, and thus increases greatly the difficulty of holding the breath. At each foot of descent this pressure will increase upwards of sixty lbs. on every square foot of the body; and if we suppose the chest to expose half a square foot, we have, at the depth of fifteen feet, a force equal to the weight of 450 lbs. loading the chest, and tending to propel the included air. A very great muscular exertion, therefore, will evidently be required to resist this enormous strain; nor is it practicable, by any breastplate or other contrivance, to defend the chest from this pressure, as this, to do any good, would require to be so large, and of such strength, as greatly to obstruct the free motions of the diver. It is this pressure of the deep water, and the violent exertion necessary to overcome it, that causes, in divers who go down frequently, the eyes to become blood-shot, and brings on a spitting of blood.

Marvellous accounts of divers.

The art of diving having always in it, and particularly during the infancy of science, something of the marvellous, the most extraordinary accounts have been given, by different authors, of the feats of some of the most noted divers. The most singular of these is that given by Kircher, of the Sicilian diver *Nicolo Pesce*, taken, as he states, from the archives of the kings of Sicily.

Sicilian diver.

"In the times of Frederick king of Sicily," says Kircher, "there lived a celebrated diver, whose name was *Nicholas*, and who, from his amazing skill in swimming, and his perseverance under water, was surnamed the *fish*. This man had from his infancy been used to the sea, and earned his scanty subsistence by diving for corals and oysters, which he sold to the villagers on shore. His long acquaintance with the sea at last brought it to be almost his natural element. He was frequently known to spend five days in the midst of the waves, without any other provisions than the fish which he caught there, and ate raw. He often swam over from Sicily into Calabria, a tempestuous and dangerous passage, carrying letters from the king. He was frequently known to swim among the gulfs of the Lipari islands, noway apprehensive of danger.

"Some mariners out at sea one day observed something at some distance from them, which they regarded as a sea monster; but upon its approach it was known to be Nicholas, whom they took into their ship. When they asked him whither he was going in so stormy and rough a sea, and at such a distance from land, he showed them a packet of letters which he was carrying to one of the towns of Italy, exactly done up in a leather bag, in such a manner as that they could not be wetted by the sea. He kept them thus company for some time in their voyage, conversing and asking questions; and after eating a hearty meal with them, he took his leave, and, jumping into the sea, pursued his voyage alone.

"In order to aid these powers of enduring in the deep, nature seemed to have assisted him in a very extraordinary manner; for the spaces between his fingers and toes were webbed, as in a goose; and his chest became so very capacious that he could take in, at one inspiration, as much breath as would serve him for a whole day.

"The account of so extraordinary a person did not fail to reach the king himself, who commanded Nicholas to be brought before him. It was no easy matter to find Nicholas, who generally spent his time in the solitudes of the deep; but at last, after much searching, he was found and brought before his majesty. The curiosity of this monarch had been long excited by the accounts he had heard of the bottom of the Gulf of Charybdis; he now therefore conceived that it would be a proper opportunity to have more certain information. He therefore commanded our poor diver to examine the bottom of this dreadful whirlpool, and, as an incitement to his obedience, he ordered a golden cup to be flung into it. Nicholas was not insensible of the danger to which he was exposed, dangers best known only to himself, and therefore he presumed to remonstrate; but the hopes of the reward, the desire of pleasing the king, and the pleasure of showing his skill, at last prevailed. He instantly jumped into the gulf, and was as instantly swallowed up in its bosom. He continued for three quarters of an hour below, during which time the king and his attendants remained on shore anxious for his fate; but he at last appeared, holding the cup in triumph in one hand, and making his way good among the waves with the other. It may be supposed he was received with applause when he came on shore; the cup was made the reward of his adventure; the king ordered him to be taken proper care of; and, as he was somewhat fatigued and debilitated by his labour, after a hearty meal he was put to bed, and permitted to refresh himself by sleeping."

The diver then, according to the account, gave a narrative of the wonders he had seen, which so excited the curiosity of the monarch, that he again tempted the diver to a second and fatal descent. After plunging into the whirlpool, he was never more heard of.

Authe statem of the power divers

But to return to more authentic statements, these on the whole agree very well with the views already stated. Among the pearl divers at Ceylon and other parts of the East, instances have been known of a diver remaining six minutes under water; but these are very rare; the ordinary time seldom exceeds a minute, and sometimes it is a minute and a half, or two minutes. There are generally ten divers in each of the boats belonging to the fishery; five descend into the sea at a time, and the other five remain above to recruit their strength. In order to hasten their descent, a large stone is used, with a rope attached to it, which the diver seizes with the toes of his right foot, while he grasps a bag of net-work with those of the left. He then seizes another rope with his right hand, and keeping his nostrils shut with his left, plunges into the water, and soon reaches the bottom. Then hanging the net round his neck, he speedily collects the oysters, and resuming his former position, he makes a signal to those in the boat, and is immediately hauled up, and the stone which assisted his descent is pulled up afterwards.

The divers are all Indians, who are accustomed to this seemingly dangerous occupation from their infancy, and who fearlessly descend to the greatest depths. They will frequently make from forty to fifty plunges in a day; but the exertion is so extremely violent, that in coming up they discharge water, and sometimes blood, from their mouths, ears, and nostrils. Some of them rub their bodies with oil, and stuff their ears to prevent the water from entering; but the greater part use no precautions whatever. They take no food while in the boats, nor till they return on shore and have bathed themselves in fresh water. The only danger to which they are exposed is from meeting, while at the bottom, with the ground-shark, which is a common inhabitant of those seas, and of which the divers are under dreadful apprehensions; some of them indeed are so expert as to avoid this enemy, even when they remain under water for a considerable time; but the uncertainty of escaping is so great, that, in order to avert the danger, they consult, before they begin, their priests or conjurors, in whom they place implicit confidence.

Florida Indian divers.

Use of sponges.

Dr Halley relates, as a remarkable circumstance, that he observed a Florida Indian diver at Bermudas, who could remain two minutes under water. He states, that the divers for sponges in the Archipelago are in the practice of taking down in their mouths a piece of sponge dipped in oil, and by this are enabled to dive longer than others who have none. It is not easy to conceive how this can assist the diver's breathing; for the introduction of any foreign substance into the mouth must necessarily diminish the quantity of air he can take down. But it has been lately said that the real object of taking oil in their mouth is to calm those small waves on the surface of the sea which prevent the light being so steadily transmitted to the bottom as is necessary to enable the divers to find the small objects they search for without delay. By ejecting a little oil from their mouths, it rises to the surface, and spreading upon it, calms the waves in a most remarkable manner, and gives a brilliant light at the bottom.

South Sea divers.

Many nations, and particularly the savages in the South Sea and other islands, are remarkable for the expertness they acquire by habit in diving and moving about in the water. Being accustomed to it from their infancy, the element becomes so natural to them that they seem to have the use of all their faculties in the water the same as on the dry land. According to the accounts of voyagers, they are such expert divers, that when a nail or other piece of iron was thrown overboard, they would instantly jump into the sea after it, and never fail to recover it. On one occasion a smith's anvil is said to have fallen overboard. Not being able to bring this up, the islanders notwithstanding contrived to bring it ashore, by descending a great many times to the bottom, and rolling it over and over till it reached the land.

Apparatus for aiding the divers.

Such is the length to which diving has been carried by the natural powers of the body alone. But from the curious and difficult nature of the object, and the many important purposes to which the art might be employed, ingenious men were led to the invention of various contrivances for the use of the diver, which have greatly extended his powers and the usefulness of the art. A multitude of these contrivances of different descriptions have been brought forward by mechanical projectors for the last two hundred years. They all resolve themselves into three different kinds.

1*st*, Water-tight armour or dresses for the body, so strong as to protect it from the external pressure of the fluid; and, along with this, the means of supplying the diver with fresh air, so as to enable him to remain any time under water.

2*dly*, Water-tight vessels of metal for inclosing the diver, and of such capacity as to contain a supply of air for a limited period of perhaps half an hour or an hour or more, and giving him also the use of his hands and arms externally by a sort of flexible sleeves.

3*dly*, The diving-bell, which, from its simplicity, safety, and perfect efficiency, has now almost entirely superseded every other, though there is no doubt that in many cases these may still be of considerable utility in subservience to the bell.

Water-tight armour.

In regard to dresses or armour, a number of different plans of this kind are detailed in Leopold's *Theatrum Machinarum Hydraulicarum.* At depths of twelve or fifteen feet these may often be of essential use; but beyond this they become inapplicable, owing to the great pressure on the limbs of the diver, which must either be exposed, or covered only with a flexible material, not to impede his motions; and in that case the pressure, acting on all sides like a ligature, is liable to obstruct the circulation of the blood in the limbs, and to drive it from these into those parts of the body within the armour, causing extreme pain. In any great depth, also, the necessary strength of the armour renders it unwieldy; and it is extremely difficult, if not impracticable, to fit it tightly on every part; while the smallest opening, by admitting water, may endanger the life of the diver.

Klingert's armour.

One of the best of these contrivances is perhaps that proposed by M. Klingert, and described in a pamphlet published at Breslau in 1798. The harness or armour is made of strong tin-plate, in the form of a cylinder, with a round end to inclose the head and body, and, for the convenience of putting it on, is made in two parts, the head-piece or helmet, and the body. Besides this, there is a leather jacket, with short sleeves, and a pair of drawers of the same, which are made water-tight, buttoned on the metal part where they join, and made tight with brass hoops, going round the leather and the metal upon the outside. The chief peculiarity in this machine is the mode in which fresh air is supplied, and respiration effected. This is done by two distinct flexible pipes proceeding from the inside of the helmet to the surface of the water; the one is for inhaling the air, and terminates in an ivory mouth-piece, which the diver may embrace with his lips and inhale the air; the other enters the helmet at the same place, and opens merely into the inside of the machine, so as to allow the foul air to be discharged. The diver, therefore, draws in the fresh air by the mouth, and discharges it into the helmet by the nostrils; and from the interior of the machine it is propelled by the act of inspiration, the expansion of the chest contracting the space between it and the armour, and forcing out exactly as much air as is drawn in, keeping up always a due equilibrium. This is certainly a very ingenious arrangement; for, if there were no second pipe to discharge the air, the expansion of the chest would compress the air round the body of the diver, and, unless this were of large capacity, which would be inconvenient, would create a difficulty in the operation. The construction of the apparatus will be understood from the drawing, fig. 1, Plate CLXXXIX., which is a front view of the diver, and by the following description: A is the helmet-piece, fifteen inches in height, and the diameter adapted to the size of the body of the diver; BB is the lower part of the cylinder, of the same diameter, and of such a height as to meet the other at the dotted line C; *dd*C is the jacket, and *ff*E the drawers; these are attached to the cylinder by buttons, as seen; and *a*, *c*, *bb* are the three brass hoops fitted over each joint to make it water-tight; the hoops are made of brass-plate, with their ends turned up, and fitted with screws, by means of which they can be drawn very tight upon the leather. The cylinder has holes for the arms, one half in the upper piece and one half in the lower; and when the jacket is fastened on, it binds the upper and lower parts of the cylinder together. It is fastened at the arms with brass screw hoops, *dd*, and the drawers by similar ones at *ff*; *k h* represent the breathing pipes, the first for drawing in the air, the second for discharging it; these are united to a little metal cylinder, which screws on the helmet at the aperture *g*; this is shown more particularly at fig. 2, where a partition will be observed in the cylinder dividing the fresh air compartment from the other, the one terminating in the ivory mouth-piece *v*, the other just entering the machine at *t*. W is a small reservoir at the lower part of the pipes, for condensing any air, or receiving what may penetrate through the pipes. To resist the external pressure of the water on the limbs, the leather drawers have a framing of iron within them, represented at fig. 3; this consists of a semicircular piece *ll*, also seen at *ll*, fig. 1, extending between the legs of the diver, and fastened to the lower extremity of the cylinder at the front and back; also two irons *nn* outside the thighs, which are jointed to the cylinder, and extend down to *f*, where they are attached to a hoop surrounding the thigh; there is another hoop for each thigh farther up at *q*; these hoops are farther connected by irons, which at the upper end are fitted to slide upon the semicircular hoop, as at *t*; and by this means, though the frame-work is very strong, the diver is at liberty to walk. *ww* are weights hooked on the cylinder, to keep the diver down. P is a small pump for discharging any leakage water which may penetrate through the joints.

When the different parts of the machine have been fitted to the body of the diver, and the proper weights are attached, he enters the water till it rises as high as his eyes, while the end of the pipe is held by an assistant above the surface; and if he finds that he can breathe freely, and no water is forced into the pipe, he may venture to go deeper; and, stopping for some time, to ascertain whether respiration be not inconvenient from the want of fresh air, he may advance to still greater depths, while he makes the proper signals by means of the rope which is secured to one of his arms, or by speaking through the pipe. By this kind of exercise for some time, the diver acquires confidence and ease for conducting the necessary operations. When he is desirous of ascending he has only to unhook the weights attached to the apparatus, or to fix them to a rope let down for the purpose, that they may not be lost, and as he is then lighter than the same bulk of water, he rises to the surface.

By following these directions, any one may be able to use the apparatus, and dive to moderate depths, in a very short time. In one of the trials upon the Oder, near Breslau, the diver was a huntsman taught by the author; the water was of considerable depth, and the current strong, and there were a great number of spectators present. He sawed through the trunk of a tree which was lying at the bottom; he showed also that he could have fastened sunk bodies to a rope in order to be drawn up, and that in case any impediment should prevent the use of the saw, the trunks of trees might be hewed to pieces by an axe. On the whole, this apparatus, or one similar, might certainly be of great use in many cases, particularly in hydraulic works, where the diving-bell and the machinery connected with it might not be attainable. The water-proof cloth of Mackintosh might also be substituted with good effect for the leather.

Apparatus by Tonkin.

Another mode of supplying air to the diving apparatus has been adopted in some cases. This consists in forcing the fresh air into the machine by a bellows or pump, till its elastic force is equal to the pressure of the water. The foul air may in this case be suffered to escape into the water through a valve, or may be conducted to the surface by a pipe. Of this kind is the apparatus contrived by Mr Tonkin, and employed for some time in raising parts of the wreck of the Abergavenny East India ship, which was unfortunately lost off Weymouth in 1804. It consisted of a body of copper with iron boots, put together and jointed in the manner of coats of mail; the whole is then covered with leather, and afterwards with canvass to distinguish it under water. The arms are made of strong water-proof leather; and the place for sight is about eight inches diameter, glazed over with a plate of glass an inch thick. The diver is sunk in this machine by means of weights, fastened equatorially round the waist of it; and he is suspended by a rope, by means of which his situation is changed at pleasure. A flexible air-tube communicates with an air-vessel in the boat above. Through this tube the diver gives his instructions and obtains his supply of fresh air. This machine was used with very good effect in a depth of water of near seven fathoms, and enabled the diver to direct the operations of several curious machines, such as saws for clearing away the ship's decks, and making sufficient openings to give him access to the treasure below, as well as tongs, &c. for taking up the heavy goods by tackle in the vessel above.

Borelli diving bladde

In regard to the second kind of diving machines, that proposed by Borelli is only curious as showing the low state of physical knowledge in his time. He proposed to have a copper vessel, or vesica as he terms it, about two feet diameter, to contain the diver's head, and to be fixed to a habit of goat skin for the body. Within the vessel there were pipes contrived to produce a circulation of air, by which Borelli supposed that the objections to other diving machines from the want of air would be obviated; "the moisture," as he says, "by which it is clogged in respiration, and by which it is rendered unfit for the same use again, being taken from it by its circulation through the pipes, to the sides of which it would adhere, and leave the air as free as before." It also contained an air-pump, by means of which the diver could raise or lower the apparatus, by condensing or rarefying the air, on the principle of the air-bladder of fishes.

Leath diving chest.

Mr Martin, in his *Philosophia Britannica*, mentions an apparatus contrived by an Englishman, consisting of strong leather, so prepared that no air could pass through. It fitted to his arms and legs, and had a glass window placed in the fore part of it. When dressed in this apparatus, which was large enough to contain half a hogshead of air, he could walk on the ground at the bottom of the sea, and enter the cabin of a sunk ship to take out the goods. The inventor is said to have himself used this machine very extensively in recovering wrecks, and with such success as to have acquired considerable property by it. We are not informed of the depths to which he descended.

Kling diving chest.

Mr Klingert, the inventor of the water armour, also contrived a diving chest, of the form of a hollow cylinder, to be used along with it. This contained fifty-eight cubic feet of air, which, he estimated, would last two hours. It was suspended from a boat, but could be raised and depressed independently of this by a pump compressing or dilating the included air. Thus the ballast is so adapted to the size of the machine, as to make it sink so far that only a cubic foot of it remains above water. In this state an additional weight of a hundred pounds will depress it below the surface, or make it sink to the bottom. The effect of adding extra weights is produced by diminishing the volume of contained air, by condensing it into a smaller space. To accomplish this, a large cylinder is applied in the bottom of the vessel, and provided with a piston, which, by a rack and pinion, can be moved from one end of the cylinder to the other, when the diver turns a handle, coming through the side of the machine, and communicating motion by a worm and wheel to the pinion of the rack before mentioned. The lower end of the cylinder is open to the water, and the upper end opens within the machine; therefore, when the diver turns the handle in the direction to raise up the piston in its cylinder, it necessarily diminishes the bulk of the included air, and the machine will sink; but on depressing the piston in the cylinder, it will ascend again. The inventor proposed to furnish the machine with two small oars to move it in the water, and an anchor or grapnel to make it fast whilst the diver walks about on the bottom, within the limits of the length of the pipe, to examine sunk bodies, and discover the best mode of raising them. To prevent danger from any accident happening to the machine, the diver is to be provided with the means of quickly detaching the pipes from the machine, and retaining a sufficiency of air in the armour to carry him to the surface when he throws off the weight suspended from his girdle.

Rve's ding cht.

Another diving machine or chest was invented by Mr Rowe in 1753, and is represented in Plate CLXXXIX. fig. 4. It consists of a trunk or hollow copper vessel AB, soldered or riveted together with strength proportioned to the depth of water where it is to be fixed. It contains the diver's body, and also a sufficiency of air for the time he intends to dive. He enters with his feet first at the open end A, which is then closed by a lid or cover screwed on by a number of screw bolts passing through the flanches. The vessel is bent at F, for the bearing of the diver's knees, and has a sufficiency of leaden ballast at B to sink it in the right position. There are two hoops surrounding it, which, at the same time that they strengthen it, afford points of suspension by a bar, which is attached to them, and is pierced with several holes to admit a span upon the rope, which is so adjusted as to suspend the whole, with the diver in it, nearly in the position of the figure, when he will be in a convenient posture for working with his arms, which come through openings C in the vessel, to which sleeves E, of very strong leather, are attached by a hoop or ring, screwed to the vessel with the leather between them. The sleeves are lined with cloth, and the edges round the holes are defended by soft quilting, from hurting the diver's arms by the pressure, as well as to prevent the sleeves and his arms being thrust inwards. D is an aperture covered by a strong lens, for the diver to see through. At H and G are two other openings in the upper part of the vessel, covered by screw caps, which are removed when fresh air is to be introduced into the machine by the nose pipe of a pair of bellows being applied to force fresh air into one, and drive out the foul air at the other. The lower opening is also of use to pump out any water which may leak through at the joints, though this is as much as possible prevented by fitting leather into the joints of the cover and the caps before they are screwed tight. The mass of lead F is fastened to the lower side of the vessel in a line between the diver's arms, by means of hoops. On this the whole rests if it comes to the ground, and remains in a proper position for the diver to work, and fasten ropes to any thing which is to be drawn up, as shown in fig. 5.

If the water be very deep, the diver must wear a kind of saddle on his back, which, having a ridge touching the top part of the vessel withinside, enables him to keep his arms properly out of the apertures, otherwise he would not have strength to resist the pressure acting upon the surface of the arms and sleeves, which forces them into it with a weight proportional to the quantity of surface exposed, and to the depth of water. The diver gives his instruction to those above by a small line, which is laid through a staple at the side of the machine, and has a handle always hanging in reach of the diver's hand. The upper part of this line is held by a person in the boat or ship above, to whom any signal is given, by the diver snatching or twitching the line a certain number of times, as has before been agreed upon. This is immediately felt by the person above, who gives orders accordingly. The size of the vessel is such that he can continue at the bottom about half an hour, without any pipes or other supply, and will be enabled to do many things very readily, such as recovering moorings, chains lost in rivers or harbours, hooking ropes for weighing up lost anchors, or any other purpose where there is free access to the object sought; though in entering and searching the wrecks of ships, it would be less convenient than some others which we shall describe.

Diving machine to move under water.

Besides the above, several other projects of a similar kind have been proposed, not only with means within itself of raising and lowering the vessel, but with contrivances in the shape of screw arms for moving it when under water in any direction; but none with much success. This is said to have been tried in the reign of King James I. by a famous English projector, Cornelius Drebell, who, we are told by Mr Boyle, made a submarine vessel, which would carry twelve rowers besides the passengers; and that he had also discovered a liquid which had the singular property of restoring the air when it became impure by breathing. This last circumstance, with the number of persons inclosed in the machine, and the imperfect state of mechanics at the period alluded to, render the whole story extremely improbable, though it shows clearly that the idea had been entertained, and perhaps some attempt made. The celebrated Bishop Wilkins, in his *Mathematical Magic*, takes up the scheme of Drebell, and, with all the sanguine facilities of a projector, describes the benefits of these submarine enterprises. The submarine vessel of Mr Bushnell of Connecticut, in America, constructed in 1787, though very complex, appears to have been a curious and ingenious machine, and to have promised success if persevered in, according to the accounts published of it. It was intended to act chiefly as an engine of war, by advancing under water towards an enemy's ship, and fixing in the bottom of it a magazine of powder, which, by peculiar contrivances, was intended to take fire after the machine had got to a sufficient distance to be out of danger. But if this be the only use of such a machine, its failure need not be regretted. Let us now turn, then, to the most important of all diving machines yet contrived, namely,

THE DIVING-BELL.

General principles.

The principle of the diving-bell is extremely simple. Let any one insert a wine glass in a tumbler of water; on sinking it to the bottom, the inside of the glass will be observed to remain nearly full of air, so that any small object within the glass will remain perfectly dry, the included air being confined on all sides, and by its impenetrability excluding the water from its place. If this experiment be made with a pretty large bell-glass, inverted over a taper floating on the surface of the water in a still larger vessel, the taper will be observed to descend with the glass to the bottom; and though surrounded on all sides with water, it will be found to remain perfectly dry, and to continue burning for some time. Conceive then a vessel of wood or metal, in the shape of a wine-glass or truncated cone, but so large as, when inverted, to admit several persons within it, sitting, for instance, on a board along one of the sides. Let the whole then be suspended by a rope or chain over the side of a vessel, with a jib pulley and crane, to lower or raise the machine at pleasure. Then, on the machine being lowered and loaded with sufficient weight to sink it, the persons may all descend to a great depth in the sea, without being wetted in the smallest degree; and there is nothing to prevent them remaining any time in this situation, and moving about and doing operations at great depths.

History.

The above, then, was the original construction of the diving-bell; and the great advantage of it, and what distinguishes it above every other similar invention, and renders it vastly superior, is, that being perfectly open below, the divers can get out and in with the utmost facility. This invention, according to Professor Beckmann, is generally assigned to the sixteenth century; and "I am of opinion," says he, "that it was little known before that period. We read, however, that in the time of Aristotle divers used a kind of kettle, to enable them to continue longer under the water; but the manner in which it was employed is not clearly described. The oldest information which we have of the use of the diving-bell in Europe is that of John Taisnier, who was born in Hainault in 1509, and had a place at court under Charles V., whom he attended on his voyage to Africa. He relates in what manner he saw, at Toledo, in the presence of the emperor and several thousand spectators, two Greeks let themselves down under water, in a large inverted kettle, with a burning light, and rise up again without being wet. It appears that this art was then new to the emperor and the Spaniards, and that the Greeks were caused to make the experiment in order to prove the possibility of it."

"When the English in 1588 dispersed the Spanish fleet called the Invincible Armada, part of the ships went to the bottom, near the Isle of Mull, on the western coast of Scotland; and some of these, according to the account of the Spanish prisoners, contained great riches. This information excited, from time to time, the avarice of speculators, and gave rise to several attempts to procure part of the lost treasure. In the year 1665, a person was so fortunate as to bring up some cannon, which, however, were not sufficient to defray the expenses. Of these attempts, and the kind of diving-bell used in them, the reader will find an account in a work printed at Rotterdam in 1669, and entitled *G. Sinclari Ars nova et magna gravitatis et levitatis.* In the year 1680, William Phipps, a native of America, formed a project for searching and unloading a rich Spanish ship sunk on the coast of Hispaniola; and represented his plan in such a plausible manner, that King Charles II. gave him a ship, and furnished him with every thing necessary for the undertaking. He set sail in the year 1603; but being unsuccessful, returned again in great poverty, though with a firm conviction of the possibility of his scheme. By a subscription, promoted chiefly by the Duke of Albemarle, the son of the celebrated Monk, Phipps was enabled, in 1687, to try his fortune once more, having previously engaged to divide the profit according to the twenty shares of which the subscription consisted. At first all his labour proved fruitless; but at last, when his patience was almost entirely exhausted, he was so lucky as to bring up, from the depth of six or seven fathoms, so much treasure, that he returned to England with the value of L.200,000. Of this sum he himself got about sixteen, others say twenty thousand, and the duke ninety thousand pounds. After he came back, some persons endeavoured to persuade the king to seize both the ship and the cargo, under a pretence that Phipps, when he solicited for his majesty's permission, had not given accurate information respecting the business. But the king answered, with much greatness of mind, that he knew Phipps to be an honest man, and that he and his friends should share the whole among them, had he returned with double the value. His majesty even conferred upon him the honour of knighthood, to show how much he was satisfied with his conduct. We know not the construction of Phipps's apparatus; but of the old figures of a diving-machine, that which approaches nearest to the diving-bell is in a book on fortification by Lorini; who describes a square box bound round with iron, which is furnished with windows, and has a stool affixed to it for the diver. This ingenious contrivance appears, however, to be older than that Italian; at least he does not pretend to be the inventor of it.

"In the year 1617, Francis Kessler gave a description of his water-armour, intended also for diving, but which cannot really be used for that purpose. In the year 1671, Witsen taught, in a better manner than any of his predecessors, the construction and use of the diving-bell; but he is much mistaken when he says that it was invented at Amsterdam. In 1679 appeared, for the first time, Borelli's well-known work *De Motu Animalium;* in which he not only described the diving-bell, but also proposed another, the impracticability of which was shown by James Bernoulli. When Sturm published his *Collegium curiosum* in 1678, he proposed some hints for the improvement of this machine, on which remarks were made in the *Journal des Sçavans.*" The diving-bell, as hitherto used in the above simple form, is liable to two great defects, viz.

1. The elasticity of the included air prevents it from resisting entirely the entrance of the water into the lower part of the bell. The water, by the universal law of fluids, presses the bell on all sides, in proportion to the depth of the immersion. This pressure therefore it exerts upwards on the bottom of the bell, and against the included air; but the air being extremely compressible, yields to the pressure, and is contracted into a smaller volume, allowing the water to enter and occupy the lower portion of the bell. Such is the effect of this pressure, that at the depth of thirty-three feet the air becomes compressed into half its volume, and the bell fills half full of water; and the same proportion at every other depth. But,

2. The air within the bell, by continued respiration, becomes speedily unfit to support life; and the whole apparatus therefore must be raised from time to time, to receive a fresh supply. Suppose that only two persons descend in the bell at a time, we have seen that a supply of two hundred cubic inches of air per minute is absolutely necessary for each person to keep in life and sensibility. But in order to breathe freely, at least double that quantity would be required; say for two persons half a cubic foot per minute. If then we have a bell six feet long, and four feet average diameter, this would contain about seventy cubic feet, and would last upwards of two hours. So that for at least one hour or more respiration might be carried on with all manner of freedom.

Effect pressu

At great depths, such as twenty, thirty, forty, and sixty feet, where the usual pressure on the body from the atmosphere above is doubled and tripled, amounting in the latter case to nearly forty pounds in every square inch, one would imagine that respiration, and indeed the whole system of the body, would be deranged under so thick and confined an atmosphere. But experience proves that no great inconvenience arises from this circumstance; and the reason is, that the air pressing into every cavity within the body, as well as externally, the pressure is exactly balanced; so that the effect of the actual increase is rendered nearly insensible. The only particular sensation felt in descending in the bell is a severe pain in the ears, particularly at first. This increases a little as we descend, but, after resting at the bottom, goes entirely off. It arises from the effect of the condensed air acting externally on the tympanum of the ear, before the air within the tympanic cavity has acquired the same density to counterbalance it. The tympanum on the outside communicates directly with the atmosphere, the pressure of which therefore acts instantaneously. But on the inside the tympanum bounds

Pain i ears.

the tympanic cavity; and this has no communication with the external air, excepting by the Eustachian tube, which leads from the cavity into the mouth. Through this tube, therefore, the condensed air must pass from the mouth, to supply what is necessary within the cavity for restoring the same equilibrium within and without. But the Eustachian tube is a long and narrow passage; at its commencement in the ear it has a bony structure, but towards its termination in the mouth, behind the nostrils, it becomes soft and fleshy, so as readily to close the passage, particularly with any pressure acting externally. It admits therefore an easy passage from the ear to the mouth; but when any pressure arises in the opposite direction, it acts in some degree like a valve, shutting the passage, until the increasing pressure again forces it open. Some time then elapses before all this can be accomplished; and during this time the external air pressing with full force on the tympanum, produces the pain which is felt. When the Eustachian tube opens, it is generally all of a sudden, and with a slight explosion or pop, which is followed by instant relief from the pain. This relief may often be produced by filling the mouth, or gulping the air and pressing it into the tube.

Different accounts have been given of this effect on the ears in the diving-bell; but the above seems the most accurate, and what really takes place. The effect, indeed, may be shown experimentally by shutting the mouth and nostrils, and exhausting the air from them by the action of the lungs. The air in the tympanic cavity immediately rushing through the Eustachian tube into the mouth, the external air acts on the tympanum, and produces a slight sensation of deafness, such as is felt in the bell. But, instead of exhausting the air, attempt to compress it, and force it through the tube into the internal ear; at first no effect is produced: but after exerting a considerable pressure, a slight pop is felt, and a little pain in the ear, which is just the sudden opening of the tube.

The great inconveniences of the diving-bell already mentioned were completely removed by the labours of the celebrated and ingenious philosopher Dr Halley, who about the year 1715 introduced the grand improvement of supplying it with fresh air for any length of time without raising the bell out of the water. This he effected by letting down from the vessel from which the bell was suspended, barrels of fresh air, which, by means of pipes, discharged their contents into the bell; while the foul air escaped by a small cock in the top of the bell. In this manner the air within the bell was kept perfectly fresh, and for any length of time. Another remarkable advantage arose from this plan. The force of the air in the barrels was made to discharge the whole of the water out of the bell, which the elasticity of the included air had hitherto allowed to enter and partially to fill the cavity. This was easily done by stopping the cock at the top, and letting down the barrels below the level of the bell, by which means the air included in them received a sufficient preponderating pressure to enter the bell and drive out the water. In this manner the whole cavity of the bell became available for working; and, what was of still more importance, the diver could with ease descend and walk on the bottom of the sea, the feet being only slightly immersed. The following is the interesting account which Dr Halley gives of his arrangements:

"The bell I made use of was of wood, containing about sixty cubic feet in its concavity, and was of the form of a truncated cone, whose diameter at the top was three feet, and at the bottom five. This I coated with lead so heavy that it would sink empty; and I distributed the weight so about its bottom, that it would go down in a perpendicular direction, and no other. In the top I fixed a strong but clear glass, as a window, to let in the light from above; and likewise a cock to let out the hot air that had been breathed; and below, about a yard under the bell, I placed a stage, which hung by three ropes, each of which was charged with about one hundredweight to keep it steady. This machine I suspended from the mast of a ship by a sprit, which was sufficiently secured by stays to the mast head, and was directed by braces to carry it overboard clear of the ship's side, and to bring it again within board, as occasion required.

"To supply air to this bell when under water, I caused a couple of barrels, of about thirty-six gallons each, to be cased with lead, so as to sink empty; each of them having a bung-hole in its lowest parts to let in the water as the air in them condensed on their descent, and to let it out again when they were drawn up full from below. And to a hole in the uppermost part of these barrels I fixed a leathern trunk or hose well liquored with bees-wax and oil, and long enough to fall below the bung-hole, being kept down by a weight appended; so that the air in the upper part of the barrels could not escape, unless the lower ends of these hose were first lifted up.

"The air-barrels being thus prepared, I fitted them with tackle proper to make them rise and fall alternately, after the manner of two buckets in a well; which was done with so much ease, that two men, with less than half their strength, could perform all the labour required; and in their descent they were directed by lines fastened to the under edge of the bell, which passed through rings on both sides of the leathern hose in each barrel; so that, sliding down by these lines, they came readily to the hand of a man who stood on the stage on purpose to receive them, and to take up the ends of the hose into the bell. Through these hose, as soon as their ends came above the surface of the water in the barrels, all the air that was included in the upper parts of them was blown with great force into the bell, whilst the water entered at the bung-holes below, and filled them; and as soon as the air of one barrel had been thus received, upon a signal given, that was drawn up, and at the same time the other descended, and, by an alternate succession, furnished air so quick, and in so great plenty, that I myself have been one of five who have been together at the bottom in nine or ten fathom water, for above an hour and a half at a time, without any sort of ill consequence; and I might have continued there as long as I pleased, for any thing that appeared to the contrary. Besides, the whole cavity of the bell was kept entirely free from water, so that I sat on a bench which was diametrically placed near the bottom, wholly dressed, with all my clothes on. I only observed that it was necessary to be let down gradually at first, as about twelve feet at a time; and then to stop and drive out the air that entered, by receiving three or four barrels of fresh air before I descended further. But being arrived at the depth designed, I then let out as much of the hot air that had been breathed as each barrel would replenish with cool, by means of the cock at the top of the bell; through whose aperture, though very small, the air would rush with so much violence as to make the surface of the sea boil, and to cover it with a white foam, notwithstanding the weight of the water over us.

"Thus I found that I could do any thing that required to be done just under us; and that, by taking off the stage, I could, for a space as wide as the circuit of the bell, lay the bottom of the sea so far dry as not to be over shoes thereon. And, by the glass window, so much light was transmitted, that when the sea was clear, and especially when the sun shone, I could see perfectly well to write or read, much more to fasten or lay hold on any thing under us that was to be taken up. And, by the return of the air-barrels, I often sent up orders written with an iron pen, on small plates of lead, directing how to move us from place to place as occasion required. At other times, when the water was troubled and thick, it would be as dark as night below; but in such cases I have been able to keep a candle burning in the bell as long as I pleased, notwithstanding the great expense of air necessary to maintain flame. This I take to be an invention applicable to various uses, such as fishing for pearls, diving for coral or sponges, and the like, in far greater depths than has hitherto been thought possible. Also for the fitting and placing of the foundations of moles, bridges, &c. in rocky bottoms, and for the cleaning and scrubbing of ships' bottoms when foul, in calm weather, at sea. I shall only intimate, that by an additional contrivance, I have found it not impracticable for a diver to go out of an engine to a good distance from it, the air being conveyed to him with a continued stream, by small flexible pipes; which pipes may serve as a clue to direct him back again when he would return to the bell."

Plate CLXXXIX., fig. 5, represents the construction and operations of Dr Halley's bell as thus described.

In 1721, shortly after the above experiments were made, Dr Halley contrived additional apparatus, to enable the diver to go out from the bell to a considerable distance, and stay a sufficient time in the sea, and walk about on the bottom, with full freedom to act as occasion required. Considering that the pressure being greater on the surface of the water in the bell than on any other surface which was higher than that in the bell, the air would pass by a pipe from the bell into any cavity for air; where the surface of the water was higher, he concluded that a man, by putting on his head a bell or cap of lead, made sufficiently heavy to sink empty, and in form resembling the bell itself, might keep his head dry, and might receive a constant stream of air from the great bell, so long as the surface of the water in the cap was above the level of that in the bell, by means of a flexible pipe which he would carry coiled on his arm.

In pursuance of this idea he procured pipes to be made, which answered all that was expected from them. They were secured against the pressure of the water by a spiral brass wire, which kept them open from end to end, the diameter of the cavity being about the sixth part of an inch. These wires being coated with thin glove leather, and neatly sewed, were dipped into a mixture of hot oil and bees-wax, which, filling up the pores of the leather, made it impenetrable to water; several thicknesses of sheep's entrails were then drawn over them, which, when dry, were covered with paint, and then the whole defended with another coat of leather to keep them from fretting. Several of the pipes were as much as forty feet long, the size of a half inch rope. One end of a pipe being fixed in the bell at some height above the water, the other end was fastened to a cock which opened into the cap. The use of the cock was to stop the return of the air whenever there was occasion to stoop down or go below the surface of the air in the bell, which occurred as often as there was occasion to go out or return into the machine. The diver, therefore, when he has descended to the bottom in the great bell, puts on his cap with the pipe hanging on his arm like the coil of a rope. As soon as he leaves the bell, he opens the cock in the pipe, and walks on the bottom of the sea, giving out the coils of his pipe as it is required; and this serves as a clue to direct him back again to the great bell, from whence he derives his supply of air by means of the pipe.

The weight of a man being very little more than that of his bulk in water, he could not act with any strength, nor stand with any firmness, especially if there is any current, without a considerable addition of weight; the leaden caps were therefore made to weigh about half a hundred-weight, to which was added a girdle for the waist, formed of large weights of lead nearly of as great weight in the whole; also two clogs of lead for the feet, of about twelve pounds each. With this accession of weight Dr Halley found a man could stand well in an ordinary stream, and even go against it. It is necessary for the diver to be provided against the cold of the water, which, though it could not be removed so that a man could endure it long, yet it was much eased by wearing a waistcoat and drawers made close to the body, of that thick woollen stuff of which blankets are made. This becoming full of water, would be a little warmed by the heat of the body, and keep off the chill of new cold water coming on.

When the water is not turbid, things are seen sufficiently distinct at the bottom of the sea; but a small degree of thickness makes perfect night in a moderate depth of water. To obtain an open view from the leaden caps, which, from their use, the doctor called caps of maintenance, he at first used a plain glass before the sight, but soon found that the vapour of the breath made such a dew on the surface of the glass that it lost its transparency. To remedy this, he found it necessary to prolong that side of the cap which was before the eyes, and thereby enlarge the prospect of what was beneath.

Another plan of the diving-bell was proposed by Mr Martin Triewald, F. R. S. and military architect to the king of Sweden, which, for a single person, is in some respects thought to be more eligible than Dr Halley's, and is constructed as follows. AB, fig. 6, is the bell, which is sunk by lead weights DD hung to its bottom. This bell is of copper, and tinned all over in the inside, which is illuminated by three strong convex lenses P, with copper lids to defend them. The iron ring or plate below the bell serves the diver to stand on when he is at work, and is suspended at such a distance from the bottom of the bell by the chains, that when the diver stands upright, his head is just above the water in the bell, where the air is much better than higher up, because it is colder, and consequently more fit for respiration. But as the diver must always be within the bell, and his head of course in the upper part, the inventor has contrived, that even there, when he has breathed the hot air as well as he can, he may, by means of a spiral copper tube *bc*, placed close to the inside of the bell, draw the cooler and fresher air from the lowermost parts; for which purpose a flexible leather tube, about two feet long, is fixed to the upper end of the copper tube; and to the other end of this tube is fixed an ivory mouth-piece, by which the diver draws in the air, at the same time expiring by the nostrils. This bell may be supplied with fresh air by barrels, the same as Dr Halley's.

Spaldi
trials
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bell.

The next improvements introduced in the construction of the diving-bell were those by Mr Spalding of Edinburgh, and for which the Society of Arts voted him a reward. These are certainly deserving of attention, although they do not appear to have afterwards been adopted in practice. Mr Spalding had, in the two preceding years, acquired considerable experience in the management of a bell on Dr Halley's plan, which he had constructed in the hopes of recovering some of a considerable property which had been lost in a ship wrecked on the Scares, or Fern Islands, in 1774, in the night, when all the crew perished. Some of the light goods were thrown on shore, and it was proposed to recover the rest by diving, the remainder of the owners giving up the management of the whole to Mr Spalding. His first experiments were made in depths of five, six, and eight fathoms, in Leith Roads; and having in these made his apparatus tolerably perfect, he sailed for Dunbar, thirty miles distance, in an open long boat, sloop-rigged, and of about six or eight tons burthen. By a mistaken account he had been informed the bottom of the Fox ship of war lay there; but upon his arrival, the oldest seaman in the place could give him no intelligence; and as that vessel had perished in the night with all on board, somewhere in Dunbar Bay, and by storms, so long before as thirty years, it was thought to be sanded up. In order to gratify the curiosity of some friends there, he still determined to descend where it might be thought probable her bottom lay; but in seven and eight fathoms water he found nothing but a hard sandy bottom, from which he was led to conjecture that the proprietors of the valuable effects which were on board that vessel might have found their account in sweeping for her. Being informed that a vessel, which was thrown up by accident in the river Tay, near Dundee, with a large quantity of iron, lay within two fathoms of the surface at low water, he determined to make trial there, and accordingly sailed across the frith to that place, about fifteen leagues distant from Dunbar. Here he went down three different times, changing the ground at each going down, and at last fell in with a stump of the wreck, sunk five fathoms deep at low water to a level with the soft bed of the river, which is composed of a light sand intermixed with shells. The principal parts of this wreck were supposed to have been carried away by an immense body of ice the year before. He found that the muddiness of the river occasions a darkness at only two fathoms from the surface that cannot be described; and from the smallness of his machine, which contained only forty-eight English gallons, it was impossible to have a candle burning in it, which would consume the air too quickly for any man to be able to work, and at the same time pay attention to receiving the necessary supplies of air.

These trials were only preparatory to his views at the Scares, hoping to acquire experience which would enable him to surmount the dangerous difficulty of the unequal rocky bottom which he expected to meet with; but in the preceding trials, and different alterations of the machinery, so much time had been lost, that the weather became stormy, and he was obliged to wait at Bamborough Castle some time till the weather became more favourable. He then sailed to the Scares with his brother, three sailors, and two pilots. It was four in the afternoon, about high water, when he went down at a small distance from the place where he judged the wreck to lie. The depth was about ten fathoms. He fortunately alighted on a flat part of the rock, within a small space of a dreadful chasm, and had just gone two steps with his machine, when the terror of the two pilots was so great, that, in spite of his brother, they brought him up very precipitately, before he had in any degree examined around him. On coming into the boat, they remonstrated on the danger of the machine being overturned either on the wreck or the rocks, and also on the impossibility of raising any of the weighty goods with so small a purchase in an open boat, and in a place where, at this season, no large vessel would venture to lie, as the nights were then so long, and only two passages for a small vessel to run through, in case of a gale of easterly or southerly wind; one of the passages being extremely narrow, and both of them dangerous.

"Convinced from this," says Mr Spalding in his account, "that with an open boat nothing could be accomplished, and that, except in June and July, no man would risk himself with me in a sloop, to continue a few days and nights at anchor there, I was obliged to abandon my project; yet I determined to take a view of the guns of a Dutch ship of war lost in the year 1704; and as they lay two or three miles nearer the land, I could execute this design with less difficulty, especially as the weather continued still favourable. Having procured all the intelligence possible, we went to the place, where I went down four different times, but could find no marks of any wreck, notwithstanding my walking about in five and six fathoms water, as far as it was thought safe to allow the rope to the bell, continuing generally twenty minutes each time at the bottom. On this occasion I was obliged to carry a cutting hook and knife, and clear away the sea weeds, which at this place are very thick and strong; without this method I could not move about. At the fifth going down, each trial being in a different place, I was agreeably surprised to find a large grove of tall weeds, all of them from six to eight feet high, with large tufted tops, mostly in regular ranges, as far as the eye could reach, a variety of small lobsters and other shell-fish swimming about in the intervals." He then discovered the place where one of the cannons lay; but was too much exhausted, by having been down at intervals for near three hours, to attempt bringing it up.

In these descents Mr Spalding found out two very serious dangers attendant on the use of the bell on Dr Halley's plan. These are, 1. By Dr Halley's construction, the sinking or rising of the bell depends entirely upon the people who are at the surface of the water; and as the bell, even when in the water, has a very considerable weight, the raising of it not only requires a great deal of labour, but there is a possibility of the rope breaking by which it is raised, and thus every person in the bell would inevitably perish. 2. As there are, in many places of the sea, rocks which lie at a considerable depth, the figure of which cannot possibly be perceived from above, there is danger that some of their ragged prominences may catch hold of one of the edges of the bell in its descent, and thus overset it before any signal can be given to those above, which would infallibly be attended with the destruction of the people in the bell, especially as it must always be unknown, before trial, what kind of a bottom the sea has in any place.

Spalding's improvements.

To obviate these defects, Mr Spalding introduced a balance-weight suspended below the bell, and which, when it reached any rocky or uneven ground, settled down first, and then the bell being made too light to sink without the weight, remained suspended and free from danger; and for the purpose of raising or levelling the bell without aid from above, he divided with an air-tight partition the upper portion of the bell from the lower. The former was capable of being filled either with water or air at pleasure, and of thus increasing or diminishing the buoyant effect at pleasure, on the same principle as the air-bladder in fishes.

Plate CLXXXIX. fig. 7, represents these arrangements, which will be understood from the following description: ABCD represents a section of the bell, which is made of wood; *ee* are iron hooks, by means of which it is suspended by ropes QBF*e*, and QAER*e*, and QS, as expressed in the figure; *cc* are iron hooks, to which are appended lead weights, that keep the mouth of the bell always parallel to the surface of the water, whether the machine, taken altogether, is lighter or heavier than an equal bulk of water. By these weights alone, however, the bell would not sink; another is therefore added, represented at W, and which can be raised or lowered at pleasure by means of a rope passing over the pulley, and fastened to one of the sides of the bell at M. As the bell descends, this weight, called by Mr Spalding the *balance-weight*, hangs down a considerable way below the mouth of the bell. In case the edge of the bell is caught by any obstacle, the balance-weight is immediately lowered down, so that it may rest upon the bottom. By this means the bell is lightened, so that all danger of oversetting is removed; for, being lighter without the balance-weight than an equal bulk of water, it is evident that the bell will rise as well as the length of the rope affixed to the balance-weight will allow it. This weight, therefore, will serve as a kind of anchor, to keep the bell at any particular depth which the divers may think necessary; or, by pulling it quite up, the descent may be continued to the very bottom.

By another very ingenious contrivance, Mr Spalding rendered it possible for the divers to raise the bell, with all the weights appended to it, even to the surface, or to stop at any particular depth, as they might think proper; and thus they could still be safe, even though the rope designed for pulling up the bell was broken. For this purpose the bell is divided into two cavities, both of which are made as tight as possible. Just above the second bottom EF, are small slits in the sides of the bell, through which the water entering as the bell descends, displaces the air originally contained in this cavity, which flies out at the upper orifice of the cock GH. When this is done, the divers turn the handle G, which stops the cock; so that if any more air was to get into the cavity AEFD, it could no longer be discharged through the orifice H, as before. When this cavity is full of water, the bell sinks; but when a considerable quantity of air is admitted, it rises. If, therefore, the divers have a mind to raise themselves, they turn the small cock *g*, by which a communication is made between the upper and under cavities of the bell. The consequence of this is, that a quantity of air immediately enters the upper cavity, forces out a quantity of the water contained in it, and thus renders the bell lighter by the whole weight of the water which is displaced. Thus, if a certain quantity of air is admitted into the upper cavity, the bell will descend very slowly; if a greater quantity, it will neither ascend nor descend, but remain stationary; and if a larger quantity of air is still admitted, it will rise to the top. It is to be observed, however, that the air which is thus let out into the upper cavity must be immediately replaced from the air-barrel; and the air is to be let out very slowly, or the bell will rise to the top with so great velocity that the divers will be in danger of being shaken out of their seats. But, by following these directions, every possible accident may be prevented, and people may descend to great depths without the least apprehension of danger. The bell also becomes so easily manageable in the water, that it may be conducted from one place to another by a small boat with the greatest ease, and with perfect safety to those who are in it.

Instead of wooden seats used by Dr Halley, Mr Spalding made use of ropes suspended by hooks *bbb*, and on these ropes the divers may sit without any inconvenience. I and K are two windows made of thick strong glass, for admitting light to the divers. N represents an air-cask with its tackle, and NP the flexible pipe through which the air is admitted to the bell. In the ascent and descent of this cask the pipe is kept down by a small weight appended, as in Dr Halley's machine. F is a small cock by which the hot air is discharged as often as it becomes troublesome. Fig. 5 is a representation of the whole diving apparatus, which it is hoped will be readily understood without any further explanation. Two air-barrels are represented in this figure; but Mr Spalding was of opinion that one air barrel capable of containing thirty gallons is sufficient for an ordinary machine.

An improvement has been suggested on Mr Spalding's plan of raising or lowering the bell, by shutting up the upper bell entirely, and forming it into a magazine of condensed air, which being charged by two air-pumps within the bell, could be let off at pleasure, and filling the lower bell, would displace the water and increase the buoyancy.

Last gr improv ment ir troduct of an ai pump b Smeato

The last great improvement on the diving-bell, and what stands next in importance to that of Halley, and has brought the machine to that perfect state in which it is now so successfully employed, was introduced by the celebrated engineer Mr Smeaton. This consisted in substituting for the air-barrels of Halley a forcing air-pump, by which a continued stream of air was poured into the bell without any farther trouble or apparatus than a man or two to work the pump.

Trial a Hexha Bridge

It was about the year 1779, in the repairs of the foundations of Hexham Bridge, that Mr Smeaton first tried the use of the diving-bell; and this was the first attempt indeed to introduce it into the operations of engineering, where it has since rendered such essential service. The piers of the bridge having been undermined by the violence of the current sweeping away the gravel from under the floor timbers of the caissons by which they were founded, it occurred to Smeaton that by means of the diving-bell the cavities under the foundations might be filled up with rough stones, rammed and wedged firmly together. His diving-bell consisted of a square box or chest of wood, three and a half feet long, two feet broad, and four feet high. The pump for supplying it with air was fixed on the top of the bell, and worked by a handle at one side. The depth of the river being small, it was not intended to go down so as to cover the whole of the bell, else the air-pump would have required to be removed; it was only necessary to sink the mouth of the bell down to the level of the caisson bottom. With the assistance of this machine Mr Smeaton succeeded in underpinning the foundations of some of the piers. The calamitous accident which followed in 1782, when the whole structure was carried away by a sudden and violent flood, only proved the great insufficiency of the natural bed of the river.

Operat at Ran gate ha bour.

In 1788 Mr Smeaton constructed a second diving-bell, for the operations contemplated at Ramsgate harbour, on a much more substantial and improved plan; and this is the model on which all the succeeding diving machines have been formed. Instead of the usual form of a bell or conical inverted tub of wood, sunk by weights attached to the outside, this consisted of a square chest of cast iron, four and a half feet long, four and a half feet high, and three feet wide, affording sufficient room for two men at a time to work under it. Instead of the weights applied externally, the bell itself was cast of such thickness, particularly at the bottom, that its own weight, viz. fifty cwt., was more than sufficient to sink it when full of air. The pump also for supplying fresh air was placed in a boat by itself, on which several hands were stationed, to keep the pump continually in action. The air from the pump was conveyed to the machine by a flexible tube, which allowed the bell to be moved up or down, or in any direction, independent of the motion of the boat. From the above dimensions, the bell would always contain about fifty cubic feet of air, which, from what we have already shown, would be sufficient to support life for two persons for about an hour, independent of any supply from above; so that any idea of danger from this source is completely removed. It was in clearing the foundations for the advanced pier at Ramsgate that it occurred to Mr Smeaton the operation might be facilitated by the diving-bell. A large quantity of stones had been thrown in, to secure the old pier head; and it seemed doubtful whether they could be got up in nine and ten feet water by the usual method of tongs from the barges. The diving-bell was found to answer completely the object intended. In the course of two months the foundations were cleared; and it was computed that of 160 tons of stone raised out of the foundation, about 100 stones, many of them above a ton each, were brought up by the diving-bell, without which a full season would have been lost.

The pier, which was afterwards built on the foundation thus cleared, was founded by caissons, but in the course of years was found to require renewal in some places, and in others to be protected by an apron or outside wall of regularly-built masonry; and here a new application of the diving-bell arose in the building of this wall under water. For this purpose the bell is suspended by powerful tackle to the extremity of a long wooden frame, which rests on the top of the pier, the one end projecting over the pier, and the other running back and turning on a centre pin, which is fixed in a heavy stone on the pier. The frame thus sweeping with a long radius, and the weight of the whole being borne by a roller running along near the edge of the pier on a cast-iron plate or rail in the segment of a circle, the bell is capable of having a considerable motion right or left along the wall, and the block of the tackle being moveable along the frame, the bell is by this means shifted out or in from the wall at pleasure; and by these two motions can be set in any required position within the sweep of the apparatus. The directions for moving it are given by the divers, and communicated to those who have charge of the apparatus above, by merely striking with a hammer on the inside of the bell. From the great facility with which water conducts sound, the strokes of the hammer are heard at a great distance, and have a peculiar character, which is not easily mistaken for any other. To convey various directions, the divers have established a sort of language from the number of blows of the hammer. One blow, for instance, denotes more air; two, stand fast; three, heave up; four, lower down; and so on. The first operation in the building is to clear and level the foundation. If this be loose materials, they are removed by dredging, in the usual manner; but wherever rock occurs, it is done by the bell, with two men in it, being let down to the bottom, which, at Ramsgate, is a hard chalk rock. When it stands thereon, it lays the chalk dry to the level of the bottom edge of the bell; but if the surface is uneven, the bell cannot descend so low but that it will leave six or eight inches of water on the bottom. The surface of this water is the level they work to, and by cutting away every eminence which rises above the water, they soon obtain a perfectly level surface. They work with a small pick, made something like a narrow adze, for this purpose; and the work proceeds rapidly, for the chalk is not very hard. When they have accumulated as much rubbish as becomes inconvenient, they give three knocks on the bell to order the people to draw it up, till they, standing on the bottom, find themselves knee deep; then two knocks to stand fast. They now take in a shallow basket which has been previously let down from above, and fill the rubbish into it, then snatch it to order it to be drawn up, and strike four times on the bell, that they may be lowered down to proceed with their work. Having in this manner hewed away the surface till the water, standing equally all over it, shows it to be a perfect level plane, they give orders to be removed to a new situation, yet at such a small distance that part of the surface they before levelled is still beneath the bell, in order that both may be brought to one plane. Thus continuing the work, they get all the rock prepared for the stone-work, without any other level than the water.

The foundation being thus levelled, the stones are in the mean time all prepared and jointed, either square or with dovetails. These are first hoisted from the pier by means of a crane, and let down to their places in the work, as nearly as can be done, by the crane. As each stone is thus laid, the divers direct themselves right or left, up or down, until they be exactly over the stone; then making fast a strong chain to the lewis of the stone, the other end of which is attached to a ring in the top of the bell, they give the signal to heave, and the bell, with the stone under it, are both suspended by the tackle, and being moved right or left until it cover exactly over its place in the wall, it is then let down, and the chain being detached, the operation proceeds with another stone in the same manner, until the wall be completed. No cement is generally used to unite the stones; their own weight, and the accuracy of the joints, being sufficient to hold them together.

Diving-bell employed in other places.

Since the completion of Ramsgate harbour, the diving-bell has been applied with great success to various other operations of a similar kind in different parts of the kingdom, and particularly at Dublin, Donaghadee, and other harbours in Ireland, and at Holyhead and Portpatrick on this side the channel. Plate CLXXXVIII. contains drawings of the bell and machinery used for the harbour of Houth, near Dublin, under the direction of the late eminent Mr Rennie, and with which the foundations of the pier wall were laid with success at very considerable depths below water.

Account of bell and machinery at Houth, near Dublin.

Fig. 1 is a section showing the machine and the bell viewed in the direction of the length of the wall which is to be erected, and fig. 2 is an elevation of the same as it appears when viewed from the sea. A is the bell, which is made of cast iron. It is suspended by strong chains passed through eyes *rr*, fig. 5, and through the ring *m* of a tackle B. FF, figs. 1 and 2, are strong beams supported in a horizontal position by cross beams G, resting at one end on the shore, and the other ends supported by a scaffolding L of piles firmly braced. On the beams F two iron railways are laid for the wheels of two carriages to run upon; one of these carriages contains the tackle which suspends the bell, and the other has a similar tackle to hoist the large stones, which are to be laid on the wall X. Each carriage runs with four wheels *aa* upon the railways F, and has a smaller or upper carriage running upon it in a transverse direction; and this upper carriage contains the windlass purchase tackle, by which the bell or the stone is raised. Thus F' is the timber frame of the principal carriage, on the top of which are railways for the wheels *dd* of the upper carriage, of which D is the frame; and C is the roller or barrel to wind up the rope or fall of the great purchase tackle B, which is suspended from the frame of the carriage, and bears the weight of the bell. On the end of the barrel is a large cog-wheel M, which is turned round by a pinion fixed on the axis N of a second wheel O, and this is turned by a pinion, to which the handles H are applied. By turning these, two men can raise or lower the bell with ease. In order to move the bell in either direction, the wheels *aa* of the lower carriage E are provided with cogs at one edge, and pinions *b* work in the teeth of these; both pinions *b* are fixed on the same axis, which extends across the frame; and wheels *c* are also fixed on each extremity of the axis. These wheels have holes or mortises in them to receive handspikes or levers, by which they can be turned round, and will then move the lower carriage and the bell along the railways FF, in the direction of the length of the wall, which is to be built as shown by X. In like manner the wheels *dd* of the upper carriage are provided with cogs and pinions *e*, on the end of which are the capstan head *f* to receive handspikes, when it is required to move the upper carriage and the bell in a transverse direction. By means of these two motions in transverse directions, the bell or the stone can be suspended over any required spot in the wall, and lowered down thereupon as the men in the bell direct. Fig. 5 is a section of the bell, and fig. 6 a plan to show the apertures *nn* for the lenses which give light. Two men descend together, a seat *s* being fixed across on each side of the bell. The air-pipe is screwed on at *k*, and proceeds to the air-pump as shown in fig. 1. The pump is placed on the top of the scaffold G; it has two barrels I I, which are worked by a lever K, by one or two men; they act as forcing pumps, and the air which is thrown down escapes from the lower edge of the bell, and rises up through the water in bubbles. By this means the air in the bell is at all times quite fresh and pure.

The stones which are to be used in building the wall are prepared on shore, and fitted to each other. When all is prepared, these stones are lowered down the bank by a capstan to the position *w*. The rope of the machine is then attached, and by the aid of both ropes the stone is lowered down upon the wall. The divers then descend in the bell, and the two carriages are brought close together, by which means the bell will hang partly over the stone W, fig. 2, so that the men can guide it into its place on the wall X, and make signals to those above to direct them which way to move the stone, and where to lower it. The bell was also employed, in the first instance, to clear the foundation for the walls. It was then lowered quite down on the bottom, and the men worked the rock to a level surface. In many parts it was requisite to blast it with gunpowder. The divers bored the hole in the rock, and placed the powder in a tin cartridge, which was well secured in the hole, by running in small fragments of stone. A small tin pipe was affixed to the canister, long enough to reach up above the surface of the water. When all was prepared, the bell was drawn up out of the way, and a nail or other small piece of iron heated red hot was dropped into the tin pipe, thereby to descend to the powder.

Figures 3 and 4 represent a vessel which was fitted up under the direction of Mr Rennie, to carry a diving-bell of cast iron. This vessel was used in Plymouth Sound, and the bell was swept over the bottom to discover and take up old anchors, &c. The bell A is suspended over the bow of the vessel, by a strong tackle *q*, from the extremity of a pair of shears; that is, two masts DB, DB, fig. 4. The fall or rope of the tackle *q* is drawn up by a windlass at C. There is also another strong tackle GH, extended between the head of the mast I and the top of the shears D. This is drawn by the windlass F. The use of this is to raise the shears upright, and bring the bell on board. A platform S is fixed on the deck to lower it upon when out of use.

The diving bell has lately been employed with success in improving the navigation of the Clyde between Glasgow and Greenock, by raising up and removing out of the bed of the river a number of large stones which obstructed the channel, and could not be so readily got out by any other means. The bell is constructed similarly to that in fig. 3, but instead of being let down at the end or side of the barge, has a well constructed in the middle of the vessel itself, in which it is made to rise and fall by strong chains, tackling, and cranes. Recently a second barge and bell have been constructed, and are now employed on the river for the same purpose. The management of the vessel and bell requires six or seven hands. The whole can be moved with great facility to different parts of the river, and moored wherever their assistance is required.

Such, then, is an account of the construction and uses of the different diving machines, and particularly the diving-bell; and we have no doubt that the principle, as it is susceptible of it, may yet be still more extensively applied, and in various other ways. The only disadvantage attending the machine in its present form is the expense and cumbrous nature of the apparatus, which prevents its use in many cases where it might be of real service; so that it is only in some great and extensive public work that it can ever be thought of. It is to be hoped, therefore, that the skill and ingenuity of our mechanicians may yet succeed in introducing the machine in a more accessible and manageable form.

See Halley, *Phil. Trans.* 1716, vol. xxix. p. 492, also vol. xxxi. p. 177; Triewald, *Phil. Trans.* 1736, vol. xxxix. p. 377; Spalding, *Transactions of the Society of Arts*, vol. i. p. 220; Klingert, *Phil. Mag.* vol. iii. p. 172; Lawson, *Phil. Mag.* vol. xx. p. 362; Bushnell, *Transactions of the American Philosophical Society*, vol. iv. p. 303; *Repertory of Arts*, vol. xv. p. 383; Nicholson's *Journal*, vol. iv. p. 229; Healy, *Phil. Mag.* vol. xv. p. 9; Robertson, *Phil. Trans.* 1757, p. 30; Franklin's *Works*, letter lv.; Leopold's *Theatrum Pontific.* tom. i. ii. xxvi.; Borelli and Mersenne, in Hooke's *Phil. Collections*, No. ii. p. 36; Bachstrom's *Kunst zu schwimmen*, Berlin, 1742; Bazin, *Hamb. Mag.* i. iii. and xxi.; Gelacy, *Mém. de l'Acad. Par.* 1757; and Coulomb, *Recherches sur les moyens d'exécuter sous l'eau Travaux Hydrauliques.* (c.)

DIVINITY properly signifies the nature, quality, and essence of God.

DIVINITY is also used in the same sense with theology.

DIVISIBILITY, that property by which the particles of matter in all bodies are capable of separation or disunion from one another.

As it is evident that body is extended, so it is no less so that it is divisible; for since no two particles of matter can exist in the same place, it follows that they are really distinct from each other; which, indeed, is all that is meant by being divisible. In this sense the least conceivable particle must still be divisible, since it consists of parts which are really distinct. To illustrate this by a familiar instance, let the least imaginable piece of matter be conceived lying on a smooth plain surface; it is evident the surface will not touch it everywhere, and those parts, therefore, which it does not touch may be supposed separable from the others, and so on as far as we please. And this is all that is meant when we say that matter is infinitely divisible.

All that is supposed in strict geometry, says Mr Maclaurin, concerning the divisibility of magnitude, amounts to no more than that a given magnitude may be conceived to be divided into a number of parts equal to any given or proposed number. It is true that the number of parts into which a given magnitude may be conceived to be divided is not to be fixed or limited, because no given number is so great but a greater may be conceived and assigned; but there is not, therefore, any necessity for supposing the number of parts actually infinite; and if some have drawn very abstruse consequences from such a supposition, yet geometry ought not to be loaded with these.

How far matter is actually capable of being divided, may in some measure be conceived from this, that a piece of wire gilt with so small a quantity as eight grains of gold, may be drawn out to a length of 13,000 feet, the whole surface of it still remaining covered with gold. We have also a surprising instance of the minuteness of some parts of matter in the nature of light and vision. Let a candle be lit and placed in an open plain, it will then be visible for about two miles round; and consequently, were it placed two miles above the surface of the earth, it would fill with luminous particles a sphere four miles in diameter, and this before it had lost any sensible part of its weight.

A quantity of vitriol being dissolved, and mixed with nine thousand times as much water, will tinge the whole; consequently it will be divided into as many parts as there are visible portions of matter in that quantity of water. There are perfumes which, without a sensible diminution of their quantity, will fill a very large space with their odoriferous particles, which must therefore be of an inconceivable smallness, since there are a sufficient number in every part of that space sensibly to affect the organ of smelling. Dr Keill demonstrates, that any particle of matter, how small soever, and any finite space, how large soever, being given, it is possible for that small particle of matter to be diffused through all that space, and to fill it in such a manner as that there shall be no pore in it whose diameter shall exceed any given line.

The chief objections against the divisibility of matter *in infinitum* are, that an infinite cannot be contained by a finite; and that it follows from a divisibility *in infinitum*, either that all bodies are equal, or that one infinite is greater than another. But the answer to these objections is easy; for the properties of a determinate quantity are not to be attributed to an infinite considered in a general sense; and who has ever proved that there could not be an infinite number of infinitely small parts in a finite quantity, or that all infinites are equal? The contrary is demonstrated by mathematicians in innumerable instances.

DIVISION, in general, is the separating a thing into two or more parts.

Mechanical Division signifies that separation which is occasioned in the parts of a body by help of mechanical instruments. The mechanical division of bodies does indeed separate them into smaller, homogeneous, and similar parts; but this separation cannot extend to the primary integrant molecules of any body, and consequently it is incapable of breaking what is properly called their *aggregation;* also, no union is formed betwixt the divided and dividing bodies, in which respect division essentially differs from dissolution.

Division is not properly a chemical operation; it is, in fact, only employed preparatorily, in order to facilitate other operations, and particularly solution. For this purpose it is very useful, as it increases the quantity of surface, and consequently the points of contact, of any body. Different methods are used to divide bodies according to their nature. Those which are tenacious and elastic, as horns and gums, require to be cut, rasped, or filed. Metals, because of their ductility, require the same treatment; but as they are also fusible, they may be quickly and conveniently reduced into grains small enough for most operations, by pouring them, when melted, into water. All brittle bodies may be conveniently reduced into fine parts by being bruised in a mortar with a pestle. Very hard bodies, such as glass, crystals, and stones, particularly those of the vitrifiable kind, before they are pounded, ought to be plunged when red hot into water, by which means they are split and cracked, and rendered more easily pulverable. Bodies of this kind may also be bruised or ground by means of a hard and flat stone, upon which the matter is to be put, and bruised by another hard stone so small as to be held and moved upon the larger stone with the hand. The larger stone is called a *porphyry*, from its being generally of that kind of stone; and the operation is called *porphyrization.* Instead of porphyrization, a mill may be used, composed of a hard grit millstone, moving round upon another stone of the same kind, which must be fixed; in the upper stone is a groove or channel through which the matter to be ground passes. By this method a substance may be more quickly reduced to a fine powder than by porphyrization. But these mills can be only employed for considerable quantities of matter.

These methods of mechanically dividing bodies are attended with some practical inconveniences, the most considerable of which is, that some parts of the dividing instruments are always struck off and mixed with the matter to be divided. This may greatly affect the operations; for instruments of iron and copper furnish metallic colouring particles, and copper is very prejudicial to health. Porphyry is coloured by a reddish-brown matter, which injures the colour of crystal glasses, enamels, and porcelains made with matters ground upon this stone. These matters, therefore, must be cleansed after their porphyrization, or else no instruments capable of injuring the intended operations ought to be employed. Thus, for the preparation of all medicines to be taken internally, no copper instruments, as mortars, pestles, or the like, should be used, those made of iron being preferable; and mortars, grinding stones, and mill-stones, made of hard and white stones, ought to be employed, instead of those made of porphyry, for substances which are to enter into the composition of enamels, crystal glass, and porcelain, the whiteness of which is a most necessary quality.

Division, in *Algebra*. See Algebra.

Division, in *Arithmetic*. See Arithmetic.

Division of an Army, in the military art, two or more brigades under the command of a general of division.

Division, in sea affairs, a number of ships in a fleet or squadron of men of war, distinguished by a particular flag or pendant, and usually commanded by a general officer. A squadron is commonly ranged into three divisions, the commanding officer of which is always stationed in the centre.

DIVORCE, a breach or dissolution of the bond of marriage.

Divorce was allowed of in great latitude both amongst the Pagans and Jews. In Rome, barrenness, age, disease, madness, and banishment, were the ordinary causes of divorce. Under the consulship of M. Attilius and P. Valerius, Spurius Carvilius was the first who put away his wife because she was barren; though Plutarch, in his Roman Questions, maintains that Domitian was the first who permitted divorce. Justinian afterwards added impotence, a vow of chastity, and the profession of a monastic life, as valid reasons of divorce.

The Roman lawyers distinguish between *repudium* and *divortium;* the former being the breaking of a contract or espousal, and the latter separation after matrimony. Romulus enacted a severe law, which forbade a wife to leave her husband, but gave the husband the liberty of turning away his wife, either upon her poisoning her children, counterfeiting his private keys, or committing the crime of adultery; if the husband, however, put her away on any other occasion, he ordered one moiety of his estate to be settled on the wife, and the other to be given to the goddess Ceres, besides an atonement to the gods of the earth. In later times, however, the women as well as the men might sue a divorce. The common way of divorcing was by sending a bill to the woman, containing the reasons of separation, and the tender of all her goods which she brought with her, and this was called *repudium mittere;* or else it was performed in her presence, and before seven witnesses, accompanied with the formalities of tearing the writings, refunding the dowry, taking away the keys, and turning the woman out of doors.

The Grecian laws concerning divorce were different. The Cretans allowed divorce to any man who was afraid of having too many children. The Spartans seldom divorced their wives, and it was extremely scandalous for a woman to depart from her husband. The Athenians allowed divorce on very trivial grounds. It proceeded by a bill, containing the reason of the divorce, and approved, Divorce.

if the party appealed, by the chief magistrate; and women also were allowed to leave their husbands on just occasions. Persons divorcing their wives were obliged to return their portions, otherwise the Athenian laws obliged them to pay nine oboli a month for alimony. The terms expressing the separation of men and women from each other were different; the men were said *αποπεμπειν* or *απολυειν*, *to dismiss their wives;* but wives, *απολειπειν*, *to leave their husbands.*

" The law of Moses," observes Archdeacon Paley, " for reasons of local expediency, permitted the Jewish husband to put away his wife; but whether for every cause, or for what cause, appears to have been controverted amongst the interpreters of those times. Christ, the precepts of whose religion were calculated for more general use and observation, revokes this permission, as given to the Jews 'for their hardness of heart,' and promulgates a law which was thenceforward to confine divorces to the single cause of adultery in the wife: 'Whosoever shall put away his wife, except it be for fornication, and shall marry another, committeth adultery; and whoso marrieth her which is put away, doth commit adultery.'

" Inferior causes may justify the separation of husband and wife, although they will not authorize such a dissolution of the marriage contract as would leave either at liberty to marry again; for it is that liberty in which the danger and mischief of divorces generally consist. The law of this country, in conformity to our Saviour's injunction, confines the dissolution of the marriage contract to the single case of adultery in the wife; and a divorce even in that case can only be brought about by the operation of an act of parliament, founded upon a previous sentence in the spiritual court, and a verdict against the adulterer at common law; which proceedings taken together compose as complete an investigation of the complaint as a cause can receive. It has lately been proposed to the legislature to annex a clause to these acts, restraining the offending party from marrying with the companion of her crime, who by the course of proceeding is always known and convicted; for there is reason to fear that adulterous connections are often formed with the prospect of bringing them to this conclusion; at least, when the seducer has once captivated the affection of a married woman, he may avail himself of this tempting argument to subdue her scruples and complete his victory; and the legislature, as the business is managed at present, assists by its interposition the criminal design of the offenders, and confers a privilege where it ought to inflict a punishment. The proposal deserved an experiment; but something more penal, it is apprehended, will be found necessary to check the progress of this alarming depravity. Whether a law might not be framed, directing *the fortune of the adultress to descend as in case of her natural death;* reserving, however, a certain proportion of the produce of it, by way of annuity, for her subsistence (such annuity in no case to exceed a certain sum); and also so far suspending the estate in the hands of the heir as to preserve the inheritance to any children she might bear to a second marriage, in case there was none to succeed in the place of their mother by the first; whether such a law would not render female virtue in higher life less vincible, as well as the seducers of that virtue less urgent in their suit, I would recommend to the deliberation of those who are willing to attempt the reformation of this important but most incorrigible class of the community. A passion for splendour, for expensive amusements and distinctions, is commonly found in that description of women who would become the subject of such a law, not less inordinate than their other appetites. A severity of the kind proposed applies immediately to that passion; and there is no room for any complaint of injustice, since the provisions above stated, with others which might be contrived, confine the punishment, so far as it is possible, to the person of the offender; suffering the estate to remain to the heir, or within the family of the ancestor from whom it came, or to attend the appointments of his will.

" Sentences of the ecclesiastical courts, which release the parties *a vinculo matrimonii*, by reason of impuberty, frigidity, consanguinity within the prohibited degrees, prior marriage, or want of the requisite consent of parents or guardians, are not dissolutions of the marriage contract, but judicial declarations that there never was any marriage; such impediment subsisting at the time as rendered the celebration of the marriage rite a mere nullity. And the rite itself contains an exception of these impediments. The man and woman to be married are charged 'if they know any impediment why they may not be lawfully joined together, to confess it;' and assured, 'that so many as are coupled together, otherwise than God's word doth allow, are not joined together by God, neither is their matrimony lawful;' all which is intended by way of solemn notice to the parties, that the vow they are about to make will bind their consciences and authorize their cohabitation only upon the supposition that no legal impediment exist."

By the law of Scotland, a divorce may be obtained on the ground either of adultery or of wilful desertion; but neither of these grounds dissolves the marriage *ipso jure;* and if a process of divorce be not instituted, the marriage subsists, notwithstanding the adultery or desertion. Until recently the action of divorce proceeded before the commissaries of Edinburgh; and in every such action, whether founded on adultery or desertion, the pursuer must make oath that the action is not collusive. The legal effect of divorce on the ground of desertion is, that the offending party loses the " tocher," as it is called, and the *donationes propter nuptias;* that is, the offending husband is bound to restore the dowry, and to pay or make good to the wife all her provisions, legal or conventional; and the offending wife forfeits her dowry, and all that would have come to her had the marriage been dissolved by the predecease of her husband. It is now held that recrimination is not a good defence against divorce for adultery; yet, as the mutual guilt may affect the patrimonial interests of the parties, it may be stated in a counter-action. But *lenocinium*, or the husband's participation in the profits of his wife's prostitution, nay even the husband's connivance in her guilt, is a good defence to the wife against an action of divorce on the ground of adultery. The statute 1600, c. 20, declares marriages contracted between the adulterer and the person with whom he or she may be found, by the sentence of divorce, to have committed the crime, to be null and unlawful, and the issue of such marriages to be incapable of succeeding to their parents; but the act, nevertheless, has not the effect of bastardizing such issue. The right to institute a divorce is personal to the husband or wife; but if, after the action has been raised, either party die before the decree of divorce becomes final, it has been argued that the natural dissolution of the marriage by death supersedes and definitively closes all proceeding commenced for dissolving it on any other ground. The natural dissolution, it has been contended, is the first effectual one, and that which is to regulate all questions as to the patrimonial rights or the *status* of the survivor. But the question how far litiscontestation in such a case renders it transmissible to representatives, has not yet, we believe, been decided.

By the law of England there are two kinds of divorce, the one total and the other partial; the one *a vinculo matrimonii*, the other merely *a mensa et toro.* The total divorce must be for some of the canonical causes of impediment, and these existing *before* the marriage, not supervenient or arising afterwards; for in cases of total divorce the marriage is declared null, as having been absolutely unlawful *ab initio.* Divorce *a mensa et toro* is when the marriage is just and lawful *ab initio*, but, for some supervenient cause, as in the case of adultery in either of the parties, it becomes impossible for them to live together. But in England adultery is only a cause of separation from bed and board; because, according to the law of that country, if divorces were allowed to depend upon a matter within the power of either of the parties, they might become extremely frequent, and the stability of society might in consequence be shaken. However, divorces *a vinculo matrimonii* have latterly been frequently granted by act of parliament; though, in order to prevent such from being obtained by fraud and collusion, the two houses not only examine witnesses in order to be convinced of the adultery of the wife, but they also require that the husband shall have obtained a sentence of divorce in the spiritual courts, and a verdict with damages in a court of law against some one who has had criminal intercourse with the wife. But this is not a standing order of the House of Lords; it is merely adopted as a rule of caution, and, in particular circumstances, it may therefore be dispensed with.

In connection with this subject a most important question has arisen, and can scarcely be said to be yet determined, namely, whether an English marriage can be dissolved by a Scottish court, when the parties have come within its jurisdiction. This question has been decided in the negative by the English, and in the affirmative by the Scottish judges. The ground taken by the English courts was, that an English marriage was by its nature indissoluble, and that as the *lex loci contractus* regulates other contracts, so it ought to regulate this. But in the Scottish courts it was contended, with much apparent force, that, in such a question as this, the *lex loci* must prevail over the *lex loci contractus*, and that the principle of *comitas* between the two countries, as well as public policy, requires that this doctrine should be recognised and admitted. The question, however, being one of great difficulty and nicety, we abstain from giving any opinion in this place concerning it.

DIVUS, DIVA, in *Antiquity*, appellations given to men and women who had been deified, or placed in the number of the gods.

Hence it is that upon medals struck on the consecration of an emperor or empress, they have the title of *divus* or *diva*; thus, DIVUS JULIUS, DIVO ANTONINO PIO, DIVO PIO, DIVO CLAUDIO, DIVA FAUSTINA AUG. and so on.

DIXMUYDEN, a city, having been formerly fortified, in the province of West Flanders, and circle of Furnes. It is situated on a rich soil on the river Yser, and the butter is considered the best in Flanders. It has 2563 inhabitants.

DIZIER, ST, a city of the department of the Upper Marne, in France, on the river Marne. It is a fortified place, well built, situated in a pleasing district, and contains 816 houses, and 5640 inhabitants, some of whom find employment in building vessels from wood, which is abundant near to the city.

DJEBAIL, a town of Syria, situated on an eminence near the sea, two miles north of the river Ibrahim, which is crossed by a bridge of a single arch, fifty paces wide, and of light architecture. The Arabs established themselves here under the caliphate of Omar, and it is conjectured that the bridge was built by them. The crusaders in 1100 took possession of the town, which, after some vicissitudes, remained subject to them during their sway in the East. There was formerly a harbour, now almost obliterated. This town occupies the site of the ancient Biblos. The population is 6000.

DJEZIZA OMELMELECK, a sandy islet of the Red Sea, two miles from the Arabian shore. Here a singular bank is seen, in which all stages of petrifaction are observed in the course of a few feet from the sand. It is calcareous, and exceedingly white. The island is covered with plants. Lat. 25. 15. N.

DJIDEIDA, a town of Arabia, in the province of Hedsjaz, situated in a valley. The houses are very low, and constructed of stone without cement. It is twenty-eight leagues east-south-east from Yeuboa.

DMITRIEW, a circle in the Russian government of Kursk, bounded on the north and west by Orel, on the east by Fatesch, and on the south by Lgow. It is watered by the rivers Swapa, Usoscha, and numerous small streamlets, and is very productive of corn, potatoes, and hops. The inhabitants are about 96,000, in two cities and 138 villages, with sixty-five churches. The capital is a city of the same name, situated on the Swapa, but does not contain more than 1000 souls. Long. 35. 44. E. Lat. 52. 7. N.

DMITROW, a circle in the Russian government of Moscow, bounded on the north by Twer, on the east by Wladimir, on the south-east by Bogorodsk, on the south-west by Swenigorod, and on the west by Klin. It extends over 980 square miles, or 619,520 English acres, of which nearly one half is covered with wood. It contains 58,240 inhabitants, living in one city and in 463 villages, distributed in seventy-five parishes. The capital is a city of the same name, situated on the river Jachroma, at its junction with the Neteka. It contains 594 houses, and 2950 inhabitants, who carry on some trade by the rivers that pass near it. Long. 37. 30. E. Lat. 56. 18. N.

DMITROWSK, a circle in the Russian government of Orel, south-east from that city. It is watered by the river Narusa, and consists chiefly of good arable land, which is celebrated for its production of hemp. The capital is a city of the same name, situated on the Oscheriza, which contains 600 houses and 3400 inhabitants. It was originally a colony of Greeks, Moldavians, and Wallachians, induced to settle here by Prince Kantem, to whom the land belonged, and it was first incorporated as a city in 1778. Long. 37. 12. E. Lat. 52. 25. N.

DO, in *Music*, a note of the Italian scale, corresponding to *ut* of the common gamut. See MUSIC.

DOAB. This term in Hindustan means any tract of country included between two rivers. It should properly include all the territory between the Jumna and the Ganges; but it is usually restricted to the southern portion of it, for the most part comprehended in the province of Agra. This country is of a fertile soil, and yields a large return to the cultivator. It produces mullet, sugar cane, and barley, and is peculiarly adapted for indigo, which grows here in a wild state. Tobacco has also been introduced by the Europeans, and thrives well. The climate during the rainy season is exceedingly hot, and during the winter is only cool in the morning. The country was once in a high state of cultivation; and the remains of former prosperity are everywhere seen amidst the extensive wastes and jungles which now occupy a large portion of the surface. The tranquillity which it has enjoyed under the dominion of the British is highly favourable to its improvement. By a treaty concluded with Scindia in 1803, the forts and territories of the Doab between the Jumna and the Ganges were ceded to the British; and the southern part of the Doab was ceded in 1801 by the reigning nabob.

DOABEH BARRY is a district of Hindustan, in the province of Lahore, situated between the Beyah and Ravey rivers, and between the thirtieth and thirty-first degrees of north latitude. Doabeh Jallinder is a large district in the Darne province, between the Sutlege and Beyah rivers, and for the most part between the thirtieth and thirty-first degrees of north latitude.

DOBBERAN, a town in the duchy of Mecklenburg Schwerin, the capital of a district of the same name, which comprises two towns, three parishes, and several hamlets, with 8800 inhabitants. The town is a mile from the Baltic, and is much frequented by visitors, on account of its sulphureous natural baths, and for the advantage of sea-bathing. The reigning duke makes it his residence in the bathing season, and has constructed appropriate buildings for the accommodation of the company that resort to it. It is about six miles from Rostock. The regular residents are between 1400 and 1500, but the summer visitors more numerous.

DOBRUSHKA, or Dobruska, a town in the Austrian kingdom of Bohemia, in the circle of Königingratz, the residence of the princes Colloredo. It has much trade in corn, flax, and yarn, which are largely sold at its weekly market. It contained, in 1819, about 400 houses and 1893 inhabitants.

DOBSCHAU, a town of Hungary, in the province of Hither Theis. It is situated on the banks of the Dobsina. It is the chief place of the mining district Rosneau, in which are extracted iron, copper, cobalt, and mercury. In the neighbourhood asbestos and granite are found. It contains one Catholic and one Lutheran church, with about 500 houses and 4000 inhabitants, mostly Germans, who find employment in manufacturing the metals.

DOBSON, William, an English portrait and historical painter, born at London in 1610. He served an apprenticeship to one Peek, a stationer and picture dealer; and owed his improvement to the copying of some pictures of Titian and Vandyck, whose manner he always retained. He had further obligations to the latter of these artists; for it is said that a picture of his painting being exposed at a shop on Snow-hill, Vandyck, happening to pass by, was struck with it exceedingly, and having inquired after the author, found him at work in a poor garret. Vandyck had the generosity to equip him in a manner suitable to his merit. He presented him to King Charles I. who took him under his protection, kept him at Oxford all the time his majesty continued in that city, and not only sat to him several times for his own picture, but caused the Prince of Wales, Prince Rupert, and indeed most of the lords of his court, to do so likewise. Mr Dobson, however, being somewhat loose and irregular in his way of life, was far from improving the many opportunities he had of making his fortune, and died very poor, in 1647, at his house in St Martin's Lane.

DOBUNI, or Boduni, an ancient people of Britain, who possessed the territory which now forms the counties of Oxford and Gloucester. Both the names of this British nation seem to have been derived from the low situation of a great part of the country which they inhabited; for both *Duvn* and *Bodun* signify deep or low in the ancient language of Gaul and Britain. The Dobuni are not mentioned among the British nations who resisted the Romans under Julius Cæsar, which was probably owing to the distance of their country from the scene of action; and before the next invasion under Claudius, they had been so much oppressed by their ambitious neighbours the Cattivellauni, that they submitted with pleasure to the Romans, in order to be delivered from that oppression. Cogidunus, who was at that time prince of the Dobuni, recommended himself so effectually to the favour of the Emperor Claudius, by his ready submission, and other means, that he was not only continued in the government of his own territories, but had some other states put under his authority. This prince lived so long, and remained so steady a friend and ally to the Romans, that his subjects, being habituated to obedience in his time, never revolted, nor stood in need of many forts or forces to keep them in subjection. This is certainly the reason why we meet with so few Roman towns and stations in the country anciently inhabited by the Dobuni. The Durocornovium of Antoninus, and the Corinium of Ptolemy, are believed by antiquaries to have been the same place, namely, the capital of the Dobuni, and situated at Cirencester, in Gloucestershire, where there are still many marks of a Roman station. Clevum or Glevum, in the thirteenth *iter* of Antoninus, stood where the city of Gloucester now stands; and Abone, in the fourteenth *iter*, was probably situated at Avinton on the Severn. The country of the Dobuni was comprehended in the Roman province *Britannia Prima.*

DOCETÆ (from δωκειν, *to appear*), in *Ecclesiastical History*, the followers of Julius Cassianus, one of the Valentinian sect, towards the close of the second century, who revived a notion which had been adopted by a branch of the Gnostics, against whom St John, Ignatius, and Polycarp, had asserted the truth of the incarnation. They, as their name imports, believed and taught that the actions and sufferings of Jesus Christ were not real, but only apparent.

DOCIMASIA, or Dokimasia, in Greek antiquity, a probation of the magistrates and persons employed in public business at Athens. It was performed publicly in the forum, where they were obliged to give an account of themselves and of their past lives before certain judges. Amongst the questions proposed to them was, whether they had been dutiful to their parents, had served in the wars, and had a competent estate.

DOCIMASTIC, or Dokimastic, Art, a name given to the art of trying, by operations in small, the nature and quantity of metallic or other matters which may be obtained from mineral or other compound bodies.

DOCIMENUM Marmor, a name given by the ancients to a species of marble, of a bright and clear white, which was much used in large and sumptuous buildings, such as temples and the like. It derived its name from Docimenos, a city of Phrygia, afterwards called Synaia, near which it was quarried, and whence it was conveyed to Rome. It was accounted little inferior to the Parian in colour, but not capable of so elegant a polish; and hence it was less used by the statuaries, or in other smaller works. The Emperor Hadrian is said to have used this marble in building the temple of Jupiter; and many of the great works of the Romans are constructed of the same materials.

DOCK, in the manège, is used for a large case of leather, as long as the dock of a horse's tail, which serves it for a cover. The French call the dock *trousse-queue.* It is made fast by straps to the crupper, and has leathern thongs which pass between the thighs, and along the flanks of the animal, to the saddle straps, in order to keep the tail tight, and to prevent it from whisking about.

DOCK,

An inclosed space for the reception of ships, either for their security or for the convenience of building or giving them repairs. This word has been derived by some, absurdly enough, from the Greek δεχομαι, to receive. That we had it, along with almost the whole of our sea-terms, from the northern continental nations, is sufficiently obvious. Thus in Flemish it is *dok;* Teutonic, *dock;* Swedish, *docka;* Suio-Gothic, *docka;* perhaps originally from *dekken*, to cover, protect, secure, inclose. The *dock* for inclosing the prisoner in a court of justice is evidently from the same origin.

Docks for the reception of ships are of two kinds, *wet* and *dry*.

A *wet dock* may either have gates to retain the water in it, so that ships shall constantly remain afloat, or be left open for the tide to flow into and ebb out of it at pleasure, either leaving it dry at low water, or with a certain depth of water remaining in it, according to its construction and situation with regard to the low-water mark, and to the ebbing of the sea at spring or neap tides. A wet dock, without gates, is generally distinguished by the name of a *basin*, which, however, is sometimes indiscriminately applied to a wet dock, whether with or without gates.

A *dry dock* either becomes dry by the ebbing of the tide when the gates are left open, or by shutting the gates at low water, and pumping out whatever water may remain in it at that time, by the power of men, horses, wind, or, which is now most commonly performed in the king's dock-yards, by the steam-engine.

A *wet dock*, therefore, may be defined to be "a basin of water, in which ships may be kept afloat at all times of the tide;" a *dry dock*, a "receptacle in which every part of a ship can be examined, and its defects repaired." Ships may also be conveniently built in dry docks, and floated out by opening the gates; though, in all dock-yards, there are places set apart for this purpose, under the name of *slips*. A wet dock is called by the French *un basin;* a dry dock, *une forme;* and a slip, *un calle*.

The digging out the earth, and building the surrounding walls of masonry to prevent the sides falling in, and the preparation of the mortar and puzzolana, in the construction of a wet dock, are attended with great labour and expense. The two wet docks or basins of Cherbourg (see Breakwater), which are probably the finest specimens that exist in the world, are estimated to have cost three millions sterling. The labour of excavation may sometimes be spared, and a series of wet docks or basins conveniently made by turning the course of a tide-river through an isthmus, and placing a pair of gates at each end of the old channel. In this way were the new docks of Bristol constructed out of the bed of the Avon.

We ocks.

Wet docks are an improvement in navigation and commerce of the utmost importance, but of very modern date in this country; indeed, they owe their introduction entirely to a spirit of individual enterprise in commercial speculation. Liverpool might still have remained a poor fishing village but for its convenient docks, which not only produce to the town and corporation a large revenue, but ensure to the merchant every possible facility in refitting, loading, and discharging his ships, whatever their burden or their cargo may be, without being exposed to the risk of losing both ship and cargo in a rapid tide-river; and, at all events, to an unavoidable delay, occasioned by distance, the weather, or the state of the tides.

Hull is also greatly indebted for the extension of its commerce to its docks. Its old wet dock contains an area of ten acres nearly, and has accommodated at one time 130 sail of such vessels as frequent that port.

London, though unquestionably the first city in the world for its opulence, its commerce, and public spirit, and possessing within itself the powerful internal means of supporting docks, and all other conveniences that trade and shipping may require on the most extensive plans; London has been the last to try the experiment of docks, except in the case of two spirited individuals, Mr Perry at Blackwall, and Mr Wells at Greenland Dock, both private ship-builders. Notwithstanding the total inadequacy of legal quays, which subjected the merchants to incalculable losses and delays, and in many cases proved absolutely ruinous; notwithstanding the effect of the heavy, expensive, and fatal embarrassments experienced regularly on the arrival of the West India fleets, and the annual losses, by plunder in the river, on West India produce, which alone were calculated to amount to L.150,000 to the proprietor, and L.50,000 to the revenue, and more than the double of those sums, including other branches of commerce; it was not till the year 1799 that prejudices and private interests were so far removed as to enable the merchants concerned in the West India trade to obtain an act of parliament to carry into execution a plan of docks, quays, and warehouses, for the convenience of that trade on the Isle of Dogs. Since that time the London Docks, St Katharine Docks, and various others, have been completed, to the incalculable benefit of the shipping interest and the commerce of the metropolis.

The docks of Liverpool were the first of the kind that were constructed in this kingdom, by virtue of an act of parliament passed in 1708; and from that period the town of Liverpool has rapidly raised itself from a poor fishing village, and a port for coasting vessels, to be the second commercial town and port in the empire; and the plan of improvements now carrying into execution for the enlargement and better arrangement of the docks will, when completed, render it, for convenience and appearance, in this respect the very first, not London even excepted.

It appears from a statement, apparently authentic, that in the ten years ending with 1808, the number of ships which entered these docks was 48,497, tonnage 4,954,204; and the dock duties received L.329,566; and that, in the following ten years ending in 1818, the number of ships was 60,200, the tonnage 6,375,560, and the amount of duties L.666,438. It may also be observed, that this extraordinary increase has taken place since the abolition of the slave trade, which, it was asserted, would be the ruin of Liverpool.

The docks of Hull have also been advantageous, though in a less degree, to the wealth and prosperity of this trading town. The docks at Leith afford security and convenience to the increased commerce of the capital of Scotland.

The *West India Docks* on the river Thames commenced in February 1800, and were opened in August 1802. They consist of an outward and a homeward-bound dock, and communicate by means of locks with a basin of five or six acres on the end next to Blackwall, and with another of more than two acres at the end next to Limehouse, both of which basins communicate with the Thames. The outward-bound dock is about 870 yards in length, by 135 in width, containing consequently an area of more than twenty-four acres; the homeward-bound dock is of the same length, and 166 yards in width, its area being little short of thirty acres; and the two together will contain with ease at least 500 vessels of from 250 to 500 tons. The whole are surrounded with a high wall, and, as a security against fire, the moment that a ship enters the dock the crews are discharged, and no person whatever is allowed to remain on board, or within the premises, the gates of which are closed at a certain hour. They are surrounded by immense warehouses, which are estimated to contain nearly 10,000 hogsheads of sugar, and an immense quantity of rum. The sum authorized by parliament to be raised for completing these docks and warehouses was L.1,200,000, and the total expense was probably not far short of one million and a half; yet on this capital the subscribers have been receiving from a very short period after their opening ten per cent., which, by the terms of the act, is not to be exceeded, and the term granted is limited to twenty-one years; but, like most other property, these docks have been greatly depreciated in value, and at present barely pay eight per cent.

The next set of docks that were undertaken for the advantage of the trade of the capital was the *London Docks*. These docks are situated in Wapping, and are appropriated for the reception of all ships arriving in the port of London with wine, spirits, tobacco, and rice on board, but not exclusively, ships having on board other cargoes being admitted, on the payment of certain fees. The act of parliament for incorporating the dock company was passed in 1800, authorizing them to raise a capital of L.1,200,000; but such was the number of houses to be purchased (we believe not less than twelve hundred) occupying the site of the dock, that this capital, by subsequent acts, was extended to L.2,200,000, the dividends on which are limited, as in the West India Docks, to ten per cent. The great dock is 420 yards in length, and 230 yards in width, covering an area of twenty acres. A basin of three acres nearly connects it with the river. The warehouses are very magnificent; and the tobacco warehouse is the grandest and most spacious building of its kind in the world, being capable of containing five and twenty thousand hogsheads of tobacco, and the vaults underneath as many pipes of wine. This single building, under one roof, is said to occupy upwards of four acres of ground. These docks were opened in February 1805.

The *East India Docks*, for the exclusive reception and accommodation of the East India ships, were the last in succession. The act for the incorporation of the company was passed in July 1803, authorizing them to raise a capital of L.200,000, which was afterwards increased to L.600,000, the dividend, as in the case of the two others, to be limited to ten per cent. These docks are situated at Blackwall. That for the reception of homeward bound ships is 470 yards in length by 187 in width, containing a surface of rather more than eighteen acres; the outward-bound dock is 260 by 173 yards, and is consequently something more than nine acres. An entrance basin of three acres nearly, and a spacious lock, connect them with the Thames.

Dry docks. A dry dock, requiring to be perfectly water-tight, demands the greatest care in its construction. It is sometimes lined all round with wood, but more generally with masonry, mostly of hewn granite. The expense is very considerable, as the foundation, by means of piles or otherwise, must be well secured, all leakage prevented, and the culvers or drains properly constructed, to let in and carry off the water without its undermining the quays or piers. The cost of a complete dry dock will vary probably from L.20,000 to L.100,000, according to the size of the ships it is intended to admit, and the nature of the ground on which it is to be constructed. A dry dock may be *single*, or made to contain only one ship; or *double*, to contain two ships; but the former is the most common, because most convenient.

As it is of the utmost importance to preserve the water *in* a wet dock, and to keep it *out* of a dry dock, it may be proper to describe the different kinds of *gates* which are in use for this purpose.

The most common, and on the whole, perhaps, the best and most convenient, are swinging gates, which open in the middle, and lie flat, one part against each wharf or side-wall of the passage leading into the dock or basin. The elevation of this kind of gate is represented in Plate CCIII. fig. 3. This kind of dock gate requires to be made of great strength, with sound timber and good iron, and the gudgeons on which the hinges turn to be well secured into the stone abutments. Care also must be taken to make the bottom of the passage and the bottom of the gates perfectly plane and parallel, to prevent leakage, and give facility to their opening and shutting, which is usually assisted by rollers fixed in a groove, and performed by means of a small capstern on each pier. Attached to the top of the gates is usually a foot bridge with railing, which, separating in the middle, opens and shuts with the gates.

The most simple, but by no means the most effective contrivance for keeping out the water, is the wicket-gate, of which the plan and elevation are represented in Plate CCIII. fig. 5 and 6. It consists of three parts, which, when opened, are removed separately. This gate is rarely made use of unless where the abutments are not sufficiently strong, or their foundation sufficiently secure, to bear the weight of a pair of swinging gates.

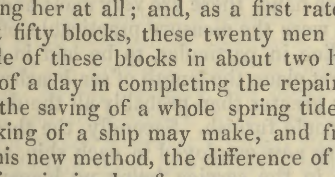
A third kind of gate consists of a floating dam or caissoon, first introduced into this country by General Bentham, and first applied to the great new basin in Portsmouth dock-yard. They are built somewhat in the shape of a Greenland fishing-boat, sharp at the two ends, narrow, and deep in proportion to the depth of water at the entrance of the dock. The keel fits into a groove at the bottom of the passage, and the two slanting ends rise and fall in corresponding grooves cut into the two abutments. Of this kind of gate, fig. 1 and 2, Plate CCIII. represent the plan and elevation. By letting in the water, the caissoon sinks in the grooves, and acts as a closed gate; and by pumping out the water, or letting it out to a certain depth, the dam floats as the tide rises, and the narrow part, rising to the top, is readily disengaged from the grooves, and easily floated away as a boat. The advantages of these floating dams, as stated by General Bentham, are, that they are cheaper of construction than the gates heretofore in use for closing docks or basins; that they occupy less space, are more easily repaired, and one and the same dam is capable of being used, as need may require, in different places at different times. These caissoons have also the advantage of serving as bridges of communication for loaded carriages across the entrances they close, and they require much less labour than gates in opening or shutting up passages into docks or basins, since their occasional buoyancy may be obtained without pumping water or unloading ballast.

Fig. 7 represents a plan, and fig. 4 a sectional elevation, of a dry or graving dock, into which ships are taken to have their defects examined and repaired, coppered, &c. and in which, if necessary, as already observed, ships may be built.

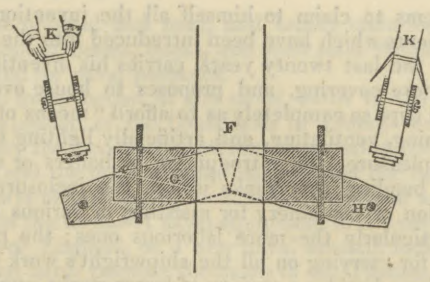
When a ship is brought into a dry or graving dock, she gradually subsides as the water flows out, till her keel rests upon the line of square blocks which are placed to receive it along the middle for the whole length; and on these blocks she is kept steady and upright by a number of shores or poles on each side, one of their ends being placed on the *altars* or steps of the dock, the other under the ship's bends and bottom. As a ship under repair generally requires something to be done to the main or false keel, or at any rate these parts require to be inspected, sometimes to shift the main keel, or to add to the whole length of the false keel, it was always found necessary in such cases to remove the blocks in order to get at the bottom of the ship; but this operation could not be performed without the more serious one of first *lifting* bodily the ship clear of all the blocks, and suspending her as it were in the air. This process was performed by driving wedges simultaneously under the ends of all the shores that supported the ship; an operation that required from four to five hundred men to enable them to suspend a ship of the first rate. When the San Josef, a large three-decker, required her bottom to be examined in 1800, the assistance of almost every artificer in the dock-yard was found necessary to perform this process of lifting her; nor was this the only inconvenience; the ship, thus suspended, suffered very material injury by the pressure of her own enormous weight against the ends of the shores that supported her, such as forcing in her sides, straining the knees and all her fastenings, breaking the treenails, &c.

To remedy these glaring inconveniences and very serious injuries that ships thus placed were apt to sustain, and to effect a saving of time and expense in the operation, Mr (now Sir Robert) Seppings, then master shipwright, and afterwards surveyor of the navy, contrived, sixteen or eighteen years ago, an improvement, as ingenious as it is simple, by which twenty men will suspend the largest ship in the navy, or rather, which amounts to the same thing, will disengage any one block that may be required, in the space of two or three minutes, without the necessity of suspending her at all; and, as a first rate in dock sits upon about fifty blocks, these twenty men will clear her of the whole of these blocks in about two hours; and as the saving of a day in completing the repairs of a ship is frequently the saving of a whole spring tide, the docking and undocking of a ship may make, and frequently has made, by this new method, the difference of a fortnight in the time of equipping her for sea.

The block of Mr Seppings, instead of being one solid piece, consists of three wedges, or, more properly speaking, of one obtuse wedge and two inclined planes, which, when put together and placed under the ship's keel, appear as under, when viewed in the direction or line of the keel,



where G is the wedge on which the keel rests, having its obtuse angle equal to 170°, and HH are the two inclined planes, each having an acute angle of 5°. The wedge is of hard wood, having its two sides lined with iron; the two inclined planes are of cast iron. When one of these blocks is to be disengaged from under a ship's bottom, nothing more is required than a few smart blows alternately on the two sides of the two inclined planes, when they fly out, and the middle part or wedge drops; and the facility of thus disengaging any of the blocks is in proportion to the quantity of pressure upon that block. The strokes are usually given by a kind of catapulta or battering-ram, being a thick spar or pole moving on a pair of wheels, as KK.



This simple contrivance to get at any part of a ship's bottom by removing in succession all the blocks, without the necessity of lifting the ship, which the removal of any one block required to be done by the old method, is now universally adopted in all the dock-yards; and the lords of the admiralty marked their sense of the great utility of the improvement, by bestowing on Mr Seppings a reward of L.1000 for the invention.

Roofing the docks.

Another very material improvement, recently introduced into his majesty's dock-yards, is that of covering the dry docks and building slips with roofs. The rapid decay of our ships of war by that species of disease known by the name of the *dry rot*, attracted very general attention; its effects were well known, but a variety of opinions were entertained as to its causes and its cure. It was quite obvious, however, that exclusion of air and moisture were the two great operating causes in giving activity to the progress of the disease (see Dry Rot); and that a ship in dock, stripped of her planking, and open to the weather in every part, alternately exposed to frost, rain, wind, and sunshine, must at least have her timbers differently affected, some swelled and water-soaked, others shrunk with heat, and others rifted with the wind and frost; and, if closed up with planking in this state, might be expected, at no great distance of time, to exhibit symptoms of decay. The workmen, too, in the open docks or slips, suffered from the vicissitudes of the weather no less than the ships, and their labour was frequently suspended, to the great detriment of the naval service. The measure of roofing over the docks and slips had long and repeatedly been suggested, but, either from prejudice or a false economy, it was only very recently carried into practice, but is now almost universal in all the yards. These roofs are generally constructed so as to be capable of having the sides and ends occasionally closed, according to the quarter from which the wind may blow; and by this contrivance the timber is prevented from rifting, as it is liable to do, by the action of a thorough draught of wind, and the health of the artificer is prevented from injury. The light is admitted through numerous windows placed in the roof. These roofs are in general supported on a row of wooden pillars, and covered with slate, some with plates of iron, and others with shingle. Plate CCIII. fig. 8, exhibits the transverse section of a roof thrown over the head of the dock at Plymouth, in which the Foudroyant is repairing; its span, from A to A, being 95 feet 4 inches, and the extreme width, from B to B, 125 feet 4 inches, supported, on the principle of trussing, without a single beam. Another of the same kind was built over the Prince Regent at Chatham, whose span was 100 feet, and the extreme width 150 feet. These immense roofs were constructed after a plan of Mr Seppings. The cost of one of the dimensions above mentioned was from L.6000 to L.7000, which, great as it may appear, must be amply repaid by the superior quality and durability of the ships built under it; but the same roof, with little or no repair, will, in all probability, serve as a covering for eight or ten different ships in succession. General Bentham, who, in his statement of *Services rendered in the Civil Department of the*

Navy, seems to claim to himself all the inventions and improvements which have been introduced into the dock-yards for the last twenty years, carries his invention beyond a mere covering, and proposes to house over the docks and slips so completely as to afford "means of heating, warming, ventilating, and artificially lighting the interior at pleasure; the introduction of boilers or steam-kilns for bending the planks within the inclosure; the introduction of machinery for assisting in various operations, particularly the more laborious ones; the providing room for carrying on all the shipwright's work within the building; besides a variety of lesser works, such as it is found very inconvenient during the building or repairing of a ship to have executed, for example, in a smith's or carpenter's shop at a distance." Such buildings would not only be enormously expensive, but, in the present crowded state of the dock-yards, utterly impracticable. With regard to the invention of covered docks and slips, they have been used in Venice from time immemorial; and it appeared, from the evidence given by Mr Strange, the consul at that port in the year 1792, before the commissioners of land revenue, that two-and-twenty large ships had been under covered slips, some of them for sixty years nearly. At Carlscrona, also, there are several covered docks, and both Mr Nicholls and Mr Snodgrass strongly recommended the building of ships under cover nearly thirty years ago.

Hauling up ships on slips.

Among other experiments which have recently been making in the dock-yards for facilitating and expediting the repairs of ships, one may be mentioned, of which many persons are sanguine enough to think that the successful result is likely to be attended with most important benefits to the naval service. It is that of hauling up ships of war, of any dimensions, on building slips, instead of taking them into docks. It is no uncommon practice, at various ports of this kingdom, where there are neither artificial basins nor natural harbours, to haul vessels of the burden of fifty to two hundred tons, or probably larger, upon the beach, by means of capstans, to give them repairs; in like manner, most of the large fishing smacks are hauled up for security in tempestuous weather; but the practicability of hauling up ships of war, especially of the larger classes, was a matter of some doubt. Several frigates had, at various times, been hauled upon slips, when the docks were all occupied; and the ease with which the operation was performed induced the officers of the dock-yard to propose the hauling up of a line-of-battle ship. The Kent, of 74 guns, was selected for this purpose. It was necessary, in the first place, to take her into a dock, to have proper bilgeways prepared, and to be stripped, so as to be made as light as possible, her weight being, according to a calculation made from the water she displaced when afloat, about fourteen hundred tons. To heave up this weight fourteen capstans were employed, and the number of men to work these were as under:

Nine men to each bar and swifter	1512
Eight men to hold on at each	112
Three men to each capstan, to attend the fall	42
Men on board the ship, and employed in other operations	450
Total of men employed	2116

The time occupied in hauling her up, after all the purchases were brought to bear, was forty minutes. The expense of preparing her, and the loss and wear and tear of the materials, was estimated at somewhere about L.2000.

The advantages which slips are supposed to possess over dry docks are many and important. They can be constructed at one twentieth part of the expense; they occupy less space; they can be constructed on a steep or a shelving shore; and ships can be hauled upon them either in spring or neap tides; whereas a dry dock can only be made in particular situations, and, when made, ships can only be docked and undocked in certain states of the tides; from which circumstance a considerable delay and inconvenience are frequently experienced. It should be recollected, however, that a large ship must necessarily go into a dock preparatory to her being hauled up on a slip.

It has been considered as not at all impossible, as was suggested some time ago by Mr Perring, the ingenious clerk of the check in Plymouth dock-yard, that the whole ordinary may hereafter be laid up on slips, which, if housed over, would unquestionably be the best means of increasing their durability, and preserving them from partial decay. Nor is it certain that in the end it would not be the most economical mode of preserving them. The expense, as appears from the *Estimates of the Ordinary of the Navy* for the year 1817, is L.187,000 for harbour victuals, harbour moorings and riggings, &c. besides L.135,000 for wages; the chief part of both which sums is on account of ships of war laid up in ordinary, none of which would be required by placing them on slips. It would indeed form a singular revolution in naval management, if ships hereafter should be laid up in ordinary on dry land, whilst the timber of which they are built is now considered to be the best preserved under salt water; a process which, from some experiments recently made, promises fair to be the most effectual prevention of, and a probable cure for, the dry rot. (See DRY ROT). This method of preserving timber has long been practised at Brest, Carthagena, and several other places on the Continent; and the only objection to it in some of our ports appears to be the attack of the worm known to naturalists by the name of *teredo navalis*, whose bite is almost as destructive as the dry rot.

On the other hand, there are very many and serious objections, even were the measure practicable, of hauling up ships of the line in particular, to be laid in ordinary on slips. In the first place, the length of sea-beach which would be required is greater than probably all the dock-yards in the kingdom could furnish. Secondly, the three warrant-officers who are now employed in each ship, and who are the best men in the service, being no longer necessary, would be turned adrift, and, in all probability, utterly lost to the navy. Thirdly, no large ship could be hauled on the slips without being previously taken into a dock to have her bilgeways fitted, and her bottom prepared for placing her on the slip. The time taken for this purpose must necessarily interfere with the other works of the yard; and after taking her out, the preparations for heaving her up, the capstans, blocks, purchase-falls, chains, and a variety of other articles, amount to a very large expense, not less, with the expense of the roof to cover the ship, than L.10,000 for each slip so hauled up.

Dock-Yards.

Previously to the reign of Henry VIII. the kings of England had neither naval arsenals nor dock-yards, nor any regular establishment of civil or naval officers to provide ships of war, or to fight them. They had admirals, however, possessing a high jurisdiction and very great power. (See the article ADMIRAL). And it would appear, from a very curious poem in *Hackluit's Collection*, called *The Policie of Keeping the Sea*, that Henry V. had both ships, officers, and men exclusively appropriated to his service, and independently of those which the Cinque Ports were bound, and the other ports were occasionally called upon, to furnish, on any emergency. By this poem it also appears that Little Hampton, unfit as it now is, was the port at which Henry built

> ....his great *Dromions*
> Which passed other great shippes of the commons.

But what these *dromions* were no one can now tell; nor is it easy to conceive how the building and repairing of the Great Harry, which in the reign of Henry VII. was launched at Portsmouth, and cost L.15,000, was managed, considering the very rapid strides made at once from the small Cinque Port vessels, manned with twenty-one men and a boy, to this enormous floating castle. At that time it is well known that they had no docks, nor even substitutes for them.

The foundation of a regular navy, by the establishment of dock-yards, and the formation of a board, consisting of certain commissioners for the management of its affairs, was first laid by Henry VIII., and the first dock-yard erected under his reign was that of Woolwich. Those of Portsmouth, Deptford, Chatham, and Sheerness, followed in succession; and the last, excepting the new and unfinished yard of Pembroke, was Plymouth, which was founded by William III.

From the first establishment of the king's dock-yards to the present time, most of them have gradually been enlarged and improved by a succession of expedients and make-shifts, which answered the purposes of the moment; but the best of them possess not those conveniences and advantages which might be obtained from a dock-yard systematically laid out on a uniform and consistent plan, with its wharfs, basins, docks, slips, magazines, and workshops, arranged according to certain fixed principles, calculated to produce convenience, economy, and dispatch.

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Neither at the time when our dock-yards were first established, nor at any subsequent periods of their enlargement as the necessities of the service demanded, could it have been foreseen what incalculable advantages would one day be derived from the substitution of machinery for human labour; and without a reference to this vast improvement in all mechanical operations, it could not be expected that any provision would be made for its future introduction; on the contrary, the docks and slips, the work-shops and store-houses, were successively built at random, and placed wherever a vacant space would most conveniently admit them, and in such a manner as in most cases to render the subsequent introduction of machinery and iron railways, and those various contrivances found in the large manufacturing establishments of private individuals, quite impossible, even in the most commodious and roomy of his majesty's dock-yards.

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The want of a systematic arrangement in our dock-yards, independently of machinery, and the enormous expenditure of money laid out on expedients, were questions of frequent discussion among naval men connected with the various administrations of the navy, and it was thought by many that it would be more desirable to construct an entire new dock-yard in some eligible situation, on an extensive scale, than to continue the *improvements* in the old ones. For this purpose, so early as the year 1765, the attention of the naval administration appears to have been turned to the Isle of Grain in the river Medway, along the shore of which is a fine expansive sheet of deep water. A dock-yard thus placed, on a systematic plan, would supersede that of Chatham on one side and Sheerness on the other; but it was discovered on boring that the substratum was so loose and sandy as not to admit of a solid foundation. General Bentham, however, revived the project in the year 1800, which he seems to claim as his own, and painted the situation in such glowing colours, and as affording so many advantages for a grand naval arsenal, that the lords of the admiralty were induced to order a fresh set of borings to be taken. These were carried to the depth of sixty feet, and were everywhere found to consist of sand and mud, and totally unfit for the construction of basins, docks, and such solid buildings as are required for naval purposes.

On the peninsula of Northfleet.

The imperfection of the naval yards to the eastward, the extension of the boundaries of France towards that quarter, the occupation of the great naval port of Antwerp, and the uninterrupted command of the Scheldt and the ports of Holland by that power, rendered an enlargement of the means of naval equipment in the eastern dock-yards of England, or a new naval arsenal, indispensable. For the latter purpose the banks of the Thames were considered, in every point of view, as preferable to those of the Medway, the entrance into the latter being narrow, and having a bar across it, on which, at low water of spring tides, there is only fourteen or fifteen feet of water; whereas the navigation of the Thames is at all times uninterrupted, excepting by the badness of the weather. It communicates directly with the great market-town of London, in which every description of stores, foreign and domestic, is accumulated; and the trade of the Thames is the great source from which the fleet is supplied with seamen. The marshy peninsula of Northfleet was considered by naval men, who had turned their attention to the subject, to possess every possible requisite for the establishment of a royal dock-yard on an extensive scale. It was sufficiently removed from the mouth of the river to be completely sheltered, yet near enough for ships to proceed to sea with one wind. In the river between Northfleet and the sea there is plenty of water for the largest three-deckers to proceed with all their guns, ammunition, stores, and provisions on board, and almost with any wind, if moderate. A copious stream of good fresh water runs across the peninsula. The soil afforded plenty of earth suitable for bricks; the foundation was excellent for docks, slips, wharfs, and buildings of all kinds. It was sufficiently near the metropolis for speedy communication with the naval departments, and to receive stores in barges and the river craft. It was capable of being defended both on the land and river side; and when the whole was raised to the height of twelve feet with a dry gravelly soil, from the excavations of the docks and basins, there could be no doubt of the healthiness of the situation. By the direction, therefore, of the lords of the admiralty, a complete survey was made by Messrs Rennie and Whidbey, who furnished a plan and estimate of a naval arsenal on a magnificent scale, within which all kinds of machinery were proposed to be employed for the making of anchors, sawing of timber, rope-making, block-making, &c.; iron railways to be laid from the timber wharfs to the timber fields, from thence to the mills and pits, and from them to the docks, slips, and workshops. The estimate, it appears, was about six millions sterling, which Mr Rose, in his letter to the late Lord Melville, calculates, with the fortifications and unforeseen expenses, to amount actually to ten millions; an expense which the minister did not venture to propose, though there can be little doubt that, when the case was fairly stated to the public, and the necessity of increasing our naval establishments to the eastward had been made apparent, no violent opposition would have been made to a measure which tended to keep up our naval superiority, and which was the less objectionable, as none of the money would have been taken out of the country, but circulated within it, to the encouragement of the arts, trades, and manufactures of the kingdom.

The board of revision made a detailed report on the merits of the plan, which, however, as the execution of it was delayed, was not printed; but the real reason was supposed to be, the very gloomy view taken by the commissioners of the disadvantages and imperfections of the present dock-yards, which Mr Rose seems to think, and indeed it is generally thought, is by no means warranted, and that those disadvantages in that report are greatly exaggerated, perhaps to enhance the value of the Northfleet plan, of which they seem to have been much enamoured. Imperfect as the old dock-yards are, chiefly from their having risen, as before observed, to their present state, by a succession of expedients and make-shifts, they are nevertheless far superior to any similar establishments on the Continent of Europe, if we except the unfinished arsenal of Cherbourg, whose magnificent basins (see Breakwater) are certainly unequalled, and the space surrounding them capable of being turned to every possible advantage. M. Charles Dupin, a French officer, who examined all our dock-yards with a skilful eye, pronounces them as by far superior to any on the Continent. We have heard much of the magnificent basins and the covered docks of Carlscrona, but the one has been greatly overrated, and the others are merely covered over with shed-like roofs; nor is there the least likelihood that the plan will ever be finished. We have been told likewise of the superior advantages of the naval arsenal of Copenhagen, where every ship has its appropriate storehouse. This plan has been adopted at Brest, and is reprobated there by every naval officer, and the officers of the yard, as most inconvenient, and a great waste of room, by having the most bulky and the most trifling articles stowed together in the same room. A better arrangement is that of having certain magazines appropriated to certain kinds of stores, and arranged according to the class or rate of ship for which they are intended, and, if appropriated or returned stores, the name of the ship to which they belong painted in front of the birth in which they are deposited. This is the system generally followed in our dock-yards.

The great point in which our naval arsenals are most defective is the want of wet docks or basins; which, however, are to a certain extent compensated at the two principal dock-yards of Portsmouth and Plymouth, by two magnificent harbours, in which the whole navy of England, when dismantled, may be moored and laid up in ordinary, in perfect security. The want of basins, however, in our dock-yards is most severely felt in time of war, when the expeditious fitting out of the fleet becomes so very desirable. One at Portsmouth on a small scale has been found of incalculable advantage to that yard; and a larger one, now constructed at Sheerness, will probably make that yard of sufficient capacity to supersede the necessity of a new establishment at Northfleet, or in any other situation to the eastward.

Idea of a perfect dock-yard.

The perfection of a dock-yard, then, independently of the advantages of machinery, which are but contingent, may be considered to depend upon one or more extensive basins, surrounded by spacious wharfs or quays. By means of these a prodigious saving of time, labour, and expense may be saved, in every stage of the progress of fitting out a ship for sea, from the moment she is launched from the slip, or taken out of a dock, as well as in dismantling a ship on returning to port to be paid off and repaired, or laid up in ordinary. For this purpose the docks and slips should occupy one of the sides of the basin, with working sheds for carpenters and joiners, smiths' shops, saw-pits, and seasoning-sheds between them. The ship, when completed on the slip and launched into the basin, may then be taken immediately into the adjoining dock to be coppered. From this she proceeds to the second side of the basin, in the corner of which is the ballast-wharf; the remainder of the side will probably be occupied by the victualling department, with appropriate stores in the rear for various kinds of provisions, and behind these the bakery, brewery, and slaughter-houses; on the wharf the iron tanks for holding water, now universally used for the ground tier, in lieu of wooden casks. These are taken on board next after the ballast, and, together with the superincumbent casks, would be filled in the ship's hold by means of flexible pipes to convey the water into them. The provisions would at the same time be taken on board at the same wharf, in front of the victualling stores. The third side might be appropriated to the ordnance department, with the gun-wharf extending along the whole side, and the gun-carriage storehouses, magazines, &c. in the rear. The fourth side would be occupied as the anchor wharf, with the cable storehouses, the sail lofts and stores, rigging loft, and magazines for various stores, in the rear. Behind these, again, on the first side, containing the dry docks and building slips, the ground would be appropriated to the reception, birthing, and converting of timber, from whence iron railways would lead to the saw-mills, saw-pits, and work-shops, all of which would be placed on that side. On the second side a pond or basin for the victualling lighters and craft, with wharfs communicating with the manufactories and storehouses; the same on the ordnance or third side; and on the fourth side might be placed the ropery, hemp storehouses, tar-houses, with a basin for hemp-vessels, lighters, and the like. Communicating with the great basin on the building side, and also with the river or harbour, on the shore of which the dock-yard is to be formed, should be a mast-pond, with a lock for the storing of spars; in front the mast-houses, top-houses, capstan-houses, and a slip to launch the masts into the pond. Here also might be placed the boat-houses and boat-pond.

Advantages of systema dock-ya

A peninsular situation like that of Northfleet, having at least three fourths of its shore surrounded with deep water, is peculiarly favourable for some such arrangement as is here mentioned; as any number of locks and canals might be made to communicate with the river, so that ships coming into the basin might not interfere with those going out, nor the lighters and other craft bringing their several species of stores, with either or with one another. By such an arrangment a ship would be equipped for sea at half the present expense, and within half the usual time. A ship fitting out for an anchorage distant from the dock-yard, as at the Nore and Spithead, is liable to every inconvenience and delay, as all her guns, stores, provisions, and water, must be carried to her in dock-yard lighters and other craft, into which and out of which they must be hoisted and rehoisted; liable to delay from bad weather and contrary winds; to be stove alongside the ship, to the total loss or damaging of their cargoes: added to which is the loss of time in going backwards and forwards, especially to the artificers; the desertion of the men; the accidents from the upsetting of boats; and many other evils of a magnitude not easily to be calculated, and exceeded only by the disappointment and vexation that unavoidably occur when ships are preparing for some particular and pressing service; all of which, when ships are fitted out in a basin for sea, are avoided. Here no delay, no embezzlement, no desertion, can take place. A ship in returning from sea may be docked and undocked into the basin with all her stores on board; and if to be paid off, instead of keeping the crew on board for weeks, till all the stores have been delivered into the dock-yard, the ship, by the proposed plan of basins, would remain securely in the basin, to be stripped at leisure by the riggers and labourers of the yard, and the crew become immediately available for other ships. Of the many superior advantages of wet docks for laying up ships to discharge, over the practice of exposing them in rivers or harbours, the shipping interest of the ports of London, Liverpool, Bristol, and Hull, can best testify, more especially that of London, which has taken the precaution to surround the docks with high inclosing walls, by means of which all access is debarred, and all possibility of embezzlement prevented.

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From a brief description of the royal dock-yards as they now stand, a general idea may be formed of their several capacities, advantages, and defects. Taking them in succession, according to their vicinity to the capital, the first is

Deptford.—The front or wharf wall of this dock-yard, facing the Thames, is about 1700 feet in length, and the mean breadth of the yard 650 feet; the superficial content about thirty acres. It has three slips for ships of the line on the face next the river, and two for smaller vessels, which launch into a basin or wet dock, 260 by 220 feet. There are also three dry docks; one of them a double dock, communicating with the Thames, and the other a smaller one, opening into the basin. With these restricted means, even with an adequate number of workmen, its capacity for building ships, or for large repairs, must be very limited; but in the occasional repair of fourth-rates and frigates, and in the fitting out of sloops and smaller vessels, a great deal of work was performed at Deptford in the course of the war. The proximity of Deptford dock-yard to the capital is, however, of great importance, in the convenience it affords of receiving from this great mart all the home manufactures and products which may be purchased by contract for the use of the navy. It is, in fact, the general magazine of stores and necessaries for the fleet, from whence they are shipped off, as occasion requires, to the home yards, the out-ports, and the foreign stations, in store-ships, transports, coasting sloops, lighters, and launches, according to the distance to which they must be sent, to the amount, in time of war, of more than 30,000 tons a year.

The principal stores deposited in Deptford dock-yard are small cordage, canvass, and ships' sails, to an immense amount; beds, hair for beds, hammocks, slops, and marine clothing; anchors under the weight of about seventy-five hundred, which are generally made by contract, all above that size being manufactured in the king's dock-yards.

The great magazines for the reception of these stores consist of a large quadrangular building, with a square in the middle, of three stories in height, with cellars underneath, in which are contained pitch, tar, rosin, and turpentine. The length of each side of these storehouses is nearly the same, differing from a square only by some eighteen feet: this length is about 210 feet, but they vary in width from forty-six to twenty-four feet.

Parallel to the west front of this quadrangle is the rigging-house and sail-loft, 240 feet, and nearly fifty feet wide, in which all the rigging is fitted for ships and stowed away, the sails cut out, made, and placed in proper births for their reception, as well as for various other stores of a smaller kind.

On the eastern extremity of the yard is a long range of building, called the pavilion, in which the beds, hammocks, and slop-clothing are kept, and in which also are the house-carpenters', the joiners', and wheelwrights' shops. This building is about 580 feet long by twenty-six feet wide.

The remaining buildings usually appropriated to the different services of a dock-yard are all to be found at Deptford; a good blacksmith's shop, a plumber, glazier, painter-shops, seasoning-sheds, store-cabins, saw-pits, mast-house, and pond, boat-houses, mould-loft, timber-births, besides good houses and gardens for the principal officers, with several coach-houses and stables, so that the whole space is completely filled up in every part.

The number of men employed in this yard, in time of war, may have been about fifteen hundred, of whom about one half were shipwrights and other artificers, and the other half labourers. There were, besides, in constant employ, eighteen or twenty teams of four each, of horses, to drag timber and heavy stores. Deptford dock-yard has recently been put down.

Deptford victualling-yard.

Adjoining to the dock-yard is the victualling-yard, the completest establishment of the kind, perhaps, in this or any other kingdom, though still capable of much improvement in the arrangement. Its frontage to the Thames is about 1060 feet, and mean depth 1000 feet, containing about nineteen acres. This space is laid out in a more convenient manner than any of the dock-yards, for answering all the purposes which were intended. The general storehouses in front of the wharf wall, the cooperage, the brewery, the butchery, and the bakery, are all separate and complete in themselves. A mill has recently been erected, of such capacity as to grind corn to be made into biscuit sufficient for supplying the whole navy. Besides all the requisite offices for keeping the accounts, there are houses and gardens for eight of the principal officers of the yard; and when the old wharf wall shall have been repaired, and carried out a little farther into the river, for which a sum of L.27,000 appears on the estimate of 1817, the victualling-yard will be complete in all respects, according to the present arrangement. (*Navy Estimates for* 1817.)

The cooperage is spacious and well laid out. The staves are all sawed by hand, and this operation employs about 100 sawyers in time of war. Mr Brown of Fulham has succeeded, it seems, in making casks by machinery, by which seventeen men in nine hours are stated to be able to complete 300 casks, whereas, by the ordinary method, the same number could only complete about eighty. The brewery is well arranged, so is the bakery; and the butchery, consisting of a yard for keeping the cattle, with pens for sheep and hogs, two spacious slaughtering-houses, cutting and salting-houses, by the abundant supply of water and constant washing, are kept in the cleanest order, and free from any disagreeable smell.

In the salting season 260 carcasses have been slaughtered in each of the two days in the week appropriated to killing, and the hog hanging-house is capable of containing 650 carcasses.

The total number of coopers, sawyers, bakers, and labourers employed during war, in the victualling-yard at Deptford, amounted probably to twelve or thirteen hundred.

Woolwich Dock-Yard.—This first and most ancient of the dock-yards presents a frontage to the river of 3300 feet; the breadth is very irregular, being from 250 to 750 feet; and it contains an area of about thirty-six acres. It has five slips, which open into the river, three of which are for ships of the line, one for frigates, and one for vessels of a smaller class. It has three dry docks, one a double and one single dock, all of them capable of receiving ships of the line. With all its imperfections, Woolwich yard, with a complete establishment of artificers, has been of great service both in the building and repairing of ships of all classes. Some of the largest and finest ships in the navy have been launched from Woolwich yard, among which may be mentioned the Nelson and the Ocean. In fact, it is chiefly as a building yard that Woolwich ought to be considered as of much importance; and even in this respect it has of late years much deteriorated, owing to the increasing shallowness of the river, and the immense accumulation of mud, which is found in a very few weeks completely to block up all the entrances into the docks and slips, and along the whole length of the wharf wall. It is stated in the *Eighth Report of the Select Committee on Finance* (1818), that "the wharf wall at Woolwich, owing to the action of the tide on the foundation, is in a falling state, and in danger of being swept into the river, it being secured only in a temporary manner, and requires to be immediately rebuilt in a direction that will preserve it from similar injury hereafter, and prevent, in a great degree, that accumulation of mud which has, in the course of the last ten years, occasioned an expense of upwards of L.125,692, and would threaten in time to render the yard useless."

It was, in fact, found necessary to diminish the depth of the hold of the Nelson, in consequence of the Trinity Board having stated that no vessel drawing above nineteen feet of water could be navigated down to Erith Reach, and one even of that draught not without difficulty and danger.

The magazines or storehouses are not to be compared with those of Deptford. They are more confined, and, owing to the narrowness of the yard, and the progressive additions made according as necessity required, there is little or no methodical arrangement. As far, however, as regards the building and repairing of ships, its conveniences may be reckoned superior to those of Deptford. The new mast-houses and mast-slip, the new mast-ponds, and the houses for stowing yards, topmasts, &c. with the locks under them, are all excellent; and a new and spacious basin completes these great conveniences. The timber-births are well arranged, and the addition recently made to the western extremity of the yard will allow the stacking of several thousand loads of timber, and of classing it according to the purposes to which it may be applicable; and when the new smithery, and the line of wharf wall shall be completed, the dock-yard of Woolwich will become an important and valuable naval arsenal.

Ropery. A considerable quantity of cables and cordage are manufactured at Woolwich; but the ropery is most inconveniently situated at a distance from the dock-yard, and great part of the town intervenes between them. Its length is 180 fathoms, but so narrow that the hemp storehouses, of three stories high, come close to the spinning house on either side. These storehouses are capable of containing about 2000 tons of hemp, and the cellars underneath them about 6000 barrels of pitch and tar. The hemp stores in the dock-yard are capable of containing about 2000 tons more.

In the present state and situation of the ropery, it would scarcely admit of the introduction of machinery, as has been done in most of the great private manufactories. The process of tarring, or passing the yarns through heated tar, and then drawing them through apertures in an iron plate, is performed at Woolwich by four horses. The laying of a cable of twenty-two or twenty-three inches is performed by the simultaneous exertion of 170 or 180 men, and requires upwards of an hour of the most severe exertion of strength, especially on the part of those who are stationed at the cranks, who not unusually break a blood-vessel by the severity of the labour. The simple and beautiful machine invented by the late Captain Huddart, performs with more accuracy the same process, and with the attendance of only three persons. For the reasons here stated, and the sufficiency of the other rope-yards, this at Woolwich has recently been disposed of.

Woolwich dock-yard seems to be complete in all the usual appendages of artificers, work-shops, store-cabins, offices for the clerks, houses and gardens for the commissioner and the principal officers of the establishment. The number of men employed during the war amounted to about 1800, of whom nearly 1100 were shipwrights and artificers, and the rest labourers. The number of spinners, knitters, layers, labourers, &c. in the ropery, might be about 260. Upwards of twenty teams of horses were daily employed in this yard.

One of the four divisions (the 4th, consisting of thirteen companies) of royal marines are stationed at Woolwich, where barracks and all the necessary buildings have been erected for their accommodation on shore. See the article MARINES.

Chatham Dock-Yard.—This dock-yard is situated on the right bank of the Medway, to which it presents a line of river wall at least 5500 feet in length; the width at the upper end being 400, in the middle 1000, and at the lower end about 800. The superficial contents may be estimated at about ninety acres. It has six building-slips on the front, from which ships are launched into the river; three of these are for ships of the line, and three for frigates and smaller vessels. In the same front are four dry docks communicating with the Medway.

The inconveniencies arising from want of arrangement are less felt in Chatham than in any other of his majesty's dock-yards; and it could not perhaps be materially improved, if on the same site an entirely new dock-yard was to be planned. At the southern extremity of the yard is the ropery, hemp and yarn houses, rigging houses, a range of storehouses 1000 feet in length by about 50 in breadth, in front of which, along the wharf, are the anchor-racks, extending nearly 1000 feet. Next to these are the slips and docks, with the working-sheds and artificers' shops close in the rear, an excellent smithery, timber-births, seasoning-sheds, deal and iron yard, &c.; and beyond these, on the eastern extremity of the yard, the officers' houses and gardens. The commissioner's house and excellent garden are situated nearly in the centre of the yard. The lower or north-eastern part of the yard is occupied by mast-ponds, mast-houses and slips, store boat-houses and slips, ballast-wharf, timber-births, and saw-pits.

With all the advantages of interior arrangement, Chatham dock-yard still labours under that great defect to which most of the dock-yards are liable, from the injudicious manner in which the wharf walls have been constructed, without any regard being paid to the ebbing and flowing of the tide, or the currents of rivers, projecting in one part and retiring in others; the consequence of which is, that eddies are formed, and a constant accumulation of mud takes place along the line of the wall, and particularly in the openings of the dry docks, the slips, and the jetties. Of late years, however, since the attention of engineers has been called to this important subject, every opportunity is taken, in the repair of the wharf walls of the dock-yards, to correct the injurious effects arising from their improper direction; and as the river wall of Chatham is rebuilding, there is no doubt that due attention will be had to the line in which it is to be carried, so as to obviate the evil so universally complained of.

There is no wet dock or basin in Chatham-yard; but the Medway, flowing along it in a fine sheet of water, in some degree answers the purpose of one. The whole river might indeed be converted into a magnificent basin, by pursuing the same plan as that adopted in forming the new docks at Bristol. This would be effected by cutting a new channel for the river through the chalk cliff below Frindsbury Church, opening out a little above Upnor Castle, and continuing the new channel across the marsh near St Mary's Creek, so as to open out into Gillingham Reach close to the fort. Here a basin might be constructed wherein ships might be equipped in all respects ready for sea, whenever the wind and tide should be favourable. At present, owing to the shallowness of the water and the crooked navigation from Chatham round Upnor Point, they are obliged to take in their water and ballast at one place, their stores and provisions at another, their guns, powder, and ammunition at a third; in consequence of which, a ship is usually longer in getting out to sea from

Chatham than even from Deptford. If this new channel was made for the river, the whole space from the first reach below Rochester Bridge to St Mary's Creek, at the lower extremity of the dock-yard, might be converted into one magnificent basin.

Chatham being a building, a repairing, and refitting yard, the establishment of men was much greater in war than at Woolwich or Deptford; the number of shipwrights and other artificers, and labourers, being probably upwards of 2000, besides those of the rope-yard, which might amount to about 250.

A considerable piece of new ground (about 2000 feet in length by 200 in breadth) has recently been added to the upper part of Chatham dock-yard, on which is erected one of the completest saw-mills in the united kingdom, under the direction of Mr Brunell. The mill is situated on high ground, and close to the margin of a deep circular basin or reservoir of water, dug down to the level of the Medway, with which it communicates by a tunnel or subterranean canal, passing through the mast-pond. From the side of the reservoir opposite to the mill proceeds a long iron railway, supported on a double row of iron pillars; and alongside of and parallel to this railway, on the side next to the dock-yard, are a continued series of stages for the reception of timber after it has been sawn into planks. A steam-engine of the power of thirty-six horses sets in motion all the operations of this mill, which may thus be briefly enumerated: 1*st*, It drags up the large balks of timber through the canal into the reservoir as they are wanted. 2*d*, It lifts up these large logs to the margin of the basin, carries them into the mill, and places them on the frame under the saws. 3*d*, It saws them with the greatest nicety into planks of any required thickness. 4*th*, It takes the pieces away thus sawn, and places them on carriages of iron. 5*th*, It drives these carriages along the iron railway to any required distance. And 6*th*, It deposits the sawn timber on the stages, ready to be used in any part of the dock-yard where it may be required. From these stages it is conveniently conveyed to the docks or slips by single horse carts or trucks, with great expedition, down an easy descent, and without the least interference with any of the works carrying on in the yard. The whole of these operations are conducted by about ten, or at most twelve men.

This mill is supposed to be equal to the power of fifty saw-pits and nearly one hundred sawyers, and is capable of supplying the dock-yards of Chatham and Sheerness with all the straight-sawn timber that they can require. But the great advantage of the plan is in its application of the steam-engine to the management and arrangement of timber, by which the labour and expense of a great number of horses are saved, and, what is of still greater importance, the obstruction and impediments to the general services of the yard are avoided, which the dragging about of large balks to and from the saw-pits, with teams of four horses each, occasions in all the other yards. It allows, besides, the large space of ground which these saw-pits would occupy, to be appropriated to other purposes.

The first division of royal marines, consisting of twenty-one companies, is stationed at Chatham, in excellent barracks, situated near to one of the extremities of the dock-yard. (See article MARINES.)

There is a small victualling depôt, situated partly in the parish of Chatham and partly in that of Rochester, from which the ships at Chatham and at Sheerness and the Nore receive a supply of provisions and water; but no articles of ship's stores are manufactured. The storehouses are sufficiently capacious for containing all the stores that can be required for the ships fitted out at the two ports on the Medway. The establishment consists of an agent, clerk of the check, storekeeper, and their respective clerks, which, with the messengers, porters, labourers, &c. may amount to about ninety persons.

Sheerness Dock-Yard.—This dock-yard is situated on a low point of land on the island of Sheppey, whose soil is composed of sand and mud brought from the sea on the one side and down the Medway on the other, and has so much contracted the mouth of this river as completely to command the entrance of it. The situation, in a military point of view, is a most important one, particularly from its vicinity to the North Sea and to the anchorage at the Nore; by which anchorage, and the works of Sheerness, the mouths of the Thames and the Medway are completely defended.

As a situation for a dock, the objections to which it was liable are now in a fair way of being removed. On account of the low swampy ground on which it stood, fevers and agues were at one time so prevalent, that shipwrights and other artificers were literally impressed and compelled to work at Sheerness. In process of time, however, a town sprung up close to the dock-yard, and with it some little improvement by drainage, embankments, and other measures. Still it continued, till a very short time ago, an unhealthy and disagreeable place. As a dock-yard it was totally destitute of all convenience or arrangement; and the whole premises, mixed among wharfs and buildings belonging to the ordnance department, did not exceed fifteen acres of ground. The storehouses were dispersed in various parts of this space, and in so ruinous a state, that a ship hauled up in the mud was by far the best in the whole yard. It had two small inconvenient docks for frigates or smaller vessels. It was in fact a mere point of refitment, and might be considered as an appendage to Chatham.

From the very limited capacity of Sheerness, and the mighty preparations in the Scheldt, originated the magnificent project of the naval arsenal at Northfleet, which, from a change of political circumstances, and from the important improvements now carrying on at Sheerness, is not likely ever again to be revived. The Finance Committee (*Eighth Report*) say they have learnt "that the re-establishment and extension of the yards at Sheerness and Chatham may be considered as superseding, under any circumstance that can now be likely to occur, the plan contemplated for a naval establishment at Northfleet, on so extensive a scale as to require the expenditure of several millions."

These improvements appear indeed to be of sufficient magnitude to render any establishment at Northfleet wholly unnecessary, by making Sheerness, when finished, as complete a dock-yard, and perhaps more so, than any other in his majesty's dominions. Previously to carrying into execution this important undertaking, a committee of engineers and others was appointed, among whom were Watt, Huddart, and Jessop, whose plan was afterwards minutely examined, and some slight improvements suggested therein by Mr Rennie. The first stone was laid on the 19th August 1814, and the whole was completed at an expense not far short of one million sterling.

The advantages arising from the adoption of this plan are, 1*st*, The addition of nineteen acres of ground to the dock-yard, by taking in the whole of the muddy western shore of the Medway, beyond the low-water mark of neap tides, and getting rid of the offensive and unwholesome smell which it perpetually occasioned. 2*dly*, The construction of a wet dock or basin 520 feet in length by 300 in width, equal in surface to three and one half acres, and capable of containing a fleet of ten sail of the line, in which they can take on board all their stores, ammunition, and provisions, and be equipped in all respects ready to proceed to sea. The entrance into this basin is from the Medway, through a lock that is closed by a floating dam-gate. *3dly*, The construction of three dry docks on the eastern side of the basin, and opening into it, each capable of holding a first-rate ship of the line. *4thly*, Ample space for constructing storehouses, mast-houses, mast-ponds, and slip, smithery, and artificers' workshops of every description. *5thly*, A further extension of the dock-yard, by the addition of ten or twelve acres of a low marshy tract of land called Major's Marsh, which at present is below the level of the sea, and the water kept out, as in Holland, by embankments, but which will be raised several feet by the excavation of the basin, the dry docks, and the mast-ponds, so as to allow of drains to carry off the water to the shore, affording space for timber-births, houses and gardens for all the officers of the dock-yard, as well as for the admiral commanding in chief at Sheerness and the Nore. These additions, together with some part of the premises held by the board of ordnance, will make the whole area of the new dock-yard of Sheerness amount to upwards of fifty acres. The wharf wall on the south side of the basin in front of the intended mast-houses is a hundred feet, and that on the river front sixty feet in width, lined on both sides with as complete a specimen of good and beautiful masonry of granite as any in the kingdom.

The usual officers, with their clerks, amounted during the war to about fifty; and the shipwrights, artificers, and labourers, to about eight hundred; the shipwrights being the most numerous, as the principal part of the work was confined to the repairing of small vessels in the yard, but mostly to repairs of the fleet afloat at the Nore or in the Medway.

Portsmouth Dock-Yard.—Portsmouth dock-yard will always be considered as the grand naval arsenal of England, and the head-quarters or general rendezvous of the British fleet. The dock-yard accordingly is by far the most capacious; and the safe and extensive harbour, the noble anchorage at Spithead, the central situation with respect to the English Channel and the opposite coast of France, and particularly with regard to the naval arsenal at Cherbourg, render Portsmouth of the very first importance as a naval station; and in this view of it, every possible attention appears to have been paid to the extension and improvement of its dock-yard. The sea wharf-wall of this yard, extending in the direction of north and south along the western shore of the harbour, is about 3500 feet in length, and the mean depth may be 2000 feet; and it incloses an area of more than one hundred acres.

In the centre of the wharf-wall, facing the harbour, is the entrance into the great basin, whose dimensions are 380 by 260 feet, and its area $2\frac{2}{3}$ acres. Into this basin open four excellent dry docks, and on each of its sides is a dry dock opening into the harbour; and all of these six docks are capable of receiving ships of the largest class. Besides these is a double dock for frigates, the stern dock communicating through a lock with the harbour, and the head dock with another basin about 250 feet square. There is also a camber, with a wharf-wall on each side, 660 feet in length, and of sufficient width to admit of transports and merchant ships bringing stores to the dock-yard. In the same face of the yard are three building slips capable of receiving the largest ships, and a small one for sloops, besides two building slips for frigates on the northern face of the yard, and a smaller slip for sloops. The range of storehouses on the north-east side, and the rigging-house and sail-loft on the south-west side of the camber, are magnificent buildings, the former occupying nearly 600 feet in length, exclusive of the two intermediate spaces, and nearly sixty feet in width, and the two latter 400 feet. The two hemp-houses and the two sea-store houses occupy a line of building which, with the three narrow openings between them of twenty-five feet each, extend 800 feet. The rope-house, tarring-house, and other appendages of the ropery, are on the same scale. The two sets of quadrangular storehouses, and the two corresponding buildings, with the intervening timber-births and saw-pits, at the head of the dry docks, issuing from the great basin, are all excellent, and conveniently placed. The smithery is on a large scale, and contiguous to it is an iron-mill, a copper-mill, and a copper refinery, at which is remelted and rolled all the old copper which is taken from ships' bottoms; and here, also, are cast bolts, gudgeons, and various articles of copper used in the navy. The number of sheets manufactured in one year of the war amounted to about 300,000, weighing above 12,000 tons; on which it has been calculated that a saving of at least L.20,000 was effected for the public, besides obtaining a good pure article. Most of these were constructed under the direction of General Bentham. (Bentham's *Services*.) At the head of the north dock are the wood mills, at which every article of turnery, rabitting, &c. is performed for the use of the navy, from boring the chamber of a pump to the turning of a button for a chest of drawers. But the principal part of these mills is the machinery for making blocks, contrived by that ingenious artist Mr Brunell (see BLOCK-MACHINERY), which cannot be regarded without exciting the highest respect for the talents and skill of the author.

The northern extremity of the dock-yard is chiefly occupied with seasoning-sheds, saw-pits, and timber-births, the working boat-house, and boat-storehouse. On the eastern extremity are situated the houses and gardens of the commissioner and principal officers of the yard; the chapel, the royal naval college, and the school of naval architecture. The former institution has recently been remodelled, and the latter is a new establishment formed by the recommendation of the commissioners for revising the civil affairs of the navy, for the education of a certain number of naval architects, known by the name of the "Superior Class of Shipwright Apprentices." These two establishments were combined by order in council of the 30th January 1816, under the following regulations:

Naval College.—The number of students not to exceed, in time of war, one hundred; in peace seventy; of whom thirty are to consist of the sons of commissioned officers of the navy, and to receive their board, clothing, lodging, and education, free of all expense; the remainder to consist of sons of noblemen, gentlemen, civil and military officers, on payment of L.72 a year. The age of admission from twelve and a half to fourteen years. A bond is to be signed by their friends, in the penalty of L.200 for the first class, and L.100 for the second class, in the event of any young gentleman being withdrawn from the navy before he has served the proper time to qualify for the commission of lieutenant. (See article NAVY.) No student to remain at college longer than three years; at the end of which, or sooner if he shall have completed the plan of education, he is discharged into one of his majesty's ships, the college time being reckoned two years of the six required to be served to qualify for such commission.

Naval Architectural School.—The number of students not to exceed twenty-four. Candidates for admission examined at stated periods, the degree of merit alone giving preference of admission; the age of entrance from fifteen to seventeen, and the duration of their apprenticeship seven years. The students are lodged, boarded, and educated, free of all expense, and have the following yearly allowances: 1st year L.25, 2d L.30, 3d L.35, 4th L.40, 5th L.45, 6th L.50, 7th L.60. And at the expiration of their apprenticeship they are eligible to all the situations in the ship-building department of his majesty's dock-yards, to be there employed as supernumeraries until regular vacancies may occur; provided the apprentice shall have completed the plan of education, and be certified by the professor to be properly qualified.

The consolidated establishment of the two departments consists of a governor, who is the first lord of the admiralty for the time being; a lieutenant-governor, who is a post-captain in the navy, with a salary of L.800 a year and apartments; two lieutenants of the navy, with L.200 a year each, apartments, and an allowance for board; a professor, who is a graduate of the university of Cambridge, with a salary of L.700 a year, and apartments; a master of classics, history, and geography, with L.350 a year and apartments; three assistant-masters, well skilled in mathematics, the first with L.250, the two others L.200 a year each, with an allowance for house-rent; besides masters for teaching drawing, dancing, fencing, and the French language, and two serjeants of marine artillery. In addition to these, there is a superintendent of the school for naval architecture, a professional ship-builder, brought up in one of his majesty's dock-yards, to instruct the apprentices in the practical parts of ship-building. The school for naval architecture has recently been abolished.

The professor has the charge and keeps the rate of all the chronometers which may not be in use belonging to the navy; and all midshipmen in the navy are now required to pass their examination in the theory of navigation, at the naval college, by the professor, in presence of the admiral commanding in chief, and the lieutenant governor. (See NAVY.)

The strength of Portsmouth dock-yard, during the war, was considerably above 4000 working men, of whom about 1500 were shipwrights and caulkers; the joiners and house-carpenters were nearly 500; the smiths 200 nearly; the sawyers 250; the riggers and their labourers nearly 200; the scavelmen and labourers of various kinds nearly 700; and the rope-yard employed about 350 persons.

There are two victualling establishments at this port; the one in Portsmouth town, the other across the harbour, at a place called Weevil; both of them inconveniently situated for supplying the ships with water and provisions, more especially such as may have to take them in at Spithead. The former consists chiefly of provision-stores and magazines, with a tide-mill and a bakery; at the latter there is a cooperage and a brewery. The total number of persons employed, including the officers, at the two establishments, during the war, amounted to about 500. The victualling establishments are now consolidated at Weevil.

The noble building for the reception of sick and wounded seamen is situated on the Gosport side of Portsmouth harbour. Being appropriated to the military branch of the navy, it will be described under the head of NAVY.

The second division of royal marines, consisting of eighteen companies, is stationed at Portsmouth, in barracks, which are inconveniently situated in the town; and eight companies of the royal marine artillery have their head-quarters at Fort Monckton, not far from Haslar Hospital. (See the article MARINES.)

Plymouth Dock-Yard.—The naval station of Plymouth is inferior only to that of Portsmouth; and, in point of its more westerly situation, as considered with reference to the grand naval arsenal of Brest, it is superior even to Portsmouth. It possesses one of the finest harbours in the world, capable of containing, in perfect security at their moorings, not less than a hundred sail of the line; and by means of the breakwater it may boast of an excellent roadstead for eighteen or twenty sail of the line. The dock-yard, however, has only one small basin, without gates, whose dimensions are 250 by 180 feet, and contents little more than an acre; but the excellent harbour of Hamoaze, on the western bank of which the wharf-wall extends, almost compensates for the want of one, especially as the depth of water allows the largest ships to range along the jetties, and receive their stores on board immediately from the wharf.

Plymouth dock-yard extends in a circular sweep along the shores of Hamoaze 3500 feet, its width about the middle, where it is greatest, being 1600, and at each extremity 1000 feet, making its superficial contents about ninety-six acres. In the line facing the harbour are two dry-docks for ships of the first rate, a double dock for seventy-four gun ships, communicating with Hamoaze, and another dock for ships of the line, opening into the basin. There is, besides, a graving-dock without gates, and a canal or camber similar to that in Portsmouth yard, for the admission of vessels bringing stores into the yard; which, communicating with the boat-pond, cuts the dock-yard nearly into two parts. There are five jetties projecting from the entrances of the dry-docks into Hamoaze, along side of which ships are conveniently brought when undocked. All these are situated between the centre and the northern extremity of the harbour line. On the southern part are three building slips for the largest class of ships, and two for smaller vessels; the outer mast-pond and mast-houses, timber-births, saw-pits, and smithery. Higher up, on this end of the yard, is an extensive mast-pond and mast-locks, with plank-houses over them; and, above these, three hemp magazines, contiguous to which is the finest ropery in the kingdom, consisting of two ranges of buildings, one the laying-house, the other the spinning-house, each being 1200 feet in length, and three stories in height. In the construction of the new rope-house no wood has been used excepting the shingles of the roof, to which the slates are fastened. All the rest is of iron. The ribs and girders of the floors are of cast iron, covered over with Yorkshire paving stone, and the doors, window frames, and staircases, are all of cast iron, so that the whole building may be considered as proof against fire.

The northern half of the yard, besides the docks and basin, with all the appropriate working sheds and artificers' shops, contains a cluster of very elegant stone buildings, ranged round a quadrangle, the longest sides being about 450 feet, and the shortest 300 feet. Within the quadrangle are also two new ranges of buildings, in which iron has been used in the place of wood. These buildings consist of magazines for different kinds of stores, rigging-houses, and sail-lofts. The northern and upper part of the yard is occupied by a range of handsome houses, with good gardens behind them, for the commissioner and the principal officers of the yard, the chapel, the guard-house, and pay-office, stables for the officers, and the teams, and a fine reservoir of fresh water for the supply of the yard.

Plymouth is not only a good building and repairing yard, on account of its excellent docks and slips, and the great length of line along the Hamoaze, but also a good refitting yard, and was fully occupied during the war with the refitment of the western squadron, employed in the constant blockade of Brest. The number of men borne on the establishment of this yard might have been about 3000, of which about 800 were shipwrights.

Plymouth Victualling Establishments.—The victualling establishments are here, as well as at Portsmouth, unconnected, and, in fact, dispersed in three different places; the cooperage and the brewery being at South Down, near Millbrook, on the farther side of Hamoaze; the bake-house and principal stores at the entrance of Sutton Pool, in the Catwater; and the slaughter-house on the Devil's Point, at the head of the Sound. The total establishment of the victualling department at this port, officers included, amounted to about 400 persons. As at Portsmouth, the victualling establishments have been consolidated at Cremill, which consists of every possible convenience for victualling and watering the navy.

Plymouth Hospital is a handsome building of stone, or rather a series of separate buildings, regularly arranged, in which respect, as admitting a freer circulation of air, it is perhaps superior to that of Haslar. (See Navy.)

The third division of royal marines, consisting of twenty companies, are stationed at Plymouth. The barracks are conveniently situated at Stonehouse, very airy, and sufficiently spacious. (See Marines.)

Pembroke Dock-Yard.—This dock-yard has been established but a few years, and is intended merely as a building-yard. It is situated on the southern shore of Milford Haven, not two miles from the town of Pembroke. It includes an area of about sixty acres, its surface descending in a gradual slope to the water's edge, along the shore of which is ample space for a couple of dry docks, and at least twelve building slips, over which it is intended to erect a connected series of roofs, which will not only be attended with much convenience to the workmen, but also with a great saving of expense. The slips, being built of wood, on a limestone foundation, are erected at a very trifling cost; and the only works of any considerable expense in the yard will be those of the dry docks, each of which will amount to the sum of L.60,000 nearly. For a new building yard a small storehouse will be quite sufficient, and an old ship hauled up serves all the purposes of one at present. There is no commissioner, nor is the usual establishment of officers completed. The total number of persons of all descriptions employed in the yard is under 500.

Ordinary of the Dock-Yards.—At each of the ports where there is a dock-yard, Pembroke excepted, a certain number of ships when put out of commission, or new ships not commissioned, are laid up in what is called a state of ordinary; and such ships, until recently, used to be placed under the immediate charge of the commissioner, the masters attendant, and other officers of the dock-yard. But a new system has lately been adopted, both with regard to the fitting of the ships for their better preservation, while thus unemployed (See Dry Rot), and also as to the care and management of them by naval commissioned officers living constantly on board. (See Navy.)

Capacity of a Dock-Yard.—The capacity of a dock-yard for building, repairing, and refitting ships of war, depends upon so many circumstances that it scarcely admits of calculation; chiefly, however, on the facilities afforded by a suitable arrangement of dry docks, building slips, and basins, and on the number of shipwrights and other artificers borne on the strength of the yard. In building new ships, where the materials are at hand, and no interruptions occur, the capacity may be ascertained to a tolerable degree of accuracy. To complete the building of a seventy-four gun ship, it is calculated that the labour of one man would be required for 18,000 days, or of eighteen men for 1000 days, or about fifty-four men to finish her in the space of one year. A dock-yard, therefore, with 500 good shipwrights, might be expected to launch from eight to ten sail of the line every year, if the conveniences of the yard admitted them all to be employed on building. But with regard to repairs, they are so various and so uncertain, that it would be next to impossible to form any calculation that should at all approach to the truth. A writer well versed in naval matters, in attempting to prove the sufficiency of our dock-yards, without having recourse to private merchant yards during war, has stated, that by a uniform system of management, "the annual regeneration of ships of the line may be safely reckoned at *twelve sail*, and that of frigates at *eight sail*;" and that, besides, there "might be docked for casual repairs, in the course of one year, *two hundred and sixty-seven sail* of ships and vessels of war." (*Letter to Lord Melville on the General State of the Navy*, 1810.)

Manag ment o dock-y &c.

When Henry VIII. first established a regular king's dock-yard at Woolwich, he appointed a board, consisting of certain commissioners, for the management of all naval matters; and it is curious enough, as appears from the *Pepysian Collection of Manuscripts* in the university of Cambridge, that the regulations which he made for the civil government of the navy, and which were, in the reign of Edward VI., revised, arranged, and turned into ordinances, form the broad basis of all the subsequent instructions given to the several officers to whom the management of the civil affairs of the navy has been committed. (*First Rep. Nav. Rev.*)

Comm sioners the na

The commissioners of the navy then consisted of the vice-admiral of England, the master of the ordnance, the surveyor of the marine causes, the treasurer, comptroller, general surveyor of the victualling, clerk of the ships, and clerk of the stores. They had each their particular duties; and once a week they were ordered to meet at their office on Tower Hill, and once a month to report their proceedings to the lord high admiral.

In 1609 the principal officers for conducting the civil affairs of the navy were suspended in consequence of many abuses being complained of; and other commissioners were appointed, with powers to manage, settle, and put the affairs of the navy into a proper train, and to prevent, by such measures as might appear to be necessary, the continuance of the many great frauds and abuses which had prevailed. A similar commission was renewed in 1618, which in a full and minute report detailed and explained those frauds and abuses.

That commission, which ended on the death of James I., was renewed by his successor, and remained in force till 1628, when it was dissolved, and the management of the navy was restored to the board of principal officers, as established by Edward VI.

In the disturbed reign of Charles I. the navy was suffered to go to decay; but by the extraordinary exertions of Cromwell, it was raised to a height which it had never before reached, but again declined under the short and feeble administration of his son.

Duke York lord hi admira

On the restoration of Charles II. the Duke of York was appointed lord high admiral; and by his advice a committee was appointed to consider a plan he had drawn out for the future regulation of the affairs of the navy, at which he himself presided. "In all naval affairs," say the commissioners of revision, "he appears to have acted with the advice and assistance of Mr Samuel Pepys, who first held the office of clerk of the acts, and was afterwards secretary of the admiralty; a man of extraordinary knowledge in all that related to the business of that department, of great talents, and the most indefatigable industry."

The entire management of the navy was now in the hands of the duke, as lord high admiral, by whom three new commissioners were appointed to act conjunctly with the treasurer of the navy, the comptroller, the surveyor, and clerk of the acts, as principal officers and commissioners of the navy. A book of instructions, drawn out by Mr Pepys, was sent to the navy board for its guidance. A rapid progress was made in the repair and augmentation of the fleet; but being called away, in consequence of the Dutch war in 1664, the example of zeal and industry set by Mr Pepys was not sufficient, in the duke's absence, to prevent neglect and mismanagement in every department except his own.

New set of commissioners.

From 1673 to 1679, the office of lord high admiral being put in commission, at the head of which Prince Rupert was placed, the king, through Mr Pepys, arranged all naval affairs; but in the latter year, when the duke was sent abroad, and Mr Pepys to the Tower, a new set of men were made commissioners of the navy, who, without experience, ability, or industry, suffered the navy to go to decay. "All the wise regulations," say the commissioners of revision, "formed during the administration of the Duke of York, were neglected; and such supineness and waste appear to have prevailed as, at the end of not more than five years, when he was recalled to the office of lord high admiral, only twenty-two ships, none larger than a fourth rate, with two fire-ships, were at sea; those in the harbour were quite unfit for service; even the thirty new ships which he had left building had been suffered to fall into a state of great decay, and hardly any stores were found to remain in the dock-yards." He re-appointed Mr Pepys as secretary of the admiralty; he set about an inquiry into the characters and abilities of the first ship-builders in England; and by the advice of Mr Pepys, he joined Sir Anthony Dean, eminent in that profession, with three others, to the former principal officers in a new commission. The old commissioners were directed entirely to confine their attention to the business of a committee of accounts. To each of the new ones was entrusted a distinct branch of the proposed reform; and it appears that, highly to their credit, "they performed what they had undertaken in less time than was allowed for it, and at less expense;" having completed their business to the general satisfaction of the public two months before the Revolution.

The business of the navy, thus methodized and settled, remained undisturbed by that event. The commissioners of revision justly observed, that "the great work of re-establishing the fleet, and restoring order, industry, and discipline, in the dock-yards, accomplished in so short a time by the commissioners then chosen, with so much care, proves, in the most convincing manner, how much depends on having the civil affairs of the navy placed under the management of men of real ability, professional knowledge, and uninterrupted industry."

Commissioners of naval inquiry and revision.

It will readily be supposed that the vast increase of our naval force since that time has necessarily required many additional orders and regulations, some of which, from circumstances, were not compatible with each other; some were given to one dock-yard and not to another; others in one yard became obsolete, while they continued to be acted upon in another; so that there was no longer that uniformity in the management which it is so desirable, indeed so essentially necessary, to preserve. From the year 1764 to 1804, when his majesty appointed a commission "for revising and digesting the civil affairs of his navy," the attention of the lords of the admiralty and the navy board had frequently been directed to this important subject; but owing to various causes nothing was done to forward so desirable an arrangement, except that Sir Charles Middleton (afterwards Lord Barham), when comptroller of the navy, classed and digested under distinct heads, in a book for that purpose, all orders and regulations prior to the year 1786. The commissioners of naval inquiry, appointed in 1803, state the necessity of revising the instructions, and digesting the immense mass of orders issued to the dock-yard officers, and regret that a work of such utility should not have been completed. The late Lord Melville, to whom the navy is perhaps more indebted than to any single individual, and who, from the active part he had long taken in its concerns, was well aware of the irregularities and disorder which prevailed in the dock-yards, on his appointment to the administration of naval affairs, determined to carry into execution a complete system of reform and of uniform management in all the several departments. The commission consisted of Admiral Lord Barham, John Fordyce, Esq. Admiral Sir Roger Curtis, Bart. Vice Admiral Domett, and Ambrose Serle, Esq. They made fifteen distinct reports, the date of the first being 13th June 1805, of the last the 6th March 1808; all of which, except two, have been printed, by order of the House of Commons, and mostly carried into effect by his majesty's orders in council. One of the two not printed is an inquiry into the state of the navy at different periods, and of naval timber; the other relates to the formation of a new dock-yard at Northfleet, which, however advisable and even necessary the design of it might have been considered at the time when Bonaparte was energetically carrying on his mighty plans for the creation of a naval force to contest the power of the ocean with Great Britain, will, as has already been observed, no longer be thought so under present circumstances.

Uniform system of management introduced.

From these reports have been established, for the first time, in all his majesty's dock-yards, one uniform system of management, by which it was hoped incalculable advantages would have been derived to the public, in the preventing of frauds, in the saving of labour and materials, and consequently time and expense, and in securing better workmanship in the construction of ships, which is perhaps of all other considerations the most important; but the system was cumbrous and very expensive.

Commissioners of the navy.

The management of the dock-yards, and of all the civil affairs of the navy, was, until recently, entrusted to certain commissioners appointed by patent, of whom the comptroller of the navy and three surveyors, and seven other commissioners, formed a board at Somerset House, for the general direction and superintendence of the civil concerns of the navy, subject to the control of the lords commissioners of the admiralty. At most of the home yards and of the foreign yards was a commissioner of the navy, who was always a naval officer of the rank of captain. The foreign yards over which a commissioner presided were, Bermuda, Cape of Good Hope, Gibraltar, Halifax, Jamaica, Malta, Quebec, Kingston, including the lake establishments and Trincomalee, which, with the five belonging to the home yards, Woolwich (including Deptford), Chatham, Sheerness, Portsmouth, and Plymouth, made the whole number of commissioners of the navy amount to twenty-four. The salary of each of the home commissioners was L.1000 a year, that of the comptroller L.2000. The salary of the foreign commissioners L.1200 a year, except that of the Cape of Good Hope, which was L.1800, and Trincomalee L.3000 a year. They were also entitled to liberal superannuations when unfit for further service; and, at their death, their widows received a pension for life of L.300 a year. All these have been swept away, and the two great departments, the navy and the victualling offices, have been consolidated with the admiralty, and the details of the business placed under five principal officers, each having a separate department. These are, 1. the surveyor of the navy; 2. the accountant general; 3. the storekeeper general; 4. the comptroller of the victualling and transports; 5. the physician.

Of the treasurer's office.

The treasurer of the navy is a high and responsible officer appointed by the crown, and removeable at pleasure. His salary was L.4000 a year, but it has recently been reduced to L.3000. The establishment of the navy pay-office at Somerset House consists of a paymaster and deputy; three cashiers, one for the navy, one for the victualling, and one for the allotment branch; an accountant;

inspector; a superintendent of the payments of the dock-yards, resident in London; sixty established and eighteen extra clerks, besides six pay clerks and three conductors of money at the four pay ports, Portsmouth, Plymouth, Chatham, and Sheerness.

Victualling establishment.

To each of the four dock-yards, Deptford, Portsmouth, Plymouth, and Chatham, are victualling establishments for supplying the fleet with provisions and water; and also at Dover, Cork, Cape of Good Hope, Gibraltar, and Malta. The victualling board at Somerset House consisted of a chairman and deputy chairman, the former with a salary of L.1200, the latter of L.1000 a year, and five other commissioners with salaries of L.800 a year each; a secretary to the board, and a secretary to the committee of accounts; a registrar of securities, and 136 clerks, with salaries varying from L.800 to L.80 a year, according to their class and length of service. These have all been abolished, and, as before stated, consolidated with the admiralty.

The transport board having been dissolved at the end of the war, its twofold duties were divided between the navy and victualling boards; those which concerned the hiring of transports devolved on the commissioners of the navy, and those which related to the sick and hurt department on the commissioners of the victualling board, on whom also devolves the direction and superintendence of all the naval hospitals at home and abroad. These have also merged in the admiralty.

Officers of the dock-yard; their duties.

The principal officers of an established dock-yard were, 1. the commissioner; 2. the master attendant; 3. the master shipwright; 4. the clerk of the check; 5. the storekeeper; 6. the clerk of the survey; to which have recently been added the subordinate officers of timber-master and the master measurer. By the new regulations, the commissioner has been superseded by a superintendent, the clerk of the check and clerk of the survey abolished, as well as the master measurer, and a store receiver substituted for the timber-master. Many subordinate officers have also been abolished, and the whole system of working the men, keeping the accounts, &c. simplified and amended; and some idea may be collected of the diminution of the expense by the simple fact, that, in the ordinary estimate of the navy for 1817 the establishment of officers in Portsmouth yard was L.50,065, whereas in 1833 it is only L.19,803.

Hitherto the men were usually employed by what was called task and job; but they are now wholly put upon day pay.

The commissioners of naval inquiry (*Sixth Report*) clearly expose the "combination of self-interest which has been permitted to exist against the public in all the persons who were concerned in the accounts of job-work, and the fictitious manner of making up those accounts." The quarter-men, for instance, were paid wages according to the amount of the earnings of the men under their own superintendence, and the accounts of those earnings were taken by themselves. General Bentham has furnished an instance of the gross abuses which existed under the old system of job-work. "By the regulations of the navy board, nothing less than L.5. 2s. was to be paid for the *smallest* repair of a thirty-four feet launch. If the above sum should be found inadequate to the payments for the work done to a boat of this class, the repair was then to be denominated a *middling* repair; in which case L.11. 1s. was the exact sum. Again, if this sum were insufficient, the repair was to be denominated a *large repair;* and in this case, although the value of the workmanship might have exceeded the sum of L.11. 1s. only by a few shillings, the expense was to have appeared in the account as doubled, and set down at L.22. 2s. and nothing less was to be the exact sum paid for this work." Nothing was more common, in estimating a man's wages, than to find him working three or four tides, and very often three nights, in one day. (Bentham's *Services*, &c.) The whole of this system is now done away; and the consequence is, that as much work is performed, and turned out in a more workman-like manner, and a very large saving, both in pay and materials, by resorting to day pay, under proper superintendence. The effect of the change of system, and the reductions that have been made in the establishments at home and abroad, have reduced the expense in the year 1817 from about L.556,000 to L.286,000, making a saving of L.270,000 a year.

DOCTOR, a person who has passed all the degrees of a faculty, and is empowered to teach or practise the same. Thus we say, doctor in divinity, doctor in physic, doctor of laws.

The establishment of the *doctorate*, as now in use amongst us, is ordinarily attributed to Irnerius, who himself drew up the formulary. The first ceremony of this kind was performed at Bologna, in the person of Bulgarus, who began to profess the Roman law, and on that occasion was solemnly promoted to the *doctorate*, that is, installed *juris utriusque doctor*. But the custom was soon transferred from the faculty of law to that of theology; the first instance of which was given in the university of Paris, where Peter Lombard and Gilbert de la Portrée, the two leading divines of those days, were created doctors in theology, *sacræ theologiæ doctores*.

Spelman conceives the title of doctor not to have commenced till after the publication of Lombard's sentences, about the year 1140. Others, however, go much higher, holding Bede to have been the first doctor at Cambridge, and John de Beverley at Oxford, where the latter died in the year 721. But Spelman contends that doctor was not the name of any title or degree in England till the reign of King John, that is, about the year 1207. As to the qualifications or course of study necessary to obtain the degree of doctor in the different faculties of theology, law, and medicine, see the article UNIVERSITIES.

DOCTOR of the Law, a title of honour among the Jews. The investiture, if we may so speak, of this order, was performed by putting a key and a table book in their hands; and this is what some authors imagine our Saviour had in view (Luke, xi. 52) when, speaking of the doctors of the law, he says, "Wo unto you, lawyers! for ye have taken away the key of knowledge; ye enter not in yourselves, and them that were entering in ye hindered."

DOCTOR of the Church, a title given to certain of the fathers whose doctrines and opinions have been the most generally followed and authorized. We usually reckon four doctors of the Greek church and three of the Latin. The former are, St Athanasius, St Basil, St Gregory Nazianzen, and St Chrysostom; the latter are St Jerome, St Augustin, and Gregory the Great. In the Roman breviary there is a particular office for the doctors, which only differs from that of the confessors by the anthem of the Magnificat and the lessons.

DOCTOR is also an appellation adjoined to a specific epithet, expressing the merit of some eminent schoolman. Thus, Alexander Hales is called the irrefragable doctor; Thomas Aquinas, the angelic doctor; St Bonaventure, the seraphic doctor; John Duns Scotus, the subtile doctor; Raimond Lully, the illuminated doctor; Roger Bacon, the admirable doctor; and so of the rest.

Doctor (Διδασκαλος), in the Greek church, is a particular officer, appointed to interpret portions of the Scriptures. He who interprets the gospels is called *doctor of the Gospel;* he who interprets St Paul's Epistles, *doctor of the Apostles;* he who interprets the Psalms, *doctor of the Psalter.*

DOCUMENT, in *Law*, some written monument produced in proof or support of any thing asserted.

DODD, Dr William, an unfortunate English divine, eldest son of the Rev. William Dodd, many years vicar of Bourne, in Lincolnshire, was born in May 1729. He was sent, at the age of sixteen, to the university of Cambridge, where he was admitted a sizar of Clare-Hall in the year 1745. In 1750 he took the degree of B. A. with credit, being upon that occasion in the list of wranglers. On leaving the university, he imprudently married a Miss Mary Perkins in 1751, was ordained a deacon the same year, and priest in 1753, and soon became a popular and celebrated preacher. His first preferment was the lectureship of West-Ham and Bow. In 1754 he was also chosen lecturer of St Olave's, Hart Street; and in 1757 he took the degree of A. M. at Cambridge. He was a strenuous supporter of the Magdalen Hospital, which was founded in 1758, and soon afterwards became preacher at the chapel of that charity. By the patronage of Bishop Squire, he in 1763 obtained a prebend at Brecon; and by the interest of some city friends got himself appointed one of the king's chaplains; soon after which the education of the Earl of Chesterfield was committed to his care. In 1766 he went to Cambridge and took the degree of LL.D. At this period, the estimation in which he was held by the world was sufficient to give him the expectation of preferment, and hopes of riches and honour; and these he might probably have realised had he possessed a portion of common prudence and discretion. But, impatient of his situation, and eager for advancement, he unhappily fell upon means which in the end proved the occasion of his ruin. On the living of St George, Hanover Square, becoming vacant, he wrote an anonymous letter to the chancellor's lady, offering three thousand guineas if, by her assistance, he was promoted to the benefice. This letter having been traced to him, a complaint was immediately made to the king, and Dr Dodd was dismissed with disgrace from his office of chaplain. From this period he lived neglected, if not despised; and as his extravagance still continued, he soon became involved in difficulties, which tempted him to forge a bond on his late pupil Lord Chesterfield, for L.4200, which he actually received. But he was detected, committed to prison, tried at the Old Bailey, found guilty, received sentence of death, and, in spite of numerous applications for mercy, executed at Tyburn on the 27th of June 1777. Dr Dodd was a voluminous writer, and possessed considerable abilities, with but little judgment and much vanity. An accurate list of his various writings is prefixed to his *Thoughts in Prison*, 1781.

DODDRIDGE, Philip, D.D. an eminent Presbyterian minister, was the son of Daniel Doddridge, an oilman in London, where he was born on the 26th of June 1702. Having completed the study of the classics in several schools, he was in 1719 placed under the tuition of the Reverend John Jennings, who kept an academy at Kilworth, in Leicestershire. He was first settled as a minister at Kilworth, where he preached to a small congregation in an obscure village; but, on the death of Mr Jennings, he succeeded to the charge of his academy; and soon afterwards he was chosen minister of a large congregation of Dissenters at Northampton, to which he removed his academy, and where the number of his pupils increased. He instructed his pupils with the freedom and tenderness of a father; and never expected nor desired that they should blindly follow his sentiments, but encouraged them to judge for themselves. He checked any appearance of bigotry and uncharitableness, and endeavoured to cure them by showing what might be said in defence of those principles which they disliked. He died at Lisbon, whither he had gone for the recovery of his health; and his remains were interred in the burying-ground belonging to the British factory there. A handsome monument was erected to his memory in the meeting-house at Northampton, at the expense of the congregation, on which there is an epitaph written by Gilbert West, Esq. He wrote, 1. *Free Thoughts on the most probable means of reviving the Dissenting Interest;* 2. *The Life of Colonel James Gardiner;* 3. *Sermons on the Education of Children;* 4. *The Rise and Progress of Religion in the Soul;* 5. *The Family Expositor*, in 6 vols. 4to; and other works. Since the author's death, a volume of his hymns has been published, and his Theological Lectures. Several of his works have been translated into Dutch, German, and French.

DODECAGON, in *Geometry*, a regular polygon, consisting of twelve equal sides and angles.

DODECAHEDRON, in *Geometry*, one of the platonic bodies, or regular solids, contained under twelve equal and regular pentagons.

DODONA, a town of Thesprotia, in Epirus, or, according to others, in Thessaly, in the neighbourhood of which there was a celebrated oracle of Jupiter. The town and temple of the god were first built by Deucalion, after the universal deluge. It was supposed to be the most ancient oracle of all Greece; and, according to the traditions of the Egyptians mentioned by Herodotus, it was founded by a dove. Two black doves, as he relates, took their flight from the city of Thebes in Egypt; one of which flew to the temple of Jupiter Ammon, and the other to Dodona, where, with a human voice, it acquainted the inhabitants of the country that Jupiter had consecrated the ground, and in future would give oracles. The extensive grove which surrounded Jupiter's temple was endowed with the gift of prophecy; and oracles were frequently delivered by the sacred oaks, and the doves which inhabited the place. This fabulous tradition of the oracular power of the doves is explained by Herodotus, who observes that some Phœnicians carried away two priestesses from Egypt, one of which went to fix her residence at Dodona, where the oracle was established. It may further be observed, that the fable might have been founded upon the double meaning of the word πελειαι, which signifies *doves* in most parts of Greece, whilst in the dialect of the Epirots it means *old women.* In ancient times the oracles were delivered by the murmuring of a neighbouring stream or fountain; but the custom was afterwards changed. Large kettles were suspended in the air near a brazen statue which held a lash in its hand. When the wind blew strong, the statue was agitated and struck against one of the kettles, which communicated the motion to all the rest, and raised that clattering and discordant din, which continued for a while, and from which the artifice of the priests derived the predictions. Some suppose that the noise was occasioned by the shaking of the leaves and boughs of an old oak, which the superstition of the people frequently consulted, and from which they pretended to receive oracles. It may be supposed, with more probability, that the oracles were delivered by the priests, who by artfully concealing themselves behind the oaks, caused the superstitious multitude to believe that the trees were endowed with the power of prophecy. As the ship Argo was built with oaks of the forest of Dodona, there were some beams which gave oracles to the Argonauts, and warned them against the approach of calamity. Within the forest of Dodona there was a stream and a fountain of cool water which had the power of lighting a torch as soon as the latter touched it. This fountain was totally dry at noon day, and was restored to its full course at midnight, from which time till the following noon it began to decrease, and at the usual hour was again deprived of its waters. The oracles of Dodona were generally delivered by women.

DODONIAN (*Dodonæus*), in *Antiquity*, an epithet given to Jupiter, because he was worshipped in a temple built in the forest of Dodona, where there was the most famous, and, it is said, the most ancient, oracle of all Greece. See Dodona.

DODONIDES, the priestesses who gave oracles in the temple of Jupiter in Dodona. According to some traditions, the temple was originally inhabited by seven daughters of Atlas, who nursed Bacchus, and whose names were Ambrosia, Eudora, Pasithoe, Pytho, Plexaure, Coronis, and Tythe or Tyche. In the latter ages the oracles were always delivered by three old women. The Bœotians were the only people of Greece who received their oracles at Dodona from men, for reasons which Strabo in his ninth book fully explains.

DODRANS, in *Antiquity*, three fourths of the *as*. See the article As.

DODSLEY, Robert, an eminent bookseller and ingenious writer, born at Mansfield, in Nottinghamshire, in the year 1703. He was not much indebted to education for his literary reputation, being originally a livery servant; but his natural genius and early passion for reading soon elevated him to a superior station. He wrote an elegant little satirical farce called *The Toyshop*, which was acted with applause in 1735, and which recommended him to the patronage of Mr Pope. The following year he produced the *King and Miller of Mansfield*. The profits of these two farces enabled him to commence bookseller, and his own merit procured him eminence in that profession. He wrote some other dramatic pieces, and published a collection of his works in one volume 8vo, under the modest title of *Trifles*, which was followed by *Public Virtue*, a poem in 4to. Mr Dodsley was the author of the *Economy of Human Life*, a work which acquired considerable celebrity; but for this it is supposed to have been indebted to the mistaken opinion which long prevailed of its being the production of Lord Chesterfield. The name of Dodsley is connected or associated with much of the literature of his time. Among other things he projected the *Annual Register*, in concert with Edmund Burke, who is known to have mainly contributed to its success. It would be tedious and uninteresting to enumerate the various literary enterprises in which he engaged. His personal character was excellent; he observed the strictest integrity in all his dealings; and he lived on easy terms with authors of high rank as well as genius. Dodsley may be considered as one of the founders of a great London bookselling establishment.

DODWELL, Henry, a very learned controversial writer, of English extraction, born at Dublin in 1641. He wrote an incredible number of tracts, but his services were so little acknowledged, that Bishop Burnet and others accuse him of doing more harm than good to the cause of Christianity, by his indiscreet love of paradoxes and novelties, and thus exposing himself to the scoffs of unbelievers. His pamphlet on the immortality of the soul gave rise to the well-known controversy between Mr Collins and Dr Clarke on that subject. He died in 1711.

DOFAR, or Dafar, a seaport of Arabia, in the province of Hadramaut, on the west coast of a bay of the same name in the Arabian Sea. The chief export of this town consists of olibanum. It is governed by a scheik, who is a sovereign prince. The inhabitants behave with civility to Europeans. It is 120 miles north from Cape Fartach.

DOFARY, a town of Arabia, which is now of small size, but was formerly of greater importance, and was destroyed by the Portuguese in 1526. Long. 54. 33. E. Lat. 17. N.

DOG. For an account of the natural history, acquired habits, and general uses, of the various races of this sagacious animal, see *Canis*, in the index to the article Mammalia of this work.

Dog-*Days*. See Canicula.

Dog-Island, or Desventurada, an island in the South Pacific Ocean, about twelve miles in circumference. This island is low and wooded. It was discovered by Le Maire and Schouten. Long. 141. 30. W. Lat. 15. 15. S.

DOGE, the title of the chief magistrate in the republics of Venice and Genoa. The word properly signifies *duke*, being formed from the Latin *dux*; as *dogate* and *dogado* are formed from *ducatus*, a duchy.

The dogate, or office and dignity of doge, was elective; at Venice the doge being elected for life, and at Genoa only for two years. He was addressed under the title of *Serenity*, which among the Venetians was accounted superior to that of highness.

The doge was the chief of the council, and the mouth of the republic; yet the Venetians did not go into mourning at his death, because he was not their sovereign, but only their first minister. In effect, the doge of Venice was merely the phantom or shadow of the majesty of a prince, all the authority being reserved to the republic. He only lent his name to the senate; and the power was diffused throughout the whole body, though the answers were all made in his name. If he gave any answers on his own account, they required to be very cautiously expressed, and in general terms, otherwise he was certain to meet with a reprimand.

Anciently the doges were sovereigns; but afterwards things were much altered; and latterly the prerogatives reserved to the quality of doge were, to give audience to ambassadors, but not to make any answer as from himself in matters of importance; to answer according to his own pleasure to the compliments made to the signory, such answers being of no consequence; and, as first magistrate, to preside at all the councils. The credentials with which the senate furnished its ministers in foreign courts were written in his name, but not signed by him; this was usually done by a secretary of state, who also sealed them with the arms of the republic. The ambassadors directed their dispatches to the doge, and yet he durst not open them except in presence of the counsellors. The money was struck in the doge's name, but not with his stamp or arms. All the magistrates rose and saluted the doge when he came into council; but the doge rose to none except foreign ambassadors. In short, he was a mere pageant of state, and, politically speaking, a nonentity.

The doge nominated to all the benefices in the church of St Mark; he was protector of the Monastery delle Virgine; and bestowed certain petty offices of ushers of the household, called commanders of the palace. His family was not under the jurisdiction of the master of the ceremonies; and his children might have staff officers, and gondoliers in livery.

At the same time his state was tempered with a variety of circumstances, which rendered it exceedingly burdensome. He might not go out of Venice without leave of the council; and if he did, he was liable to receive affronts, without being entitled to demand satisfaction; and should any disorder happen where he was, it belonged not to him, but to the podestà, as being invested with the public authority, to put it down.

The children and brothers of the doge were excluded from all the chief offices of state. They could not receive any benefice from the court of Rome, but were allowed to accept of the cardinalate, as being no benefice, nor including any jurisdiction. The doge could not divest himself of his dignity for his ease; and after his death his conduct was examined by three inquisitors and five correctors, who sifted it with great severity. The office of doge ceased even to have a nominal existence when Venice, "sunk in its glory, decayed in its worth," yielded, almost without a struggle, to the ascendency of republican France.

DOGGER, a Dutch fishing vessel navigated in the German Ocean. It is generally employed in the herring fishery, being equipped with two masts, namely, a mainmast and mizen-mast, and somewhat resembling a ketch.

DOGGERS, in the English alum works, a name given by the workmen to a sort of stone found in the same mines with the true alum rock, and containing some alum, though not nearly so much as the right kind. The county of York, which abounds greatly with the true alum rock, affords also a considerable quantity of these doggers; and in some places they approach so much to the nature of the true rock, that they are wrought to advantage.

DOGMA, a principal maxim, tenet, or settled opinion, particularly with regard to matters of faith and philosophy.

DOGMATICAL, something belonging to a doctrine or opinion. A dogmatical philosopher is one who asserts things positively, in opposition to a sceptic, who doubts of every thing.

DOGMATISTS, a sect of ancient physicians, of which Hippocrates was the first author. They are also called *logici*, or logicians, from their using the rules of logic in subjects of their profession. They laid down definitions and divisions; reduced diseases to certain genera, and these genera to species, furnishing remedies for them all; supposed principles, drew conclusions, and applied these to the particular diseases under consideration. In this sense the dogmatists were contradistinguished from empirics and methodists. They rejected all medicinal virtues which they thought not reducible to manifest qualities; but Galen long ago observed of them, that they must either deny plain matter of fact, or assign but poor causes and reasons for many effects which they pretended to explain.

DOGMELL, St, a town in the county of Pembroke, in South Wales, 238 miles from London, on a promontory on the northern shore of the county. The inhabitants amounted in 1801 to 1379, in 1811 to 1620, in 1821 to 2107, and in 1831 to 2109.

DOHO, a small town of Hindustan, in the province of Agra, tributary to the Mahrattas, and twenty-one miles south-west from Gwalior. Long. 79. 50. E. Lat. 26. 9. N.

DOIG, David, the most learned of Scottish schoolmasters in modern times, was born in the year 1719. His father, who was a small farmer in the county of Forfar, died when he was yet in his infancy; and his mother contracted a second marriage with a worthy man, who, though by no means in affluent circumstances, and soon burdened with children of his own, treated him with the tenderness of a parent. A constitutional defect in his sight prevented him from learning to read till he was twelve years of age, but his subsequent progress was uncommonly rapid. Having for the space of three years attended a parochial school, where he was instructed in writing, arithmetic, and Latin, he became a successful competitor for a *bursary*, or exhibition, in the university of St Andrews. Here he completed the usual course with great approbation; and, having taken the degree of A. B. he enrolled himself as a student of divinity, but his scruples respecting some articles in the Confession of Faith prevented him from entering the church. What those articles were, we have not discovered; but it appears sufficiently evident that his scruples had no reference to the essential doctrines of Christianity. Reconciling himself to the more humble avocations of a parochial schoolmaster, he for a considerable number of years taught the schools of Monifieth in his native county, and of Kennoway and Falkland in the county of Fife. He was afterwards appointed master of the grammar school of Stirling; and this office, as a late writer remarks, he discharged for forty years with the greatest ability, and with the respect and esteem of all who knew him.

His accomplishments, not only as a classical scholar, but as a man of general erudition, procured him no mean reputation long before he was known as an author. Of his extensive knowledge of languages, the earliest specimen which he imparted to the public is to be found in about twenty pages of annotations on the Gaberlunzie-man, inserted in an edition published by his learned friend and neighbour Mr Callander.[1] His contribution is introduced in the following terms: "For the following elucidations of the general principles laid down in the preface, and exemplified in the notes on the foregoing ballad, the public and I are indebted to a learned and worthy friend of the author, whose extensive erudition is only equalled by the modesty and candour conspicuous in his whole deportment. I am sure our learned readers will regret with me, that he has not pushed his researches further than he has done. But from the little he has here given us, the general principles of etymology I have endeavoured to establish will derive new force, and our readers new entertainment." Although his learning did not procure him any academical preferment, it at least procured him a due share of academical honours. On the same day he received a diploma of A. M. from St Andrews, and another of LL. D. from Glasgow.

After an interval of ten years, he published "Two Letters on the Savage State, addressed to the late Lord Kaims." Lond. 1792, 8vo. This work, which consists of 157 crown pages, is dedicated to Dr Horne, bishop of Norwich, and is introduced by a preface written by the author's friend Dr Gleig, a learned episcopalian clergyman of Stirling. The first letter, written in 1775, was sent to Lord Kames, who was passing his Christmas vacation at Blair-Drummond, and who was much struck with the learning and ability of his anonymous correspondent. Having without much difficulty detected the author, he invited him to dine with him next day; when they met and parted with mutual satisfaction, but with no abatement of the confidence of either party in the correctness of his own views as to the primitive condition of the human race. After a very copious and free discussion of the savage state, each of the disputants retained his own opinion; but they nevertheless laid the foundation of a cordial friendship, which continued uninterrupted during the lifetime of the judge, who survived till the year 1782. It was scarcely to be anticipated that his lordship should abandon the favourite paradox which pervades his Sketches of the History of Man; namely, that the tribes of mankind were originally placed in the condition of savages, from which they were enabled to emerge by the slow and gradual operation of certain instinctive principles implanted in their nature. This was a paradox which he did not himself devise, but which had already been exhibited in a variety of shapes by Condillac, Rousseau, Hume, Smith, Monboddo, and divers other speculators. Some of these lovers of wisdom delight in representing the human species as very closely allied to what we venture to describe as the lower animals; and whether the remote ancestors of men were not downright monkies, or at least ourang-outangs, they feel a very philosophical degree of hesitation in deciding. Rousseau is much inclined to doubt whether certain animals resembling the human species, but by travellers supposed to be beasts, either on account of some difference in their external formation, or merely on account of their wanting the faculty of speech, are not in reality savage men, whose race being anciently dispersed in the forests, had never had occasion to develope any of the virtual faculties, had never attained to any degree of perfection, and therefore still continued in the primitive state of nature. A shaggy skin and a long tail he did not consider as infallible marks of distinction between one race of beings and another. If such individuals as Montesquieu, Buffon, Diderot, Duclos, d'Alembert, or Condillac, had appeared in the capacity of travellers into unknown regions, he would have been disposed to listen to them when they affirmed that one animal was a man, and another a beast; but he considers it as a piece of great simplicity to leave such a matter to the decision of stupid travellers, in relation to whom one might sometimes be tempted to raise a question similar to that which they take upon themselves to determine in the case of other animals.[1] The philosophers of this school are clearly of opinion that man, however created, was left to his own unaided exertions in the formation of an articulate language; but they are so intimately acquainted with the texture of human thought, that they find no difficulty in explaining the entire process which he must have followed. Dr Smith has ascertained that "the institution of nouns substantive" must have been one of the first steps towards the formation of language; and by another philosopher the geography of language is adjusted in a manner not less satisfactory: Rousseau thinks it highly probable that articulate speech must have taken its rise in islands, and must there have been carried to perfection before it was known on the continent.

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[1] Two ancient Scottish Poems, the Gaberlunzie-man, and Christ's Kirk on the Green: with notes and observations, by John Callander, Esq. of Craigforth. Edinb. 1782, 8vo.

Dr Doig was of opinion that "had all mankind, without exception, been once in a state of absolute savagism, they would not only have continued in that state, but would have still sunk lower and lower, till they had at last, in a manner, put off the character of humanity, and degraded themselves to the level of the beasts that perish." All the learning, religion, laws, arts, and sciences, and other improvements that have enlightened Europe, a great part of Asia, and the northern coast of Africa, were so many rays diverging from two points, on the banks of the Euphrates and the Nile. In proportion as nations receded from these two sources of humanity and civilization, in the same proportion were they more and more immersed in ignorance and barbarism. "I think it obvious, beyond all possibility of contradiction," he adds, "that all those nations, and societies of men which were removed to a considerable distance from the grand sources of civilization above-mentioned, had early degenerated into a state of savagism; that this degeneracy encreased exactly in proportion to their distance from those two points; that none of those nations who are known to have sunk into that state, ever became civilized, till they had renewed their correspondence with nations, or individuals, who had derived light and knowledge from the oriental sources;[2] that previous to the opening of this correspondence, no one people discovered the least propension or tendency towards culture and civilization; that, consequently, had all mankind been, at any one period, absolute savages, they would have continued in that unhappy state as long as the world existed; that if this train of reasoning should happen to be just, there must always have existed, in some part of the globe, a select society, a civilized race of men, among whom the knowledge of arts and sciences was always preserved, and from whom the blessings of civilization, and a cultivated state of life, were, in process of time, propagated to all the other nations, which at this day enjoy these invaluable benefits." This reasoning, supported with much ingenuity and learning, directly leads to the conclusion, which he leaves the reader to draw for himself, that the scriptural account of the primeval history of the human race is much more consonant with the principles of sound philosophy, than the account devised by the united wisdom of modern philosophers.

His next publication, which is of a very different description, bears the subsequent title: "Extracts from a Poem on the Prospect from Stirling Castle. I. The Vision. II. Carmore and Orma, a love Tale. III. The Garden. IV. The King's Knot. V. Three Hymns, Morning, Noon, and Evening." Stirling, 1796, 4to. The entire publication extends to 35 pages. As a specimen of his English versification, we transcribe a passage from the Vision, in which he introduces the shade of Wallace addressing King Robert the night before the battle of Bannockburn. The hero mentioned in the first verse is Sir John Graham.

> Great was the hero's fall, when squadrons round
> Mow'd by his well-try'd falchion strew'd the ground;
> Thrice blest his envy'd fall, maturely dead,
> Fresh laurels blooming round his sacred head!
> While I by Faction's tumults rudely tost,
> My country thrall'd, my patriot labours lost,
> Betray'd, and basely sold, inglorious died,
> The sport of perjur'd peers and tyrant pride.
> Go, noble Bruce! fulfill thy happier fate,
> On thee new glories smile, new triumphs wait:
> To-morrow's sun, I see the fulgence rise,
> Shall seal thy fame, and waft it to the skies;
> To-morrow's sun shall blast yon barbarous host,
> And chase the cloud that low'rs o'er Scotia's coast.
> Dread not, great sire, their threats or boasted might,
> Their skill in council or their fame in fight.
> Now patriot blood, by impious Edward shed,
> In flaming vengeance bursts o'er Edward's head:
> Far round thy camp, array'd in blazing arms,
> Thy Scotia's slaughtered heroes sound th' alarms;
> On fiery steeds, unseen they watch the fray,
> And spread terrific din, and pale dismay;
> With dreams of conquer'd foes they fan the fire,
> And bid ev'n dastard souls to fame aspire,

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[1] Rousseau, Discours sur l'Origine et les Fondemens de l'Inegalité parmi les Hommes, p. 237. Amst. 1755, 8vo. "Je dis que quand de pareils observateurs affirmeront d'un tel animal que c'est un homme, et d'un autre que c'est une bête, il faudra les en croire; mais ce seroit une grande simplicité de s'en rapporter là dessus à des voyageurs grossiers, sur lesquels on seroit quelque fois tenté de faire la même question qu'ils se mêlent de resoudre sur d'autres animaux."

[2] Relative to the barbarism and civilization of Greece, the following passage occurs in the work of a very ancient philosopher: Πολλακις γαρ και γεγονε και ἐσται βαρβαρος ἡ Ἑλλας, οὐχ ὑπ' ἀνθρωπων μονον γινομενη μεταναστατος, ἀλλα και ὑπ' αὐτης της φυσεως οὐ μειζονος οὐδε μειονος αὐτης γινομενης, ἀλλα και νεοτερας ἀει, και προς ἡμας ἀρχην λαμβανουσης. (Ocellus Lucanus de Universi Natura, cap. iii. edit. Gale 1688.)

With shields of proof thy half-arm'd bands protect,
Each random lance, each wav'ring shaft direct,
Till deeply sped, it reach the deadly wound,
And stretch some champion breathless on the ground,
Till heaps of carnage choak th' impurpled flood,
And all these fields are drench'd in hostile blood.
I see Caernarvon pale, aghast with fear,
Fly swift, great Douglas thundering in his rear:
Ill fare the faithless churl who shelter lends,
And homeward safe the trembling tyrant sends.

These are the only works which Dr Doig published in a separate form. For the reputation of authorship he appears to have felt no particular ambition: he was however an indefatigable student, and wrote many tracts which were never printed, which he probably had no intention of printing. He wrote an elaborate dissertation *On the Ancient Hellenes,* which appeared in the Transactions of the Royal Society of Edinburgh, vol. iii. He afterwards prosecuted the same subject, and transmitted his manuscript to one of the secretaries of the society; but on the decease of that gentleman, no vestige of it could be found among his papers. His contributions to the third edition of the present work, and particularly the article *Philology,* exhibit the most conspicuous monument of his erudition. In the articles *Mysteries* and *Mythology,* although they bear marks of the same hand, he has not taken so wide a range; but the article *Philology* is a long and elaborate treatise, distinguished by ingenuity as well as learning. "In addition," says Lord Woodhouselee, "to the most profound knowledge of the Greek and Latin languages, which he wrote with a classical purity, Dr Doig had successfully studied the Hebrew, Arabic, and other kindred dialects, and was deeply versed in Oriental literature." Of this variegated knowledge he has fully availed himself in his treatise on Philology. That portion of the Encyclopædia Britannica which contains it, was published in London during the same week with a tract on the Greek verb, written by Dr Vincent, afterwards dean of Westminster,[1] "who was so struck with the coincidence of Dr Doig's opinions on many points with his own, that he began an epistolary correspondence with the author; and these two eminent scholars went hand in hand in their researches, and in a free communication of their opinions, with a liberality of sentiment which did honour to both. Such likewise was the conduct of the learned Mr Bryant, who had entered into a correspondence with Dr Doig on the subject of ancient mythology."[2]

Dr Doig, who was married and left descendants, died on the 16th of March 1800, at the mature age of eighty-one. The following epitaph, written by himself, has been engraved on a marble monument erected to his memory by the town of Stirling, where he was respected for his worth, and admired for his learning:

Edidici quædam, perlegi plura, notavi
  Paucula, cum domino mox peritura suo.
Lubrica Pieriæ tentarem præmia palmæ,
  Credulus, ingenio heu nimis alta meo.
Extincto famam ruituro crescere saxo
  Posse putem, vivo quæ mihi nulla fuit?

Of his Latin versification we subjoin a more considerable specimen, which relates to the erection of a monument to the memory of Buchanan.

En, Buchanane, pii, longo post tempore, cives
  Ingenio statuunt hæc monumenta tuo.
Scotia te natum, te Gallia jactat alumnum,
  Te canit Europe, qua plaga cunque patet.
Nil opus est saxo, nil indice: læta sonabunt
  Carmine Levinium sæcula cuncta decus.
Seu decoras Latio divina poemata cultu,
  Seu recinis nugas, ludicra, festa, sales,
Grandia seu tragico devolvis verba cothurno,
  Seu reseras varii claustra viasque poli,
Æmula seu captas Patavî præconia linguæ,
  Fœdera dum patriæ, bella virosque refers,
Eloquio, gravitate, sono, vi, lumine, verbis,
  Æquiparas veteres, exsuperasque novos.
Quod Graii potuere simul, quod Romula virtus,
  Tu solus numeris, arte, lepore potes.
Sin aliqua titubas patriæ labefactus amore,
  Aut nimium vera pro pietate pius,
Ipsa notam lecti Libertas plorat alumni,
  Ipsa tegit lauri Calliopea comis.
Sæpe nitor veri spissis latet obrutus umbris,
  Nec semper Lynceus cuncta videnda videt.

Besides Latin and English poems, Dr Doig left an immense variety of works in manuscript. The subsequent list includes his most considerable treatises. 1. A rational Demonstration of the Divinity and Incarnation of Christ, 36 pp. fol. 2. The History of the Passion, 45 pp. 4to. 3. On Vicarious Punishments, 19 pp. fol. 4. Strictures on Dr Campbell's Translation of the Sermon on the Mount, 15 pp. 4to. 5. An Analysis of the Epistle to the Romans, 48 pp. fol. 6. An Analysis of the Epistle to the Hebrews, 60 pp. 4to. 7. A Dissertation on the Place where the Ark rested after the Deluge, 30 pp. fol. 8. An Essay on the Situation of Tarshish and Ophir, 66 pp. 4to. 9. A Dissertation on the Origin of Idolatry, 21 pp. 4to. 10. An Enquiry into the Origin of Statue-Worship, 84 pp. fol. 11. A Philological Dissertation on Chain and Remphan, 135 pp. fol. 12. A Philological Dissertation on the Gods of the Egyptians, 344 pp. 4to. 13. The History of the Titans, 146 pp. 4to. 14. On the Doctrine of Demons, 199 pp. 4to. 15. Letters on Mr Bryant's Ancient Mythology, 133 pp. fol. 16. An Essay on the Origin of the Greeks, 406 pp. fol. 17. Elucidations of Grecian Antiquities, 98 pp. 4to. 18. On the Origin of the Scots, 33 pp. 4to. 19. On the Origin of Language, 59 pp. fol. 20. Letters to Lord Kames on Language, 112 pp. fol. 21. Strictures on Dr Smith's Considerations on the Formation of Language, 33 pp. fol. 22. Letters to Dr Vincent on the Formation of Greek Verbs, 48 pp. fol. 23. An Essay on the Utility of the Learned Languages, 49 pp. 4to. 24. Figures of Rhetoric poetically described, 16 pp. 4to. (x.)

DOLAH, a town and district of Hindustan, in the province of Gujerat, ceded to the British in 1803. Long. 72. 25. E. Lat. 22. 47. N.

DOLCI, CARLO, or CARLINO, a painter of considerable celebrity, was born at Florence in 1616. He was a disciple of Jacopo Vignali, and when only eleven years of age he attempted a whole figure of St John, which received extraordinary approbation. He afterwards painted a portrait of his mother, and displayed a new and delicate style, which brought him into notice, and procured him extensive employment at Florence and other parts of Italy. Dolci appears to have used his pencil chiefly in sacred subjects, and bestowed much labour on his pictures. In his manner of working he was remarkably slow; and it is said of him that his brain was affected by seeing Luca Giordano dispatch more business in four or five hours than he could have executed in as many months. His works are consequently not numerous. He generally painted in a small size, although there are a few pictures by him as large as life. He died at Florence in 1686, leaving a daughter, Agnese, who also painted historical pieces, and arrived at some degree of excellence in copying the works of her father.

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[1] On this subject, Dr Vincent published two different tracts. The Origination of the Greek Verb; an Hypothesis. Lond. 1794, 8vo. The Greek Verb analyzed; an Hypothesis, in which the Source and Structure of the Greek Language in general is considered. Lond. 1795, 8vo.

[2] Woodhouselee's Memoirs of Lord Kames, vol. ii. p. 142.

Carlo Dolci holds the same rank in the Florentine that Sassoferrato does in the Roman school. Without the possession of much genius or invention, both these artists produced pleasing and highly-finished pictures. The works of Dolci are easily distinguishable by the delicacy of the composition, and by an agreeable tint of colour, improved by judicious management of the chiaro-oscuro, which give his figures a surprising relief. "His pencil," says Pilkington, "was tender, his touch inexpressibly neat, and his colouring transparent; though he has often been censured for the excessive labour bestowed on his pictures, and also for giving his carnations more of the appearance of ivory than the look of flesh." All his best productions are of a devout description, and most frequently represent the patient suffering of Christ, or the sorrows of the Mater Dolorosa. In these the heads are marked with calm, intellectual beauty, and pathetic emotion, and are peculiarly expressive of pure and tranquil devotion. They are full of sensibility, and yet all unstained by earthly passion. There is, we allow, a want of character and deep shadowing in his pictures, but the colouring and general tone accord with the idea of the passion pourtrayed; nothing is turgid or bold, harsh or obtrusive; all is modesty, repose, and placid harmony. The best works of this master are the "St Sebastian;" the "Four Evangelists," at Florence; "Christ breaking the Bread," in the Marquis of Exeter's collection at Burleigh; and several smaller pictures, which are highly valued, and occupy honourable places in the richest galleries. (z. z.)

DOLE, in the Saxon and British tongue, signified a part or portion most commonly of a meadow where several persons had shares. It also still signifies a distribution or dealing of alms, or a liberal gift made by a great man to the people.

DOLE, an arrondissement in the department of Jura, in France, extending over 470 square miles. It is divided into nine cantons, and these into 155 communes, containing 65,380 inhabitants. The chief place, a city of the same name, is in a fine situation on the river Doubs, which winds its way through beautiful meadows. In the neighbourhood are many Roman antiquities, especially of roads and aqueducts. The canal for uniting the Doubs with the Rhone, projected by Bonaparte, commences at this city. It contains 1350 houses, and 8235 inhabitants. It is in long. 5. 25. 1. E. and lat. 47. 2. 45. N.

DOLE, in *Scotch Law*, from the Latin *dolus*, signifies a malevolent intention. It is essential in every crime, that it be committed intentionally, or by an act of the will; and hence the rule, *Crimen dolo contrahitur.*

DOLIAH, a town of Hindustan, in the province of Gujerat, thirty-three miles north-east from Cambay, possessed by independent chiefs. Long. 72. 26. E. Lat. 22. 47. N.

DOLLAR, or THALLER, a silver coin nearly of the value of the Spanish piece of eight, or French crown. Dollars are coined in different parts of Germany and Holland, and have their diminutions, as semi-dollars, quarter-dollars, and the like. See MONEY.

DOLLOND, JOHN, a practical and theoretical optician of the highest celebrity, the discoverer of the laws of the dispersion of light, and inventor of the achromatic telescope, descended from a family of French refugees, was born in London on the 10th June 1706.

His first destination was the manufactory which afforded employment to the greater part of the French colony established in Spittalfields, and he passed some of his earlier years in the mechanical labour of a silk-weaver. He was, however, always attached to the mathematics and to natural philosophy, and he even extended his studies to the outlines of anatomy and of scholastic divinity; and in the pursuit of these objects he found himself obliged to acquire a competent knowledge of the Latin and Greek languages, a task which was much facilitated to him by the possession of a memory no less retentive than his observation was accurate and his reasoning correct. He married early, and he continued in his first occupation till he had established his eldest son, Peter Dollond, who inherited his own tastes as an optical instrument maker; and the success of the undertaking was such as to induce him, in 1752, to leave his own business, and to enter into partnership with his son in Vine Court.

These arrangements having taken place, it was not long before Mr Dollond communicated to the Royal Society some of the results of the application of his inventive powers to his new pursuits; and Mr Short, who then enjoyed the highest reputation as an optician, paid him the compliment of bringing them forward to the Society under the auspices of his name.

1. *A Letter to Mr James Short, F. R. S. concerning an Improvement of Refracting Telescopes. Phil. Trans.* 1753, p. 103. The author here describes a telescope with six glasses, as calculated for correcting, either wholly or in great measure, the errors of refraction arising from the dispersion of the different colours, as well as from the spherical form of the surfaces of the eye-glasses; appealing to the superiority of the telescopes which he had thus constructed, to those which had before been in use; but he reserves a more ample detail of the theory for a future occasion, which, however, does not appear to have presented itself, the improvement having been superseded by others incomparably more important.

2. *A Letter to James Short, A. M. F. R. S. concerning a Mistake in Mr Euler's Theorem for correcting the Aberration in the Object Glasses of Refracting Telescopes;* read 23d November 1752; together with an introductory letter of Mr Short, in which Euler's calculations are somewhat too categorically condemned, and with Euler's answers to Short and Dollond. *Phil. Trans.* 1753, p. 287. It is remarkable with what profound respect the experiments of Newton are treated in Mr Dollond's letter: "It is somewhat strange," he says, "that any body now-a-days should attempt to do that which so long ago has been demonstrated impossible." But although the investigation of truth was perhaps in this instance retarded, yet its ultimate discovery was not prevented by a just deference to a high authority. Euler was, however, certainly right in considering the law which he had assumed as sufficiently compatible with the results of Newton's experiments; although he was much mistaken in his conjectures respecting the achromatic properties of the eye.

3. *A Description of a Contrivance for Measuring Small Angles. Phil. Trans.* 1753, p. 178. This apparatus consists of a divided object-glass, with a scale for determining the distance of the images, by measuring the linear displacement of the two portions of the glass, which subtends the same angle from the focus of parallel rays, as the actual distance of the images does from the object-glass. The apparatus is recommended as particularly calculated to be applied to a reflecting telescope, and was afterwards adapted by Mr Peter Dollond to the improved achromatic telescopes. Mr Savery and Mr Bouguer had before used two separate lenses in a manner nearly similar; but the employment of a single glass divided affords a much more convenient arrangement.

4. *An Explanation of an Instrument for Measuring Small Angles. Phil. Trans.* 1754, p. 551. This paper contains a more detailed theory of the divided object-glass micrometer, and a testimony of its utility from Mr Short, founded on actual experiments.

5. *An Account of some Experiments concerning the Different Refrangibility of Light. Phil. Trans.* 1758, p. 733. We have here the important results of a series of accurate experiments, by which the author had undertaken to investigate the foundations of the Newtonian theory of refraction; though he began them without any hope of a success so brilliant as that which ultimately crowned his labours.

It was in the beginning of 1757 that Mr Dollond made the decisive experiment of putting a common prism of glass into a prismatic vessel of water, and varying the angle of the vessel till the mean refraction of the glass was compensated; when he found that the colours were by no means destroyed, as they were supposed to have been in a similar experiment related by Newton; for the remaining dispersion was nearly as great as that of a prism of glass of half the refracting angle. Mr Dollond then employed a thinner wedge of glass, and found that the image was colourless when the refraction of the water was about one fourth greater than that of the glass. He next attempted to make compound object-glasses by inclosing water between two lenses; but in this arrangement he found great inconvenience from the spherical aberration; so that he was obliged to try the effects of different kinds of glass, and he fortunately discovered that the refractions of flint and crown glass were extremely convenient for his purpose, the image afforded by them being colourless when the angles were to each other nearly as two to three; and hence he inferred that a convex lens of crown glass and a convex one of flint would produce a colourless image when their focal distances were in the same proportion. The spherical aberration, where the curvature was so considerable, still produced some inconvenience; but having four surfaces capable of variation, he was enabled to make the aberrations of the two lenses equal; and since they were in opposite directions, they thus corrected each other. All these arrangements required great accuracy of execution for their complete success; but, in the hands of the inventor, they produced the most admirable instruments, and he was singularly fortunate in obtaining a quantity of glass of more uniform density than has been since manufactured on so large a scale. He afterwards made some small Galilean telescopes with triple object-glasses, and Mr Peter Dollond applied this construction to the longer telescopes with compound eye-pieces, the alteration rendering the spherical aberration still more manageable.

The merits of Mr Dollond's inventions were promptly acknowledged on the part of the Royal Society by the adjudication of the Copleyan medal for the year. In 1761, he was appointed optician to the king, and was elected a fellow of the Royal Society; a distinction which is often obtained on easy terms by those whose situation in life exempts them from the suspicion of seeking it for any purpose degrading to science, but which is generally an object of considerable ambition to persons of mechanical or commercial occupations.

A considerable share of the credit due to Mr Dollond's discoveries has been very erroneously attributed by some late historians and biographers on the Continent to Leonard Euler, a mathematician who most assuredly has little need of the appropriation of the merits of others to establish his claim to immortality. But in fact the only idea of Euler that could be said to have furnished any hint to Mr Dollond, has been shown by the calculations of Dr Maskelyne, and by the experiments of Dr Thomas Young and Dr Wollaston, to have been completely erroneous; nor did Euler even admit the accuracy of Mr Dollond's conclusions after his discovery was made, without considerable hesitation and scepticism. Mr Klingenstierna had simply expressed a doubt with respect to the result of Newton's experiments, though he by no means suspected the extent of the error. Mr Peter Dollond has sufficiently vindicated his father's claim to complete originality, in a paper read to the Royal Society in the year 1789; he has also suggested an explanation of the origin of Newton's mistake, by stating that there exists a kind of Venetian glass, of which the dispersive power little exceeds that of water, whilst its specific gravity nearly approaches to 2·58, which is assigned by Newton to glass in general; and it certainly seems more probable that some such circumstance as this was the cause of the error, than that Newton should, as some have suspected, have mixed acetate of lead with the water which he used, for an experiment which was so much more likely to be satisfactory without it.

Mr Dollond's appearance was somewhat stern, and his language was impressive, but his manners were cheerful and affable. He was in the habit of attending regularly, along with his family, the service of the French Protestant church. He constantly sought his chief amusement in objects connected with the study of those sciences which he had so much contributed to improve. Perhaps, indeed, he pursued them with an application somewhat too intense; for on the 30th of November, as he was reading a new work of Clairaut on the theory of the moon, which had occupied his whole attention for several hours, he had an attack of apoplexy, which shortly became fatal. He left two sons and three daughters. His sons succeeded to his business; and the younger dying a few years afterwards, his place was filled by a nephew, who assumed the family name, and who still conducts the establishment with undiminished respectability and success. (Kelly's *Life of John Dollond, with an Appendix of all the Papers referred to*, 3d edit. 4to, Lond. 1808.) (L. L.)

DOLOMIEU, Deodatus Guy Silvanus Tancred de Gratet de, a distinguished mineralogist and geologist, son of Francis de Gratet de Dolomieu, and Frances de Berenger, was born on the 24th of June 1750, in the province of Dauphiné.

He was admitted a member of the order of Malta during his earliest infancy, as if he had been devoted from his cradle to glory and to misfortune. At eighteen he embarked in one of the galleys belonging to the order, and soon afterwards unhappily found himself under the necessity of fighting a duel, in which his adversary fell. The laws condemned him to die, but he received a pardon from the grand master; it was, however, necessary that it should be approved by the pope, who for a long time refused to confirm it, notwithstanding the solicitations of several European powers in behalf of the offender, until his consent was at last obtained by the Cardinal Torregiani. Dolomieu, in the mean time, was closely imprisoned in the island for nine months, and this period of solitude seems to have contributed materially to increase the seriousness of his character, and to confirm him in a contemplative turn of mind.

At the age of twenty-two he went to Metz as an officer in the regiment of carabineers, in which he had held a commission for seven years; and he displayed great courage and personal activity on occasion of an accidental conflagration which occurred soon afterwards. His leisure hours were employed in the study of chemistry and natural history, with the assistance of Mr Thirion, an apothecary residing in this city. About the same time he also became intimate with De la Rochefoucault, with whom he maintained an unshaken friendship ever after.

1. He commenced his literary career with an *Italian translation of Bergman's Work on Volcanic Substances*, to which he added some *Notes*, and some observations on the *classification* of those substances.

2. He also furnished some *Notes* to a translation of Cronstedt's Mineralogy.

3. In 1775 he published *Researches on the Weight of Bodies at different distances from the Earth's Centre;* and upon the recommendation of La Rochefoucault, was made a correspondent of the Academy of Sciences at Paris. This compliment seems to have contributed to his determination to relinquish his prospects of success in the army, and to devote himself exclusively to science. Having resigned his commission, he commenced his geological labours with a tour in Sicily, Italy, and Switzerland.

4. This expedition afforded him the materials for his *Voyage aux Iles de Lipari, fait en* 1781, which he published in 1783, with some other tracts. He describes a singular kind of volcano at Macaluba, in Sicily, formed by air bubbling up from the crater, and causing its contents to overflow. The *Essay on the Climate of Malta* is rendered inconclusive by the imperfection of the eudiometrical apparatus that was then commonly employed.

5. He spent a part of the same year in examining the effects of the earthquake in Calabria, which are described in his *Mémoire sur les tremblemens de Terre de la Calabrie*, 8vo, Rome, 1784. Among other observations, he notices the singular fact, that all those parts of Calabria to which the earthquake extended are of a calcareous nature, without any traces of volcanic substances.

6. He published, in the *Journal de Physique*, vol. xxv. p. 191, a paper *on the extinct volcanoes* of the Val di Noto in Sicily.

7. His *Mémoire sur les Iles Ponces*, 1788, contains also a catalogue of the productions of Mount Etna, and an account of the eruption of 1787.

At the beginning of the revolution Dolomieu embarked, together with his friend La Rochefoucault, in that which appeared to be the cause of liberty. He was in Paris on the 14th of July, but he did not accept of any office under the newly-modified government. La Rochefoucault soon fell a victim to the horrors of the times. Dolomieu was present in his last moments, and received the affectionate messages which he sent to his mother and his wife, who were more distant witnesses of the dreadful scene.

8. No longer hoping for any benefit to his country from the political events of the day, he appears to have resumed his geological studies in other parts of Europe. In a *Letter on the Origin of Basalt*, dated Rome, 1790, *Journ. Phys.* vol. xxxvii. p. 193, he considers some stones of this description, for instance, the black trapps of Saxony, as the productions of water; and others, particularly the varieties found in the south of Europe, as of volcanic origin.

9. He writes, in 1791, a *Letter from Malta*, describing a species of limestone found in the Tyrol, hard enough to become phosphorescent upon collision, and not effervescing with acids until powdered. It was afterwards called the Dolomite. *Journ. Phys.* vol. xxxix. p. 3.

10. In a paper of *Directions for Naturalists*, he gives some useful advice to the circumnavigators about to sail to the South Seas. *Journ. Phys.* vol. xxxix. p. 310.

11. A series of his essays *On Compound Stones and Rocks* appeared from time to time in the *Journal de Physique*, vol. xxxix. p. 374; vol. xl. p. 41, 203, 372. In these he insists on the necessity of supposing that the ocean must have acted with great violence in reducing the continents into their present state; neither the slow subsidence of a general deluge, nor the continued action of ordinary rivers, being sufficient to explain the phenomena; and he remarks, that a violent agitation, such as must necessarily be supposed to have taken place, would naturally cause several alternations in the state of the waters, like immense waves or tides, which must have contributed to the modifications impressed on the earth's form. Indeed, the facts which support this opinion appear to be so obvious and so numerous, that it is difficult to understand how the opposite hypothesis should ever have become popular.

12. In the same volume there is a short paper *On Petroleum found in Rock Crystal*, and on some elastic fluids obtained from it, p. 318.

13. The progress of his memoirs was now interrupted by the proscription, in which many of the best and wisest of his countrymen were indiscriminately involved. "His duty and his inclination," he says, in a *Note* without a date, "required the devotion of his time and his arm to the defence of his king;" and he was obliged to submit to a temporary dereliction of his pursuits of science. P. 481.

14. But the cause was hopeless, and it was impossible for him to render it any essential service. He soon resumed his pen, and took occasion to express, with great spirit and energy, his political feelings, in his *Memoir on the Physical Constitution of Egypt. Journ. Phys.* vol. xlii. p. 41, 108, 194. In Egypt, he observes, there are many calcareous rocks and sands, which cannot have been brought down by the Nile; but there is also much of the soil which has the appearance of having been derived from the mud, with an admixture of sand only. The same cause, he thinks, may possibly have raised the bed of the river, so that the relative height of the inundations may have been little altered. He conceives that the Delta has increased even in modern times, though far less rapidly than it appears to have done formerly; for he is disposed to admit the credibility of the Homeric account of the distance of the Pharos from the continent, although he attempts to explain a part of the supposed change by the filling up of the lake Mareotis only; and, on the whole, he imagines that about a thousand square leagues of the surface of Egypt have been gained from the sea. He has not, however, thought it necessary to discuss the arguments which Bruce and others have brought against the established opinion, and against the facts asserted by Herodotus in its support; although some of the best informed of modern travellers have allowed the accuracy of Bruce's statements relating to this subject.

15. In a short paper *On the Figured Stones of Florence*, Mr Dolomieu attributes the appearance of the arborescent and architectural figures which characterize them, to the process of slow decomposition and oxidation, gradually producing the stains in the extremely minute fissures, which favour these changes. *Journ. Phys.* vol. xliii. p. 285.

16. Upon the establishment of the school of Mines, in 1795, he accepted the situations of professor of geology and inspector of mines. He was also made one of the original members of the National Institute of Sciences and Arts, then organized by a law of the existing government. From this time he appears to have redoubled the energy with which he had before laboured in the pursuit of natural knowledge, and he published a great number of memoirs in the course of a very few years. One of the first of these consisted of *Observations on a pretended Coal Mine, called the Désirée. Journal des Mines*, year iii. N. ix. p. 45.

17. His *Methodical Distribution of Volcanic Substances* appeared in the new *Journal de Physique*, vol. (i.) xliii. p. 102, 175, 241, 406; vol. (ii.) xliv. p. 81. Of the five classes which he had before proposed in his notes on Bergman, the first comprehends substances actually pro-

duced by volcanoes; the second, substances thrown out by them unaltered; the third, bodies altered by the volcanic vapours; the fourth, bodies altered in the moist way; and the last, substances illustrative of the history of volcanoes only. The subsequent papers are partly continuations of the *Memoirs on Compound Rocks;* and they also relate particularly to the nature of lavas, some of which are shown to be formed from argillaceo-ferruginous stones. The heat of lavas has been pretty accurately entertained, in some cases, by the fusion of silver coins exposed to it, whilst those of copper remained entire; there is, however, an account of a stream of lava over which some nuns are stated to have walked while it was yet fluid; and this circumstance Mr Dolomieu attributes to a mixture of sulphur, which remained melted at a temperature comparatively low. Some objections to this opinion have, however, been advanced by Mr Sage. *Journ. Phys.* vol. xlv. p. 281. *An Explanation of the New Method adopted in the Description of Minerals* was also published in the *Magazin Encyclopédique*, vol. i. p. 35.

18. Among the shorter essays of Mr Dolomieu, we find a *Description of the Beryl. Journ. des Mines*, year iv. Ventose, p. 11.—19. *Description of the Mine of Manganese at Romanèche.* Germinal, p. 27.—20. *Letter on the Heat of Lavas.* Messidor, p. 53.—21. *On Quartzose Concretions*, p. 56.—22. *On Ancient Lithology. Mag. Enc.* i. p. 437.—23. *Description of the Emerald*, ii. p. 17, 145.—24. *A Letter from Berlin on the Magnetic Serpentine*, ii. vol. vi. p. 7.—25. *On the Leucite, or White Garnet. Journ. des Mines*, year v. p. 177.—26. *On the Necessity of Chemical Knowledge to a Mineralogist, and on the term Chrysolith*, p. 365.

27. *An Introductory Discourse on the Study of Geology* appears in the *Journal de Physique*, vol. xlv. p. 256. It was preliminary to a course of lectures on the natural position of minerals, and it contains good and detailed directions for the use of students, with some eloquent advice on the benefits of travelling, and on the merits of temperance and simplicity of manners.

28. In the next volume, p. 203, our author announces the *Discovery of the Crystallized Sulphate of Strontia in Sicily.* It had before been found uncrystallized in France.

29. *On Colour as a Characteristic of Stones. Journ. Phys.* vol. (iii.) xlvi. p. 302. This essay contains some objections to Werner's habit of relying too implicitly on colour, and the white tourmaline of St Gothard is adduced as an instance of the triumph of form over complexion; a just tribute of commendation is also paid to the merits of Haüy.

30. A paper *On the Pyroxene, or Volcanic Schörl*, is chiefly destined to support the opinion that such crystals have been formed previously to the existence of the volcano, by the observation of a specimen found adhering to a rock which had never undergone the effect of fire. *Journ. Phys.* vol. xlvi. p. 306.

31. *A Memoir read to the Institute* contains the report of Mr Dolomieu's mineralogical tours, made in the years 1797 and 1798. *Journ. Phys.* vol. xlvi. p. 401. *Journ. des Mines*, year vi. p. 385. He visited the south of France, the Alps, and the neighbouring lakes and mountains, almost always on foot, and with his hammer in his hand, accompanied by Brochart, Cordier, Bonniers, and his brother-in-law the Marquis de Drée. From his observations in Auvergne, in particular, he concludes that the foundation or origin of the volcanoes there is certainly below the granite rocks, which therefore cannot, properly speaking, be called primitive; and he proceeds to a much bolder and less admissible conjecture, that the central parts of the globe are at present in a state approaching to fluidity, which he attempts to support by the ready transmission of the shocks of earthquakes to distant places; and he even quotes the authority of Lagrange as having been disposed to encourage the opinion. Volcanoes, in general, he divides into ancient and modern, as separated by the intervention of the changes which have reduced the continents to their present form. With respect to the heat of the lava, he observes, that it has not been sufficient to expel the carbonic acid from the limestone which has been exposed to it. He also remarks, that, where basalt in fusion has been suddenly cooled by water, the contraction has caused it to divide into columns, which are not crystalline, because their angles are irregular, and which are smaller and more uniform in proportion as the water is deeper. He contrasts the horizontal strata of France with the vertical tables of the Alps, and particularly describes the accretion of a mantle of calcareous substances, two miles in height, which has attached itself to the north-east faces of the Alps, subsequently to their first formation as mountains. From this expedition he brought home an immense collection of rocks and stones, principally valuable for their arrangement with a view to the illustration of his particular doctrines in geology, which, with the rest of his cabinet, have since formed a part of the superb museum of M. de Drée.

32. He published, about the same time, a paper *On the Mountains of the Vosges. Journ. des Mines*, year vi. p. 315.

33. *Extract of a Report on the Mines of the department of the Lozère*, p. 577.

34. The only communication of Mr Dolomieu printed in the *Memoirs of the Institute*, is rather on a mechanical than a mineralogical subject, containing an *Account of the Art of Making Gun-Flints. M. Math.* vol. iii. p. 348. Nicholson's *Journal*, 8. vol. i. p. 88.

He was engaged, after his return from Switzerland, in some mineralogical contributions to the *Encyclopédie Méthodique*, when he was invited to take a part in the scientific arrangements of the expedition to Egypt. He did not, however, strictly confine himself to this department, but was successfully employed as a negociator for the surrender of Malta. In Egypt he visited the pyramids, and examined some of the mountains which form the limits of the country, but his health soon compelled him to return to Europe. In this voyage the vessel on board of which he had embarked was nearly overwhelmed by a tempest, and appears to have been only saved by the temporary expedient of throwing overboard pounded biscuit mixed with straw, which entered the leaks with the water, and afforded a partial remedy, which was repeated from time to time, until the vessel, at the last extremity, was driven into a port in the Gulf of Tarentum. The counter-revolution of Calabria had occurred but a few days before, and Dolomieu, with his companion Cordier, and many others of his countrymen, were thrown into prison, and they even owed their lives to the great exertions of an individual among the insurgents in their favour. They were afterwards removed to Sicily, but with the loss of their collections and their manuscripts; and Dolomieu being denounced, as a member of the order of Malta, for high treason, was separated from his countrymen, and closely confined in a dungeon. Solicitations were addressed to the king of Naples on his behalf, by the National Institute, by the French government, by the king of Spain, and in the name of the Royal Society of London, although its illustrious president was certainly not "at the time in Sicily," as the *Nouveau Dictionnaire Historique* affirms; but the captive derived essential assistance from the good offices of an English gentleman at Messina, and some Danes accommodated him in his pecuniary arrangements. Whilst still a prisoner, he was appointed successor to Daubenton, at the Museum of Natural History; and the very circumstance of his captivity seemed to give him an advantage over his competitor. In the treaty made by the French with the king of Naples, after the battle of Marengo, it was expressly stipulated that Dolomieu should be set at liberty.

35. Upon his return to Paris he was made a member of the Conservative Senate, and he delivered soon afterwards a course of lectures on the philosophy of mineralogy. He had written part of an essay on this subject during his imprisonment in Sicily, with a bone for a pen, and a mixture of soot and water instead of ink, on the margins of such books as were allowed him; and his last publication was *Sur la Philosophie Minéralogique, et sur l'espèce Minéralogique.* Paris, 1801. His classification depended on considering the species as determined by the integrant molecule, and on arranging the different external forms as varieties, whether regular as modifications, or irregular as imperfections; besides the variations of colour and appearance, and the more essential affections of the consistence of the substance, which may be called contamination; but the whole essay may be considered as rather of a logical than of a physical nature.

After the delivery of his lectures, he set out upon a new expedition to his favourite mountains, in company with Mr Neergard and Mr d'Eymar, who published an account of the journey. Paris, 1802. He meditated a tour into Germany and to the north of Europe; but his return to Paris was interrupted by indisposition, when he had arrived, by way of Lyons, at Chateauneuf, where he met his sister and his brother-in-law, and this journey was his last.

The merits of Dolomieu consisted as much in his personal character as in his scientific attainments. His conversation was modest, though his courage was heroic; his manners were simple though refined; and though his talents were considerable, they seem to have been surpassed by his industry. It has been remarked, that he often undertook more than he had any reasonable prospect of completing; but, in the mean time, he was perhaps as happy in the pursuit as he would have been in the attainment of his object. He died, universally regretted, at Drée, near Maçon, on the 27th of November 1801, in the midst of his affectionate family, who had been the partakers in his pursuits, and the consolation of his misfortunes.

Lacépède, *Notice Historique sur la Vie et les Ouvrages de Dolomieu; Mém. Math. Inst.* vol. vii. 1806, p. 117; Chalmers's *Biographical Dictionary*, vol. xi. 8vo, London, 1818. (L. L.)

DOLORSKOI, a fortress of Asiatic Russia, in the province of Kolhyvane, situated on the river Irkutsk, sixteen miles west from Semipolatnoi.

DOLPHIN ISLANDS, three small islands in the Mergui Archipelago, near the north-east coast of Sullivan's Island. Lat. 11. 14. N.

DOLPHIN *of the Mast*, a peculiar kind of wreath, formed of plaited cordage, to be fastened occasionally round the masts, and the use of which is to sustain the weight of the fore and main yards, in case the rigging or chains by which these yards are suspended should be shot away in the time of battle, a circumstance which might render the sails useless at a season when their assistance is most necessary.

DOLSCHY, a circle in West or Little Wallachia. It is watered by the river Schui, which is divided into two branches, and forms a large island. It contains one city, Krajowa, one market-town, and sixty-four villages.

DOM, or DON, a title of honour, invented and chiefly used, the former by the Portuguese, the latter by the Spaniards. It is an abbreviation of *dominus*, and signifies *sir* or *lord*.

This title, it seems, was first given to Pelayo, in the beginning of the eighth century. In Portugal no person can assume the title of *Dom* without the permission of the king, since it is looked upon as a mark of honour and nobility. In France it is sometimes used among the religious.

DOM AND SOM, in old charters, signifies full property and jurisdiction.

DOMAT, or DAUMAT, JOHN, a celebrated French jurisconsult, born in 1625. Having observed the confused state of the laws, he digested them in four volumes 4to, under the title of *Lois Civiles dans leur Ordre Naturel;* an undertaking for which Louis XIV. settled on him a pension of two thousand livres. Domat was intimate with the famous Pascal, who left him his private papers at his death. He himself died in 1696. Besides the *Lois Civiles,* Domat made in Latin a selection of the most common laws in the collections of Justinian; but this work did not appear until after his death, when it was published separately, under the title of *Legum Delectus.* Subsequently, however, it was united with the *Lois Civiles.* Domat may be regarded as the restorer of reason in jurisprudence.

DOME, in *Architecture*, a spherical roof, or a roof of a spherical form, raised over the middle of a building, as a church, hall, pavilion, vestibule, staircase, or the like. See the article ARCH.

DOME, or *Doom*, signifies judgment, sentence, or decree. The homagers' oath in the black book of Hereford ends thus: "So help me God at his holy dome, and by my trowthe."

DOMEA, a town in the kingdom of Tungquin, situated inland on the Tungquin river. It had a considerable trade in the seventeenth century, and was frequented by a number of Dutch vessels. Long. 106. E. Lat. 20. 40. N.

DOMENICHINO, or DOMENICO, LAMPIERI, the celebrated painter, was born at Bologna in 1581. He was placed when young under the tuition of Denis Calvart; but having been treated with great severity by that master, he left him, and became a pupil in the academy of the Caracci, where he remained for a long time. The genius of Domenichino was slow in its development. He was at first timid and distrustful of his powers; whilst his studious, thoughtful, and reserved manners were misunderstood by his companions for dulness. But the intelligent Annibal Caracci, who observed his faculties with more attention, and knew his abilities better, testified of Domenichino that his apparent slowness of parts would in time produce what would be an honour to the art of painting. When his early productions had brought him into notice, he studied with incredible application, and made such advances in painting as to raise his works into a comparison with those of the most admired masters. From his acting as a continual censor of his own works, he became amongst his fellow pupils the most accurate and expressive designer; his colours were the truest to nature, and of the best *impasto*, and he proved the most universal master in the theory of his art; in short, the only painter amongst them all, in whom Mengs found nothing to desire, except a somewhat larger proportion of elegance. That he might devote his whole being to the art, Domenichino shunned all society, or if he occasionally sought it in the public theatres and walks, it was in order better to observe the play of the passions in the features of the people,—those of joy, anger, grief, terror, and every affection of the mind, and to commit them vividly to his tablets; and thus, says Belloni, it was that he succeeded in delineating the soul, in colouring life, and calling forth heartfelt emotions, at which his works all aim, as if he waved the same wand which had belonged to the poetical enchanters Tasso and Ariosto.

After several years' severe study at Bologna, Domenichino went to Parma, in order to examine the beautiful omenichino.

works of the Lombards, and thence proceeded to Rome, where he assisted Annibal Caracci, and obtained employment through his recommendation from Cardinals Borghese, Farnese, and Aldobrandi, for all of whom he painted works in fresco, which were justly admired. The distinguished reputation which he had acquired excited the jealousy of some of his contemporaries, who represented his very excellencies as defects. Lanfranco in particular, one of his most inveterate enemies, asserted that his Communion of St Jerome was an imitation from Agostino Caracci, and procured an engraving of this master's picture of the same subject, copies of which were circulated for the purpose of showing up Domenichino as a plagiarist. But this stratagem only tended to expose the calumnious intents of his rivals, as it was evident that there was no other resemblance in the compositions than what must necessarily be the case in the pictures of two artists treating the same subject; and that every essential part, and all that was admired in the work, were entirely his own. If it had been possible for the exertions of modest merit to have repelled the shafts of slander, the pictures which he painted immediately afterwards, representing subjects from the life of St Cecilia, might have silenced the attacks of envy and malevolence; but they only increased the alarm of his competitors, and redoubled their injustice and malignity. Disgusted with these cabals, Domenichino left Rome for Bologna, where he remained until he was recalled by Pope Gregory XV., who appointed him principal painter and architect to the pontifical palace. But the persecutions of his enemies continued unabated, and are said to have absolutely wearied out his life. He died, not without suspicion of being poisoned, in 1641.

Domenichino, in correctness of design, expression of the passions, and simplicity and variety in the airs of his heads, is allowed to be little inferior to Raffaelle. "We must," says Lanzi, "despair to find paintings exhibiting richer or more varied ornaments, accessaries more beautifully adapted, or more majestic draperies. The figures are finely disposed both in place and action, conducing to the general effect; whilst a light pervades the whole, which seems to rejoice the spirit, growing brighter and brighter in the aspect of the best countenances, whence they first attract the eye and heart of the beholder." The persons delineated could not tell their tale to the ear more plainly than they speak it to the eye. The Scourging of St Andrew, which he executed in competition with Guido at Rome, is a powerful illustration of this truthful expression. Of the two works of these masters, Annibal Caracci preferred that of Domenichino. It is said that in painting one of the executioners the artist actually threw himself into a passion, using threatening words and actions, and that Annibal Caracci surprising him at that moment, embraced him, exclaiming with joy, "To-day, my dear Domenichino, thou art teaching me." "So novel," remarks Lanzi, "and at the same time so natural, it appeared to him, that the artist, like the orator, should feel within himself all that he is representing to others." Domenichino is universally esteemed as the most distinguished disciple of the Caracci. Algarotti prefers him to the greatest masters; and Nicolo Poussin considered him as the first painter after Raffaelle. His pictures of the Communion of St Jerome, Adam and Eve, and the Martyrdom of St Agnes, are esteemed amongst his best works. Domenichino was unrivalled in his frescos. He excelled also in landscape painting. In that style the beauty arising from the natural and simple elegance of his scenery, his trees, his well-broken grounds, and in particular the character and expression of his figures, gained him as much public admiration as any of his other performances. The worth of Domenichino, as Agucchi foretold, was never rightly appreciated during his lifetime. But the spirit of party which set in so strongly against him whilst living, soon passed away when he was no more; and impartial posterity has done justice to the talents of this illustrious painter, whose works are in the highest esteem, and fetch enormous prices. (Z. Z.)

Domesday.

DOMESDAY or **Doomsday Book**, a most ancient record, made in the time of William the Conqueror, and containing a survey of all the lands of England. It consists of two volumes, namely, a greater and a less. The first is a large folio, written on 382 double pages of vellum, in a small but plain character, each page having a double column. Some of the capital letters and principal passages are touched with red ink, and some have strokes of red ink run across them, as if scratched out. This volume contains the description of thirty-one counties. The other volume is in quarto, written upon 450 double pages of vellum, but in a single column, and in a large but very fair character. It contains the counties of Essex, Norfolk, Suffolk, part of the county of Rutland, included in that of Northampton, and part of Lancashire, in the counties of York and Chester.

This work, according to the red book in the exchequer, was begun by order of William the Conqueror, with the advice of his parliament, in the year 1080, and completed in the year 1086. The reason given for taking this survey, as assigned by several ancient records and historians, was, that every man should be satisfied with his own right, and not usurp with impunity what belonged to another. But besides this, it is stated by others, that all those who possessed landed estates now became vassals to the king, and paid him so much money by way of fee or homage, in proportion to the lands they held; a circumstance which appears very probable, as there was at that time extant a general survey of the whole kingdom, made by order of King Alfred.

For the execution of this survey recorded in Domesday-book, commissioners were sent into every county and shire, and juries summoned in each hundred, out of all orders of freemen, from barons down to the lowest farmers. These commissioners were to be informed by the inhabitants, upon oath, of the name of each manor and that of its owner, also by whom it was held in the time of Edward the Confessor; the number of hides; the quantity of wood, of pasture, and of meadow land; how many ploughs were in the demesne, and how many in the tenanted part of it; how many mills, and how many fish-ponds or fisheries belonged to it; the value of the whole in the time of King Edward, as well as when granted by King William, and at the time of this survey; and also whether it was capable of improvement or of being advanced in value. They were likewise directed to return the tenants of every degree, the quantity of lands then and formerly held by each of them, what was the number of villeins or slaves, and also the number and kinds of their cattle and live stock. These inquisitions being first methodized in the county, were afterwards sent up to the king's exchequer.

This survey, at the time when it was made, gave great offence to the people, and occasioned a suspicion that it was intended for some new impost. But notwithstanding all the precaution taken by the Conqueror to have the survey faithfully and impartially executed, it appears that a false return was given in by some of the commissioners, probably, as is alleged, from a pious motive. This was particularly the case with the abbey of Croyland in Lincolnshire, the possessions of which were greatly underrated, both with regard to quantity and value. Perhaps more of these pious frauds were discovered, as it is said Ralph Flambard, minister to William Rufus, proposed making a fresh and more rigorous inquisition; but this was never carried into operation.

Notwithstanding the proof of its falsehood in some instances, which must throw a suspicion on all others, the authority of Domesday-book was never permitted to be called in question; and when it has been necessary to distinguish whether lands were held in ancient demesne or in any other manner, recourse was always had to Domesday-book, and to it only, in order to determine the doubt. From this definitive authority, from which, as from the sentence pronounced at domesday, or the day of judgment, there could be no appeal, the name of the book is said to have been derived. But Stowe assigns another reason for this appellation, namely, that Domesday-book is a corruption of "*domus Dei* book;" a title given it because heretofore it was deposited in the king's treasury, in a place of the church of Westminster or Winchester called *domus Dei*. From the great care formerly taken to preserve this survey, we may learn the estimation in which it was held. In the dialogue de Sacrariis it is said, *Liber ille* (meaning Domesday-book) *sigilli regis comes est individuus in thesauro*. Until latterly it has been kept under three different locks and keys; one in custody of the treasurer, and the others in that of the two chamberlains of the exchequer. It is now deposited in the chapter-house at Westminster, where it may be consulted, on paying to the proper officers a fee of six-and-eightpence for a search, and fourpence per line for the matter transcribed from it.

Besides the two volumes above mentioned, there is also a third made by order of the same king, and which differs from the others in form rather than in matter. There is likewise a fourth, which is kept in the exchequer, and which, though a very large volume, is only an abridgment of the others. In the remembrancer's office in the exchequer there is kept a fifth book, also called Domesday, which is the same with the fourth book already mentioned. King Alfred had a roll which he called Domesday; and the Domesday-book made by William the Conqueror referred to the time of Edward the Confessor, as that of King Alfred did to the time of Ethelred. As the fourth book of Domesday had many pictures and gilt letters in the beginning, relating to the time of King Edward the Confessor, this led some into an opinion altogether erroneous, namely, that Domesday-book was composed in the reign of King Edward.

DOMESTIC, any man who acts under another, and serves to compose part of his family. Sometimes the term domestics is applied to the wife and children, but most frequently to servants, such as footmen, lacqueys, porters, and the like.

DOMESTIC, *adj.* is sometimes opposed to foreign. Thus "*domestic* occurrences" signify those events which happen in our own country, in contradistinction to those of which we receive intelligence from abroad.

In its more usual acceptation, the term implies something peculiar to *home* or *household*. Thus we speak of *domestic* happiness or pleasures, meaning the pleasures enjoyed in the bosom of one's family; in opposition to those which are found in the bustle of public life, or delusively sought for in the haunts of dissipation.

The solace of domestic enjoyment has been coveted by the wisest and greatest of men. Senators and heroes have shut out the acclamations of an applauding world, in order to enjoy the society of their little ones, and to partake the endearments of family conversation. They knew that even their best friends, in the common intercourse of life, were in some degree actuated by interested motives in displaying their affection; that many of their followers applauded them in hopes of reward; and that the giddy multitude, however zealous, were not always judicious in their approbation. But the attentions paid them at their fire-side, and the smiles which exhilarated their own table, were the genuine result of undissembled love.

"The nursery has often alleviated the fatigues of the bar and the senate-house," says an excellent essayist, (Knox). "Nothing contributes more to raise the gently pleasing emotions than the view of infant innocence enjoying the raptures of a game at play. All the sentiments of uncontrolled nature display themselves to the view, and furnish matter for agreeable reflection to the mind of the philosophical observer. To partake with children in their little pleasures is by no means unmanly. It is one of the purest sources of mirth. It has an influence in amending the heart, which necessarily takes a tincture from the company that surrounds us. Innocence as well as guilt is communicated and increased by the contagion of example. And the great Author of evangelical philosophy has taught us to emulate the simplicity of the infantine age. He seems indeed himself to have been delighted with young children, and found in them what he in vain sought among those who judged themselves their superiors, unpolluted purity of heart.

"Among the great variety of pictures which the vivid imagination of Homer has displayed throughout the Iliad, there is not one more pleasing than the family-piece which represents the parting interview between Hector and Andromache. It deeply interests the heart, while it delights the imagination. The hero ceases to be terrible, that he may become amiable. We admire him while he stands completely armed in the field of battle; but we love him more while he is taking off his helmet, that he may not frighten his little boy with its nodding plumes. We are refreshed with the tender scene of domestic love, while all around breathes rage and discord. We are pleased to see the arm, which is shortly to deal death and destruction among an host of foes, employed in caressing an infant son with the embraces of paternal love. A professed critic would attribute the pleasing effect entirely to contrast; but the heart has declared, previously to the inquiries of criticism, that it is chiefly derived from the satisfaction which we naturally take in beholding great characters engaged in tender and amiable employments.

"But after all that is said of the purity and the solidity of domestic pleasures, they unfortunately appear to a great part of mankind insipid, unmanly, and capable of satisfying none but the weak, the spiritless, the inexperienced, and the effeminate. The pretenders to wit and modern philosophy are often found to renounce the received opinions of prudential conduct, and, while they affect a superior liberality, to regulate their lives by the most selfish principles. Whatever appears to have little tendency to promote personal pleasure and advantage, they leave to be performed by those simple individuals who are dull enough, as they say, to pursue the journey of life by the straight road of common sense. It is true, they will allow that the world must be replenished by a perpetual succession; and it is no less true, that an offspring once introduced into the world requires all the care of painful attention. But let the task be reserved for meaner spirits. If the passions can be gratified without the painful consequences of supporting a family, they eagerly seize the indulgence; but the toil of education they leave to those whom they deem fools enough to take a pleasure in it. There will always be a sufficient number, say they, whose folly will lead them, for the sake of a silly passion called virtuous love, to engage in a life of perpetual anxiety. The fool's paradise, they add with derision, will never be deserted.

"Presumptuous as are all such pretenders to newly-invented systems of life and conduct, it is not to be supposed they will think themselves superior to Cicero. Yet Cicero, with all his liberality of mind, felt the tenderness of conjugal and parental attachment, and acknowledged that at one time he received no satisfaction in any company but that of his wife, his little daughter, and, to use his own epithet, his *honied* young Cicero. The great Sir Thomas More, whom nobody will suspect of narrowness of mind, who, by a very singular treatise, evinced that he was capable of thinking and of choosing for himself, has left it on record that he devoted a great share of his time, from the united motives of duty and delight, to the amusement of his children.

"It will be objected by those who pretend to have formed their ideas of life from actual observation, that domestic happiness, however pleasing in description, like many a poetic dream, is but an alluring picture, designed by a good heart, and painted in glowing colours by a lively fancy. The constant company, they urge, even of those we love, occasions an insipidity. Insipidity grows into disgust. Disgust long continued sours the temper. Peevishness is the natural consequence. The domestic circle becomes the scene of dispute. Mutual antipathy is ingenious in devising mutual torment. Sullen silence or malignant remarks fill up every hour, till the arrival of a stranger causes a temporary restraint, and excites that good humour which ought to be displayed among those whom the bonds of affection and blood have already united.

"Experience, indeed, proves that these remarks are sometimes verified. But that there is much domestic misery is no argument that there is no domestic happiness, or that the evil may not be removed. Natural stupidity, natural ill temper, acquired ill habits, want of education, illiberal manners, and a neglect of the common rules of discretion, will render every species of intercourse disagreeable. When those are united by connubial ties who were separated by natural and inherent diversity, no wonder if that degree of happiness which can only result from a proper union is unknown. In the forced alliance which the poet of Venusium mentions, of the serpent with the dove, of the tiger with the lamb, there can be no love. When we expatiate on the happiness of the domestic group, we presuppose that all who compose it are originally assimilated by affection, and are still kept in union by discreet friendship. When this is not the case, the censure must fall on the discordant disposition of the parties, and not on the essential nature of family intercourse.

"To form under the direction of prudence, and by the impulse of virtuous love, an early conjugal attachment, is one of the best securities of virtue, as well as the most probable means of happiness. The duties which are powerfully called forth by the relations of husband and father, are of that tender kind which inspires goodness and humanity. He who beholds a woman whom he loves, and a helpless infant looking up to him for support, will not easily be induced to indulge in unbecoming extravagance, or devote himself to indolence. He who has a rising family to introduce into a vicious world, will be cautious of setting a bad example, the contagion of which, when it proceeds from parental authority, must be irresistibly malignant. Thus many who, in their individual and unconnected state, would probably have spent a life not only useless to others, but profligate and careless in itself, have become valuable members of the community, and have arrived at a degree of moral improvement to which they would not otherwise have attained.

"The contempt in which domestic pleasures have in modern times been held, is a mark of profligacy. It is also a proof of a prevailing ignorance of real enjoyment. It argues a defect in taste and judgment as well as in morals; for the general voice of the experienced has in all ages declared, that the truest happiness is to be found at home."

DOMFRONT, an arrondissement in the department of the Orne, in France. It is 510 square miles in extent, and is divided into seven cantons, which are subdivided into a hundred communes, containing a population of 117,093 persons. The chief place, a city of the same name, is situated on the river Varenne, and contains 358 houses and 2244 inhabitants. Long. 0. 57. W. Lat. 48. 54. N.

DOMICILE, in *Scotch Law*, is the dwelling-place where a person lives with an intention to remain.

DOMIFYING, in *Astrology*, the dividing or distributing the heavens into twelve houses, in order to erect a theme, or horoscope, by means of six great circles, called *circles of position*.

There are various ways of domifying. That of Regiomontanus, which is the most common, makes the circles of position pass through the intersections of the meridian and the horizon; but others make them pass through the poles of the zodiac.

DOMINANT (from the Latin word *dominari*, to rule or govern), among musicians, is used either as an adjective or substantive; but these different acceptations are far from being indiscriminate. In both senses it is explained by Rousseau. The *dominant* or sensible chord is that which is practised upon the dominant of the tone, and which introduces a perfect cadence. Every perfect major chord becomes a *dominant* chord as soon as the seventh minor is added to it.

DOMINANT (*substantive*). Of the three notes essential to the tone, it is that which is a fifth from the tonic. The tonic and the *dominant* fix the tone, in which they are each of them the fundamental sound of a particular chord; whereas the mediant, which constitutes the mode, has no chord peculiar to itself, and only makes a part of the chord of the tonic.

Rameau gives the general name of *dominant* to every note which carries a chord of the seventh, and distinguishes that which carries the sensible chord by the name of a *tonic dominant;* but on account of the length of the word, this addition to the name has not been adopted by musicians, who continue simply to call that note a *dominant* which is a fifth from the tonic; and they do not call the other notes which carry a fifth of the seventh *dominants*, but *fundamentals*, which is sufficient to render their meaning plain, and to prevent confusion.

A *dominant*, in that species of church music which is called *plain-chant*, is that note which is most frequently repeated or beaten, in whatever degree it may be from the tonic. In this species of music there are *dominants* and *tonics*, but no mediant.

DOMINATION, or DOMINION, in *Theology*, the fourth order of angels or blessed spirits in the celestial hierarchy, reckoning from the seraphim.

ST DOMINGO.

St Domingo.

St Domingo, or Hispaniola, one of the largest and most fertile of the West India islands, extending in length from east to west about 390 miles, and in breadth from 60 to 150 miles, is situated between 17. 37. and 20. 0. north latitude, and between 67. 35. and 74. 15. west longitude. It is called Hayti or the Highland country by the natives, from the mountains with which it abounds, especially in the northern part. The country was formerly divided between the Spaniards, who were the original occupiers, and the French. The last, however, having been expelled by the black population, it became an independent state under the appellation of Hayti; which in 1822, when the Spanish government was overthrown, was extended to the whole country, at that time united under one head. The line of demarcation which separated these two divisions commenced on the south side from the Pedernales or Flint River, and extended in a waving direction to the river Massacre on the north side. The country to the west of this line belonged to the French part, whilst that on the east side formed the Spanish part of the island. By far the greatest portion of the country was in the possession of the Spaniards; their division being reckoned 220 miles in length by 120 in breadth, of which, though a considerable part consists of mountains, these are said to be little inferior in fertility to the champaign country, and to be equally capable of cultivation. The French division is of an extremely irregular figure. The land is deeply penetrated by the Gulf of Gonave, and is in some parts 170 miles in length, whilst in others it is not thirty. It is nearly of the same breadth as the Spanish division.

General description of the coast.

Great part of the coast of this island is rocky and dangerous, affording but an imperfect shelter to vessels overtaken by storms. Many of the shipping places on the southern shore are nothing more than open bays, which lie exposed to the storms and hurricanes of the autumnal months. The harbour of St Domingo, formerly thought so commodious and secure, has become too shallow to admit vessels of large burden. There are, however, besides roadsteads and several small harbours, the bays of Neyba and Ocoa on this coast. Into the first flows the river Neyba, which receives vessels of thirty tons burden; its stream, before entering the ocean, divides itself into various channels, which annually changing, confound the pilot, and render the navigation difficult. These, if they were collected into one, would afford a deeper and safer channel. Ocoa Bay is a large and convenient watering-place, with several small rivers falling into it. The entrance is two leagues across, and it gradually widens to near six. On the east side of this bay is the safe and capacious port of Caldera. On the south-east coast is the great bay of Samana, which, in point of size and situation, is one of the most important on the island. From Cape Raffael, which forms the southern point of entrance into the bay of Samana, to the opposite side of the island or peninsula of Samana, the distance is eighteen miles, which is closed in by a bulwark of rocks and sands, the entrance only being left clear, with a safe and deep channel between the shore of Samana and several detached islands. This bay is about sixty miles deep, and is surrounded on every side by a fertile country, suited to all the purposes of trade. Within the compass of this bay whole fleets might ride at anchor in perfect security. The river Yuna, after being joined by the Cambu, and meandering through the rich plains of La Vega Real, falls into the bay of Samana after a course of nearly one hundred miles. Bahia Ecossaise or Scotch Bay, which is situated on the north side of the peninsula of Samana, is a dangerous rocky place. From thence to Puerto Plata the coast extends about sixty miles in a north-west direction, and in this space stands Balsama Bay, which has only fourteen feet depth of water, and is of difficult navigation. The harbour of Puerto Plata was first discovered by Columbus; the entrance is narrow but safe, and the neighbourhood is rich in every species of woods. There are several other small harbours and bays on this side of the island; but the coast is in general rocky and dangerous.

St Do mingo

Soil an surface.

A country of such magnitude as St Domingo, containing mountains of great height, with valleys of corresponding extent, necessarily comprises great variety of soil. In general, however, it is fertile in the highest degree, being everywhere watered by copious streams, and yielding in abundance every species of vegetable produce which can minister either to the luxury or comfort of man. The soil consists principally of a rich clay, sometimes mixed with gravel, lying on a substratum of rock. That part of the island formerly occupied by the French is mountainous, but fertile and well wooded, and containing mines both of silver and iron. The Spanish part of the island is mountainous in many parts; whilst in other parts the country is spread out into extensive plains. These are generally in a state of nature, covered with herbage, or with woods of immense growth and the most luxuriant foliage. The mountains intersect the island in two principal chains from east to west. From these, secondary and partial ridges diverge irregularly in different directions, forming beautiful and fertile valleys watered by numerous streams. The highest mountains of the interior, particularly those of Cibao, rise to the height of 6000 feet above the level of the sea. To the north of the capital is the valley called Vega Real or Royal Field, which is by far the largest and finest in the island. Westward it extends to the old French line of demarcation, and in this part it is watered by the river Yaque; to the east, where it is watered by the river Yuna for the space of fifty miles, it projects to the head of the bay of Samana, and is watered by numerous smaller streams, which cross it in various directions. This valley may be said to extend in length about eighty leagues, and in breadth from ten to fifteen.

Edwards, in his *Account of the West Indies*, is of opinion that this and several other districts would, under proper management, yield a greater return of sugar and other valuable commodities than all the British colonies in the West Indies. Other plains also of less extent, but of equal fertility and of easy access, are everywhere found interspersed among the mountainous tracts. Westward from St Domingo, along the southern coast, is the valley of the river Banis, extending from Nisao to Ocoa. Here the pasture is good; but the country is not so well watered as in the other parts of the island; an inconvenience which is sensibly felt by the cattle during the dry months. Farther to the westward and to the north other valleys are found; but where the land, as in this island, is everywhere intersected by ranges of mountains, it is impossible, in any general sketch, to describe particularly that continual succession of hill and dale which diversifies the face of the country. Eastward from the capital are those immense plains called Los Llanos, which stretch out to a vast extent on a dead level. They are covered with herbage, and the eye wanders unobstructed over the wide expanse of waving grass, which is occasionally diversified by natural clumps of trees, which seem planted by the hand of man. These plains occupy almost one sixth part of the island, extending nearly to its eastern coast, being a distance of more than ninety miles, by about thirty wide. They form an immense natural meadow, covered with pasture for vast herds of cattle, which belong to more than a hundred different owners.

Climate.

St Domingo is of a hot and moist climate; but the heat is mitigated by the regularity of the sea-breeze, and by the contiguity of the mountains. In the plains the thermometer rises to ninety-six degrees, sometimes to ninety-nine degrees; but in the mountainous tracts it seldom rises above seventy-eight degrees. In the more elevated parts a blanket is not unwelcome during the nights, and in the highest mountains a fire is frequently necessary. In those situations meat may be kept for several days, and in the morning hoar frost is frequent. The seasons, as in tropical countries, are divided into the wet and the dry. The rains are periodical, and are heaviest in May and June, when the rivers, which at other times scarcely supply water for a continued stream, overflow their banks, and, with an impetuous torrent, sweep over the neighbouring plains. The climate of St Domingo is unhealthy to Europeans, owing to these violent heats and heavy rains; and hence all metals, however bright their original polish, soon contract a tarnished appearance. This is more observable on the sea-coast, which is also more unhealthy than the interior parts of the island. Hurricanes are not frequent, but in the southern parts of the island violent gales of wind, generally preceded by a closeness and sultriness in the atmosphere, frequently occur. These, however, are not attended with such fatal effects as the hurricanes in the Windward Islands.

Rivers.

The island of St Domingo abounds in rivers and smaller streams, which flow from the mountains in the interior, in different directions, to the sea. Of these, the principal are the Haina, the Nigua, the Nizao, the Ozama, the Neyba, the Ocoa, the Yanc, and the St Yago or river of Monte Christi. Near the south part of the French line of demarcation is the beautiful lake of Henriquillo, which is about eighteen leagues in circumference; and though it is about eight leagues from the sea, its water is perfectly salt, and of the same specific gravity as that of the ocean. The same fishes are also found in it, such as the shark, seal, porpoise, &c.

Vegetable productions.

The fertile soil of St Domingo is distinguished by the variety of its vegetable productions, many of which are rare and valuable. The mahogany tree grows to a great size, and is of very fine quality. The manchineel tree affords a beautiful species of wood, richly veined like marble, and susceptible of the finest polish. Several species of dye-woods are produced in the forests, though none of them have been tried except fustic. There is a tree called the jagua, the fruit of which is accounted a delicacy by the natives; and of which the juice, as clear as water, makes a stain on linen which is indelible. Different kinds of lignum vitæ are found, as also of several other woods with the same properties, which grow unnoticed and nameless in those unexplored forests. The quiebra hacha or iron-wood, remarkable for hardness, as its name implies, is abundant; and the oak also, which differs in appearance from the European oak, frequently furnishes beams of from sixty to seventy feet in length. On the north side of the island are extensive forests of pine, which is much used for the purposes of ship-building; and Brazil-wood is found in many parts of the coast. The satin-wood of this island is heavier than that of the East Indies, and it takes so fine a polish that it does not require to be varnished. The cotton tree is the largest of all the vegetable productions, and is formed into the lightest and most capacious canoes. Every variety of the palm tree is found in the woods, of which they form a principal ornament. The palmetto or mountain cabbage is an erect and equal tree, which grows to the height of seventy feet, with cabbage at the top. In the congenial soil of this fertile island the sugar-cane, cotton and coffee plants, grow in the greatest luxuriance. There is also the calabash, the fruit of which serves as a substitute for earthen-ware; the plantain, the staff of life in the West Indies; vanilla, which is found indigenous in the unfrequented woods; quassia; simarouba, which is a tall and stately plant, waving gracefully in the wind; sarsaparilla, indigo, tobacco, turmeric, ginger, and rice plants. The fruits and nutritive roots of St Domingo are nearly the same as those of Jamaica; but they are more abundant, and extremely fine. Of these may be enumerated the choux caraib or Indian kale, with a variety of other vegetables that come under the same denomination; the avocato or vegetable mallow, the melon, sapadillo, guava, pine-apple, bread and jack fruit, mango, nuts, rose-apple, plums, &c. of many different species. Flowers in endless variety and splendour adorn the wild scenery of the woods, and exhale their fragrance in the desert air.

Mines.

In addition to all its other valuable productions, this island formerly contained considerable mines of gold, silver, copper, and iron. But the mines of the two former metals have, according to that strange and perverted policy by which Spain has uniformly sought to depress her colonies, been long closed against the industry of the inhabitants, and a military force was even posted at the different mining stations, to prevent those hidden gifts of nature from being brought to light, and converted into active and productive capital, for the improvement of commerce and the benefit of the world at large. St Domingo also produces jasper, porphyry, agates, antimony, of which there is a mine yielding pieces of six and eight pounds; mineral copperas, red ochre in globules as large as a pigeon's egg, amethysts of a transparent violet colour and of an excellent water, and in the Neyba and Hincha rivers pebbles have been found containing brilliants.

Animals.

The indigenous quadrupeds of this island were confined to four species, which the Indians called Hutia, Quemi, Mohuy, and Cory. Of these, all are extinct except the first. St Domingo, however, has procured, by its intercourse with Europe, a new stock of animals, of far more importance than the diminutive species which it has lost. These consist particularly of horned cattle, hogs, sheep, goats, horses, mules, and asses, which have multiplied prodigiously in the wild and extensive pastures of the interior. Wild fowl are abundant, consisting of various species of ducks, wild pigeons, the flamingo, the wild peacock, the nightingale or mocking bird, the banana bird, the Guinea fowl, the ortolan, and parrots of various species. The rivers abound with fish, some of which are very delicate. Turtle of all kinds are taken, and the land-crab is much esteemed. The serpents are not dreaded; but the centipedes, which are frequent in old buildings, are large and dangerous. The scorpion is rarely seen; but the venomous crab-spider, which is equally dangerous, is sometimes met with.

Population.

The island of St Domingo was, as already mentioned, divided between the Spaniards and the French; the latter possessing about a fourth part of it, and the remaining three fourths belonging to the Spaniards. According to the general and best authenticated estimate, the population of the French portion of St Domingo amounted in 1789 to,

Whites	30,826
Free people of colour	27,548
Slaves	465,429

But other statements add about 10,000 or 11,000 to this estimate.

In 1785 the population of the Spanish side of the island amounted to,

Free people of all colours	122,640
Slaves	30,000
	152,640

During the troubles which ensued, no records are to be found, on the truth of which we can rely. But it is certain that the population must have been greatly reduced by emigration and death; many proprietors having emigrated with their slaves both to the American continent and to the neighbouring islands, and great destruction of life having taken place in the bloody transactions which occurred between 1791 and 1820. Humboldt has estimated, though he does not tell on what data, the entire population at 375,000 in 1802; and after the death of Dessalines it has been supposed, though still on uncertain data, to amount to 400,000. Since this period it has greatly increased; and Mr Placide Justin, on information received since April 1825, considers the whole population as amounting to 700,000, whilst by Humboldt it is reckoned at 800,000. Mr Mackenzie, who was appointed in 1826 consul-general in Hayti by the British government, obtained a population return, which was officially made out and laid before the legislative body, in order to apportion the contribution for the purpose of liquidating the French indemnity. According to this official account, in the accuracy of which there is every reason to confide, the population of the French part of St Domingo amounted to 351,716, and that of the Spanish division to 71,223, making together 422,939.

History. This island was discovered by Columbus in 1492, and was soon filled with adventurers, who crowded from Europe to the new world in search of sudden wealth. The natives were reduced to slavery by these settlers, who spread themselves over the island, and by their industry the colony increased rapidly in wealth and prosperity. But as it was chiefly by the desire of gold that settlers were attracted to this distant shore, St Domingo was in its turn abandoned for other countries of greater reputed wealth; and the country gradually declined, and, instead of yielding a revenue, became a burden on the mother country. About the middle of the sixteenth century the island of St Christophers was taken possession of by a mixed colony of French and English, who being attacked by the Spaniards, were forced to fly to the barren isle of Tortuga, where they established themselves, and grew formidable, under the well-known appellation of buccaneers. They at last obtained a firm footing in St Domingo, into which they had made only predatory incursions; and by the treaty of Ryswick that part of the island of which they had obtained possession was ceded to the king of France, who acknowledged these adventurous colonists as his subjects. The French colony languished for a while under the galling restrictions imposed on its trade by the mother country; but these being removed about the year 1722, it attained to the highest pitch of prosperity; and such was its flourishing state when the French revolution commenced in 1789. In St Domingo, as in all the European colonies, the population is composed of three classes, namely, the whites, the people of colour, and the blacks. Of these the whites were the favoured class, who engrossed all public honours and emoluments, and in whose hands all power centred, both civil and military. They considered the people of colour as a degraded caste, with whom it was disgraceful to associate on terms of equality. The black slaves ranked lowest in the scale, and they experienced from both classes all the evils of the most cruel bondage. A society framed of such hostile elements contained in its very constitution the seeds of hatred and contention; and in the course of the revolution which occurred in the mother country these were brought into full activity. The important discussions by which France was at that time agitated kindled a corresponding sensation in the colonies; and the hostile races of the whites and mulattoes were already violently inflamed against each other by the eagerness of their contests, when the national convention, in 1791, passed the memorable decree, giving to the people of colour the unlimited enjoyment of all the rights which were possessed by French citizens; thus at once breaking down all the distinctions which had prevailed in the colony, and which were sanctioned by custom and inveterate prejudice. This decree was received as might have been expected. It excited loud and general disapprobation amongst the whites, who immediately adopted the most violent measures. The national cockade, the badge of their attachment to the revolution and to the mother country, was openly trampled under foot, and the authority of the governor-general and the supremacy of the mother country were equally set at nought. The several parishes proceeded to the election of a new assembly, which accordingly met on the 9th of August, under the title of the general assembly of the French part of St Domingo. The mulattoes in the mean time, alarmed at these proceedings, were collecting in armed bodies for their defence; and the whites were so intent on the meeting of the new colonial assembly that they offered no opposition to these assemblages.

Such was the state of affairs between the two hostile classes of the whites and the mulattoes, when a new and more powerful party, whom all united to oppress, now suddenly combined for their own protection and for the destruction of their enemies. On the 23d of August reports reached the town of the Cape that the negro slaves in the neighbouring parishes were in arms, and that they were destroying the plantations and massacring the inhabitants. This terrible intelligence was confirmed next day in its full extent by crowds of wretched fugitives from the neighbouring country, who, having abandoned their property, were flying to Cape Town from the fury of their savage enemies. The success of this bold and deep-laid conspiracy spread universal consternation amongst the white inhabitants. The citizens in Cape Town were immediately summoned to arms. The women and children were at the same time sent on board the ships in the harbour; the domestic negroes in the town were placed under a strong guard; and the free mulattoes, protected from the hatred of the whites by the timely interposition of the governor and colonial assembly, were enrolled in the militia, their wives and children being left as hostages for their fidelity. Other measures were also adopted to secure the place against any sudden attack of the infuriated slaves. When these precautions had been adopted, several small detachments of troops were sent out to act offensively against the insurgents; but although partial successes were obtained in these encounters, the general result too fatally demonstrated to the white inhabitants their own weakness and the strength of their enemies, whose fearful superiority of numbers, it was evident, would finally decide the contest in their favour. In this destructive war it was calculated that, about two months after its commencement, upwards of 2000 white inhabitants were massacred; that 180 sugar plantations, and about 900 coffee, indigo, and cotton settlements were destroyed, and a thousand families reduced from opulence to misery. Of the insurgents about 10,000 are supposed to have perished in the field, and some hundreds by the hands of the public executioner; and the rebellion, which had been hitherto confined to the northern parts of the island, now began to spread through the western districts, where the blacks were aided by the people of colour, and where, under their united devastations, the country was laid waste for an extent of more than thirty miles.

At length they approached the town of Port-au-Prince with the intention of setting it on fire; and it was with great difficulty that a treaty was concluded by which the place was saved from destruction. This treaty was ratified by the colonial assembly, which also announced its intention of granting an extension of privileges to the free people of colour. But in the mean time the national assembly at home, under an impression of the ruinous consequences of their rash concessions to the people of colour, had voted a repeal of the law which gave them the same privileges as the whites; and the intelligence of this repeal reached the colonies at the time when the colonial assembly was holding out the expectation of general equality and freedom. The mulattoes, therefore, when they heard that the national assembly had repealed their former conciliating act in their favour, imagining that the offer of the whites was an act of concerted treachery to deceive them into a false security, knew no bounds to their indignation. All thoughts of peace were now abandoned; and the general sentiment was that the contest could only be terminated by the final extermination of one or other of the hostile parties. The war assumed a diabolical character of cruelty, each studying to outdo the other in acts of revenge. On both sides all prisoners were either massacred without mercy, or reserved for the more solemn barbarity of a public execution.

The national assembly at home, alarmed by the intelligence of these disorders, sent out three civil commissioners, with full powers to settle all disputes. But their authority soon fell into disrepute. Other commissioners were sent, and along with them 8000 troops. Unlike their predecessors, however, they adopted the most arbitrary measures; and about the beginning of the year 1793 they became absolute masters of the colony. But their severities at last provoked resistance to their authority; and having displaced the governor Galbaud, an officer of artillery, and ordered him to France, he, along with his brother, collected about 1200 seamen, with whom they landed, and being joined by other volunteers, attacked the government house, where the commissioners were posted with their force. A fierce and bloody conflict now took place, which terminated without any decisive advantage on either side, and next day the fighting was continued in the streets of the town with various success. In the beginning of these disorders, the commissioners had sought to strengthen their party by the aid of the revolted blacks; and a body of these auxiliaries, amounting to 3000, now entered the place, which immediately became a horrid and revolting scene of conflagration and slaughter. Men, women, and children, were massacred by these barbarians without distinction. The white inhabitants, flying to the sea for protection, were met by a body of armed mulattoes, by whom they were put to the sword without mercy; the half of the town was consumed by the flames; and the commissioners, themselves affrighted at these disorders, escaped to the sea-shore, whence, under cover of a ship of the line, they viewed with dismay the wide-spreading mischief.

Ever since the commencement of these unhappy disorders, the white inhabitants had emigrated in great numbers to the neighbouring islands, and to the United States of America; and some of the principal inhabitants having repaired to Britain, induced the British government, by their representations, to prepare an armament with a body of troops to co-operate with such of the inhabitants as were desirous of placing themselves under its protection. At this period, according to the accurate information of Edwards, the military force of St Domingo consisted of from 14,000 to 15,000 effective troops, and 25,000 free negroes, mulattoes, and slaves. About 100,000 blacks had retired to the mountains to enjoy a savage independence, and in the northern districts 40,000 slaves still continued in arms. It was in these circumstances that the island was taken possession of in September 1793 by a British force. But though the expedition gained some partial advantages, the climate soon began to make the most dreadful havock amongst the troops, and prevented them from achieving any solid success. Toussaint l'Ouverture, who was appointed general in chief of the black armies of St Domingo in 1797, proved himself an able and an indefatigable enemy; and at length the British were obliged to evacuate the country in the year 1798. On the 1st of July 1801 the independence of St Domingo was formally proclaimed.

But the war in Europe between Great Britain and France being by this time concluded by the peace of Amiens, Bonaparte, now chief consul of France, sent out an armament consisting of twenty-six ships of the line, and 25,000 troops, under the command of General Leclerc, his brother-in-law, for the purpose of reducing the revolted colony of St Domingo. To enter into the details of the barbarous and bloody war now begun against the unfortunate inhabitants of St Domingo would not be consistent with our limits, nor would such a narrative, we are persuaded, be interesting to our readers. It will be sufficient to observe, that the numbers and discipline of the force now landed, joined to the skill of its leaders, overpowered all open resistance in the field; so that the blacks, after several obstinate conflicts, and after burning some of the principal towns, were finally compelled to retire into the inaccessible mountains of the interior, whence they carried on, under their undaunted leader Toussaint, a desultory war against detached parties of their enemies. Elated by this success, Leclerc now threw off the mask, and rashly issued an edict proclaiming the former slavery of the blacks. Toussaint was not slow to profit by this error. Having effected a junction with Christophe, who had still 300 troops under him, and being joined by the cultivators in great numbers, who were no longer deaf to his call, he poured with this collected host like a torrent over the plain; and having everywhere forced the French posts, and driven before him their detached corps, he surrounded the town, to relieve which the French general was compelled to hasten to the spot by forced marches with all the troops he could collect. Here he had recourse to his former arts, and he was but too successful in cajoling the negro chiefs, wearied of war, into a suspension of arms. Having watched his opportunity, he privately seized on Toussaint with his family, and embarked him on board of a frigate for France, where, being thrown into prison, he expired in April 1803.

This act of cruel treachery spread universal alarm among the black chiefs; and Dessalines, Christophe, and Clerveaux soon appeared at the head of considerable bodies of black troops. This last contest for the possession of St Domingo was distinguished by a degree of barbarity which surpasses belief. The whites and the blacks seemed to vie with each other in deeds of cruelty and revenge. Retaliation was the plea still used to sanction every enormity, under which an arrear of vengeance was at length accumulated on both sides, which nothing short of the utter extermination of one of the parties could thoroughly satisfy. The French, however, it was clear, were now gradually losing ground. About the year 1803 they were confined within their fortifications by the vigorous movements of the black armies; and though reinforcements were received from France, the French general was forced to enter into a capitulation with Dessalines, by which he agreed in 1803 to evacuate the whole island. On the 30th November of that year, the standard of the blacks was hoisted in Cape François; and the French troops, amounting to 8000, surrendered themselves prisoners of war to the British squadron, by which they were closely watched. In 1804 a formal declaration of independence was issued, to which were attached all the names of the generals and chiefs. The ancient aboriginal name of Hayti was revived; while Dessalines, whose military talents were in great esteem, was elected governor-general for life; and in October 1804 he was crowned emperor with great pomp. In this situation he began to display all the cruelties of a tyrant, massacring without mercy the white inhabitants, and committing the most barbarous depredations. A conspiracy was in consequence formed against him; and as he was advancing against the insurgents at the head of a few troops, he fell into an ambuscade where he was expecting his own advanced guard, and fell pierced with balls. His power was disputed by various chiefs, of whom those best known and most successful were Petion and Christophe, the former ruling over the north of the island, the latter over the southern districts. Each having a powerful body of adherents, a civil war was the immediate consequence of their rival claims. In this war, which continued for several years, many battles were fought and many lives were lost; but the issue of the struggle was still doubtful, when in the year 1810 a suspension of hostilities took place, though no formal treaty was signed. From this period civil war ceased in the island of St Domingo. Christophe was declared king of Hayti under the title of Henry I.; and, in imitation of other monarchs, he created various orders of nobility, together with numerous officers of state. He assumed to himself absolute power, and committed the greatest cruelties, according to the mere caprice of his own arbitrary will. His tyranny produced general discontent, and at last an insurrection against him. Being deserted by his troops, he anticipated with his own hand the fate which awaited him. On the 20th of October 1820 he retired to his chamber, where he discharged two pistols, one through his head and the other through his heart, and instantly fell dead, before any alarm could be given. Petion died in March 1818, after having presided over the republic upwards of eleven years. He was succeeded by General Boyer, who ruled over the northern division of the island until the year 1820; when taking advantage of the death of Christophe, and the confusion occasioned by that event, he pressed forward with a considerable force, and took possession of every strong place in the kingdom; and in this manner the whole French division of St Domingo was for the first time united under one ruler. The Spanish division of the island had been ceded to France in 1795 by the treaty of Basle, but it was restored to Spain by the peace of 1814. The feeble government of the mother country, however, was no longer able to control the revolutionary spirit which prevailed in the colony; and in November 1821 the Spanish governor was arrested by the insurgent party, headed by a lawyer of the name of Nunez, and a declaration of independence immediately issued. A strong party afterwards appeared in favour of a union of the whole island under one chief. On the 21st of January 1822 the Haytian flag was first displayed in the city of St Domingo; and on the 9th the keys of the city, and with them the dominion of the whole island, were surrendered to President Boyer. The independence of the new state was recognised by the mother country in 1825, on condition that its ports should be open to the ships of all nations; that French vessels should pay only half duties; and that 150,000,000 of francs should be paid as an indemnity, in five equal payments, the first on the 31st December 1825. Thus, after a series of struggles, beyond all example bloody and ferocious, the whole island of Hispaniola, with its adjacent islets, is now subject to one government, under the title of the Republic of Hayti.

An independent nation of revolted slaves is a novelty in the political world; and its constitution, laws, policy, and trade, form an interesting subject of inquiry. The original constitution of 1806, which was devised for this state, was founded on the model of the American democracy, but was in all respects very ill adapted to the emancipated blacks of St Domingo. The report of the constituent assembly, on which it is founded, is a mere exposition of abstract principles inapplicable to the condition of the community for whose use it was designed; and accordingly this constitution, framed upon the American model, is in practice an absolute elective monarchy, under the forms of a republic. The president-general, Jean Pierre Boyer, holds his office for life, and has the right of appointing his successor. There are two legislative bodies, the senate and house of representatives, who have the power of making laws, of approving or rejecting all treaties, and of negativing the president's choice of a successor. But the whole efficient authority is nevertheless wielded by the first magistrate, who has the entire patronage of the state, civil as well as military; and who has the means of controlling the legislative bodies, and rendering them subservient to his will. He proposes to the commons all the laws except those connected with taxes; he is charged with the duties of the executive, maintaining foreign and domestic peace, and declaring war, subject, however, to the approbation of the senate. He can also issue proclamations in conformity to the laws, and to these he can compel obedience; and he has the command of the armed force. In the case of every vacancy in the senate, he supplies three names, from which a new candidate must be chosen; so that the senate are in some measure his nominees. He has besides the appointment of every public functionary, and the power to dismiss them; the practice of the constitution thus varies entirely from its theory, being little else than a rude military despotism. How far the actual condition of the Haytians under their present ruler is comfortable or otherwise, whether the laws are duly administered for the protection of civil rights, and how far a liberal spirit actuates the government on these and other topics, we are not very fully informed. It is certain that the education of the people is an object of public solicitude. But though seminaries for this purpose have been established by the government, no zeal for instruction has been evinced by the people; and hence the progress of improvement has hitherto been slow. The Catholic still continues the religion of the state, though the various revolutions which have taken place have impaired the wealth and influence of the priests. The most perfect toleration is established; and public offices, whether civil or military, are open to all, whatever may be their religious creed. Besides the higher courts, which have a supreme jurisdiction, there are eight local tribunals for the trial of civil and criminal cases; and in these trial by jury has lately been introduced. From the peculiar origin and character of the Hayti community, idleness, of which the law of other countries takes no cognisance, is here punishable by imprisonment and by flogging; and every successive government has found it necessary to apply this stimulus to the languishing industry of the revolted negroes. The last law on the subject is the *code rural*, which declares that all persons must cultivate the earth, directs the mode of managing landed property, of regulating the rural police, of repressing vagrancy by converting reputed vagabonds, who may be condemned to labour on the public works, or sent to prison until they make a contract to labour for individuals.

But notwithstanding those severe laws, this fertile island, according to Mr Mackenzie, has not yet become the seat of industry and of commerce. It has never recovered from the fearful devastations to which it was exposed in the long course of the wars and bloody dissensions which followed the emancipation of the slaves. It was formerly distinguished above all the other West India islands for its beauty and fertility, and for its fine cultivation, and abundant produce of sugar, its great staple. Its sugar-works, and the magnificent aqueducts for the irrigation of its fertile plains, are now destroyed, and scarcely any sugar is produced for exportation. We learn, from the well-informed author of the *Notes on Hayti*,[1] that in 1789, the exportation of clayed sugar from St Domingo amounted to 47,500,000 French pounds; under Toussaint's government it had diminished to 16,500 pounds; and in 1818 to 190 pounds. The exportation of raw sugar in 1789 exceeded 93,500,000 French pounds; in 1801 it had fallen off to 18,500,000 pounds; and it progressively declined, till, in 1825 and 1826, it again advanced to nearly 33,000 pounds. The produce and exportation of coffee has declined in a similar proportion. In 1789 the export of this article amounted to 76,835,219 pounds, in 1801 it had declined to 43,420,270 pounds; and in 1825 and 1826 it amounted only to about 30,000,000 of pounds. Cacao was never exported in great quantities by the French colonists; nor was any great attention paid to the cultivation of indigo, of which the export amounted in 1789 to 750,000 pounds. It has now altogether ceased. Molasses or syrup was never exported in any great quantity, owing to the greater perfection of the colonists in the art of making sugar. With the decline of this more valuable cultivation, its export has increased from 25,749 pounds, its amount in 1789, to 211,927 pounds in 1822. The growth of tobacco has been greatly extended; and cigars are manufactured in great quantities, both for home and foreign use. The French exported no dye-woods, such as logwood, fustic, and lignum-vitæ. But the indolent natives of St Domingo, declining the more laborious process of sugar-cultivation, for which they have neither industry nor capital, have greatly enlarged this branch of trade, having in 1801 exported of dye-woods 6,768,634 pounds. This trade still continues to flourish, about five or six millions of pounds of the commodity being annually exported. For a like reason the exportation of mahogany has increased from about 5000 cubic feet, its amount prior to the year 1800, to 2,000,000, and in some years to 3,000,000 of feet; another fact, which, according to Mr Mackenzie, proves the decline of systematic regular industry, "and of the advance of whatever, though chiefly done by nature, may be finished at uncertain periods by man." Such is the account given by Mr Mackenzie. But it is proper to add, that there are other and different accounts from respectable eye-witnesses, who state, that the negroes are industrious of themselves, that agriculture is in a rapidly improving state, and that the products and wealth of the island are annually increasing.

The principal imports are, from Great Britain printed cottons and muslins of all kinds, cotton cambrics, handkerchiefs, checks, dimities, stockings, quiltings, ginghams, Irish and brown linens, osnaburgs, cotton and coffee bagging, woollen cloths, ironmongery, tin ware, Staffordshire ware, glass, cutlery, and paints. France supplies wines, cheese, taffetas, beer, liqueurs, brandy, oil, silk shawls, silk stockings, satins, linens, boots and shoes, toys, ribbons, parasols, gloves, cambrics, Indiennes, saddlery, hardware, military accoutrements and decorations, perfumery, confectionary, preserved fruits, &c. From Holland the importations are small, and consist of linens of different qualities, chiefly German, cotton and coffee bagging, Russia duck, linen checks, inferior woollens, German wines, provisions, and hardware. The small shipments from Germany consist of the same articles; and from the United States are received chiefly lumber, provisions, candles, mostly spermaceti, soap, tar, pitch, rosin, turpentine and other naval stores, gunpowder, anchors, cordage, copper, oils, nails, pig and sheet lead and shot, leather, India silks, Madras handkerchiefs, besides other lesser articles.

The commerce of the country is oppressed by burdensome restrictions and by heavy duties. All foreign merchants are obliged to take out, at an expense of from 1600 to 2000 dollars, a patent to allow them to carry on a wholesale business at any of the ports, not with each other, but only with the inhabitants. Heavy taxes have also been imposed to pay the French indemnity given to procure the acknowledgment of independence. All foreign merchandise is subjected to a duty of twelve per cent., but French ships are only liable to half-duties. Certain enumerated articles, such as arms, ammunition, and warlike stores, gold, silver, &c. are admitted duty free.

Military force.

The military force of the kingdom of Hayti consists of thirty-three regiments of the line, amounting to 28,600 men. Of these, according to the accurate account of Mr Mackenzie, there are two regiments of dragoons, amounting to 576 men without the staff, and five regiments of artillery, amounting to 4500 men. There is besides the guard of the president, consisting of three troops of cavalry, amounting to 864 men, and two regiments of infantry, amounting to 600 men. The corps of gens-d'armerie consist of forty-eight troops of cavalry, fifty men in each; and there are, moreover, eight companies of police. There is, besides, the national guard, in which every Haytian serves from the age of fifteen to sixty. (F.)

DOMINIC DE GUZMAN, founder of the Dominican order of monks, was born at Calahorra, anciently called Calagora, in Old Castille, in 1170. He preached with great fury against the Albigenses when Pope Innocent III. published a crusade against that unhappy people; and he was appointed inquisitor in Languedoc, where he founded his order, and had influence enough to get it confirmed by the Lateran council in 1215. He died at Bologna in 1221, in the fifty-first year of his age, and was afterwards canonized. The Dominican order has produced many illustrious men.

DOMINICA, one of the Caribbee Islands, in the West Indies, about twenty-nine miles long and sixteen broad, situated between 61 and 62 degrees of west longitude, and between 15 and 16 of north latitude. It was so called by Columbus, from its being discovered on a Sunday. The value of this island must not be judged of merely by its productions; for its situation enabled the British, in time of war, to intercept the communication between France and her colonies. The soil is light, and adapted for the growth of coffee; the hills, from which several rivers descend, are covered with the finest wood in the West Indies; and several valuable sulphur mines have been discovered in it. Dominica, on account of its importance, has been raised to the rank of a distinct government. The staple commodities are maize, cotton, cocoa, and tobacco. In this island the black and coloured population is to the white nearly as twenty to one.

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[1] See *Notes on Hayti*, by Charles Mackenzie, Esq. vol. ii. p. 158.

DOMINICA, one of the Marquesas Islands called Hiwaoa, Heevaroa, O-heeva-oa, or Ohiwana, by the natives. It is about eighteen miles in length and forty-five in circumference, being full of rugged hills rising in ridges directly from the sea, and separated by deep valleys, which, as well as the sides of the hills, are clothed with wood. It is separated by a channel two miles wide from Tuchuata or St Christina Island.

DOMINICAL LETTER, popularly called *Sunday Letter*, one of the seven letters A B C D E F G, used in almanacks, ephemerides, and the like, to denote the Sundays throughout the year. See CHRONOLOGY. The word is formed from *Dominica* or *Dominicus dies*, the Lord's day, or Sunday. The dominical letters were introduced into the calendar by the primitive Christians instead of the *nundinal* letters in the Roman calendar.

DOMINICAL, in *Ecclesiastical History*. The council of Auxerre, held in 578, decreed that women should communicate with their dominical. Some authors contend that this dominical was a linen cloth, in which they received the species, not being allowed to receive them in the bare hand; whilst others think it a kind of veil wherewith they covered the head. The most probable account is, that it was a sort of linen cloth or handkerchief in which they received and preserved the eucharist in times of persecution, to be taken upon occasion at home. That this was the case appears by the practice of the first Christians, and by Tertullian's book *Ad Uxorem*.

DOMINICANS, an order of religious persons, called in some places *Jacobins*, and in others *Predicants* or *Preaching Friars*.

The Dominicans took their name from their founder Dominic de Guzman, a Spanish gentleman of Calahorra, in Old Castille. He was first canon and archdeacon of Ossuna; and afterwards, as above stated, preached with great zeal and vehemence against the Albigenses in Languedoc, where he laid the first foundation of his order. It was approved of in 1215 by Innocent III., and confirmed in 1216 by a bull of Honorius III. under the title of St Augustin; to which Dominic added several austere precepts and observances, obliging the brethren to take a vow of absolute poverty, to abandon entirely all their revenues and possessions, and to assume the title of *Preaching Friars*, because public instruction was the main object and end of their institution.

The first convent was founded at Toulouse by the bishop of that place and Simon de Montfort. Two years afterwards another was established at Paris, near the bishop's house; and some time subsequently a third in the rue St Jacques, whence the denomination of *Jacobins*.

Immediately before his death Dominic sent Gilbert de Fresney, with twelve of the brethren, into England, where they founded their first monastery at Oxford in the year 1221, and soon afterwards another at London. In the year 1276 the mayor and aldermen of the city of London gave them two whole streets by the river Thames, where they erected a very commodious convent, whence that place is still called Black-Friars, from the name by which the Dominicans were called in England.

St Dominic at first only took the habit of the regular canons, that is, a black cassock and rochet; but this he quitted in 1219 for that which the order afterwards wore, and which, it is pretended, was shown by the blessed Virgin herself to the beatified Renaud d'Orleans.

This order gradually diffused itself throughout the whole known world. It had forty-five provinces under the general, who resided at Rome; and twelve particular congregations or reforms, governed by twelve vicars general.

Out of this order proceeded three popes, above sixty cardinals, several patriarchs, a hundred and fifty archbishops, and about eight hundred bishops; besides masters of the sacred palace, whose office has been constantly discharged by a religious person of this order ever since the time of St Dominic, who held it under Honorius III. in 1218.

Of all the monastic orders, none enjoyed a higher degree of power and authority than the Dominican friars, whose credit was great, and their influence universal. But the measures which they used in order to maintain and extend their authority were so perfidious and cruel, that towards the beginning of the sixteenth century their influence began to decline. The tragic story of Jetzer, at Bern, in 1509, during which there occurred an uninteresting dispute between them and the Franciscans, relating to the immaculate conception, must ever reflect indelible infamy on this order. An account of it will be found in Burnet's *Travels through France, Italy, Germany, and Switzerland* (p. 31), and also in Mosheim's *Ecclesiastical History* (vol. iii. p. 294, 8vo). They were indeed perpetually employed in stigmatizing with the opprobrious name of heresy numbers of learned and pious men; in encroaching upon the rights and property of others, in order to augment their possessions; and in laying the most iniquitous snares and stratagems for the destruction of their adversaries. They were also the principal counsellors by whose instigation and advice Leo X. determined on the public condemnation of Luther. The papal see never had more active and useful abettors than this order and that of the Jesuits. The dogmas of the Dominicans are usually opposite to those of the Franciscans.

DOMINIS, MARK ANTONY DE, archbishop of Spalatro, in Dalmatia, at the close of the fifteenth and beginning of the sixteenth century, was a man whose fickleness in religion proved his ruin. His preferment, instead of attaching him to the church of Rome, rendered him disaffected to it. Having become acquainted with the English bishop Bedell, whilst chaplain to Sir Henry Wotton, ambassador from James I. at Venice, he communicated to that prelate his books *De Republica Ecclesiastica*, which were afterwards published at London, with Bedell's corrections. He came to England with Bedell, where he was received with great respect, and preached and wrote against the Roman Catholic religion. He is said to have had a principal hand in publishing Father Paul's *History of the Council of Trent*, at London, which was inscribed to James in 1619. But on the promotion of Pope Gregory XIV. who had been his schoolfellow and old acquaintance, he was deluded by Gondomar the Spanish ambassador into the hopes of procuring a cardinal's hat, by which he fancied he should prove an instrument of great reformation to the church. Accordingly he returned to Rome in 1622, recanted his errors, and was at first well received; but he afterwards wrote letters to England recanting his recantation, and these being intercepted, he was imprisoned by Pope Urban VIII. and died in 1625. He was also the author of the first philosophical explanation of the rainbow, which before his time was regarded as a prodigy.

DOMINIUM DIRECTUM, in *Feudal Law*, the right which a superior retains in his lands, notwithstanding the feudal grant to his vassal.

DOMINIUM *Utile*, in *Feudal Law*, the right which the vassal acquires in the lands by the feudal grant from his superior.

DOMINUS, in ancient times, a title prefixed to a name, usually to denote that the person was either a knight or a clergyman. The title was sometimes also given to a gentleman not dubbed, especially if he were lord of a manor. In Holland the title *dominus* is still retained, to distinguish a minister of the reformed church.

DOMO D'OSSOLO, a province of the kingdom of Sardinia, the northernmost of the whole dominion. Its extent is 366 square miles, or 234,240 English acres. It contains sixty-nine market towns and villages, but no city, and only 20,750 inhabitants. The chief place, of the same name, is situated on the river Toccia, in a valley where the road over the Simplon ends. It contains 1260 inhabitants.

DOMUS, a town of Hindustan, in the province of Gujerat, situated at the mouth of the Tuptee, fifteen miles south-west from Surat. Long. 72. 53. E. Lat. 21. 5. N.

DON, or Tanais, a river of Russia, which takes its rise from the small lake of St John, near Tula, in the government of Moscow, and passing through part of the province of Voronetz, a small portion of the Ukraina-Slobodskaia, and the whole province of Azof, divides itself near Tscherkask into three streams, and falls in these separate branches into the Sea of Azof. This river has so many windings, is in many parts so shallow, and abounds with such numerous shoals, as to be scarcely navigable, excepting in the spring, upon the melting of the snows; and its mouth is also so choked up with sand that only flat-bottomed vessels, excepting in the same season, can pass into the Sea of Azof. The banks of the Don, and of the rivulets which fall into it, are clothed with large tracts of forest, the timber of which is floated down the stream to St Demetri and Rostof, where the frigates for the Sea of Azof are chiefly constructed. The navigation of the Don, Mr Cox observes, may possibly hereafter be rendered highly valuable, by conveying to the Black Sea the iron of Siberia, the Chinese goods, and the Persian merchandise; which latter commodities, as well as the products of India, formerly found their way into Europe through this same channel.

Don is also the name of a river in Scotland, which is noticed under the article Aberdeen.

Don *Kossacks*, land of, a province of Russia in Europe, taking its name from the river anciently called the Tanais, which passes through it, and falls into the Sea of Azof. It extends from 46. 7. to 51 .4. north latitude, and from 37. 15. to 44. 34. east longitude, and contains 79,442 square miles, or 50,842,000 English acres, being nearly equal to England and Scotland. The whole district is a plain, except on the south-east part, where a low range of hills, a continuation of the Caucasian range, extends into the steppes. The soil is dry, consisting for the most part of a sandy clay; but near the rivers it is highly fertile. The grass on the land is not thick, and the herds of cattle require a large space to feed upon. Besides the Don, it has some streams which mostly empty themselves into that river, but in summer they are nearly dry. Agriculture is but little pursued, and the corn raised is barely sufficient for the consumption. The breeding of cattle, especially of horses, is the chief occupation. Even the common Kossacks have from ten to a hundred horses, and many of the richer class from five hundred to a thousand. The fishing on the rivers and lakes is the branch of industry next in importance to the breeding of cattle. By a census taken in 1796, the inhabitants were 366,247: they are known to have increased since, and were estimated in 1827 as amounting to at least 500,000. The feudal system prevails, the land is held by military tenure, and every man is a soldier. The country is divided into seven circles. The chief city is Tscherkask, situated on an arm of the Don, and said to contain about 15,000 inhabitants.

DONALDSON, Walter, a learned Scotish writer of the seventeenth century, was a native of Aberdeen, but the period of his birth has not been specified. His father was Alexander Donaldson, who is described as an esquire, his mother was Elizabeth the daughter of David Lamb of Dunkenny.[1] In his youth, as he himself informs us, he attended David Cunningham, bishop of Aberdeen, and Sir Peter Young, during their embassy to the king of Denmark and to some of the princes of Germany. He returned to Scotland, but after a short residence he again visited the continent; and he now prosecuted his studies in the university of Heidelberg, where the civil law was ably taught by the elder Gothofredus. It was perhaps in this university that he took the degree of LL. D.[2] While he resided at Heidelberg, he appears to have taken private pupils; for he mentions that he there read to some students a synopsis of ethics, which a young man named Werner Becker, a native of Riga, published without his consent or knowledge. This work, which was reprinted in Britain as well as in Germany, bears the title of "Synopsis Moralis Philosophiæ, iii. libris." *Ex officina Paltheniorum*, 1604, 8vo. He likewise complains that Keckermann had too unscrupulously availed himself of his labours, and he specifies a curious instance of this plagiarism. Donaldson afterwards settled in France, where he was appointed principal of the College of Sedan, and at the same time discharged the duties of professor of moral and natural philosophy, and of the Greek language; so that his attainments must have been various, and his labours not inconsiderable. In this protestant seminary he was associated with two of his learned countrymen: Andrew Melville was one of the professors of divinity, and John Smith was one of the professors of philosophy.[3] His next publication, an arrangement in Greek and Latin of passages extracted from Diogenes Laertius, is entitled "Synopsis Locorum Communium, in qua Philosophiæ Ortus, Progressus, &c. ex Diogene Laertio digeruntur." Francof. 1612, 8vo. At Sedan he continued to reside for the space of sixteen years, and was then invited to open a college at Charenton, near Paris; but the attempt was immediately resisted, and it seems to have been ultimately frustrated by the jealousy of the papists. In order to occupy himself during the dependance of the legal process, he prepared for the press another learned work: "Synopsis Oeconomica, authore G. Donaldsono Scoto-Britanno, Abredonensi, J. C. ad celsissimum Carolum, Walliæ Principem." Paris. 1620, 8vo. It was reprinted at Rostock, 1624, 8vo. And another edition speedily followed, Francofurti, 1625, 8vo. Bayle considered this as a book which deserved to be read.[4] With respect to the subsequent history of the author, we have not been able to collect any information; but it is not improbable that he resumed his station at Sedan, and there ended his days. Elizabeth Goffin, describing herself as the widow of Donaldson, addressed to Sir John Scot a letter dated at Sedan on the 15th of April 1630.[5] From this letter it appears that he left several children. (x.)

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[1] Litera Prosapiæ Alexandri Donaldson, Medicinæ Doctoris, dated at Edinburgh 15 November 1642. This is the son of Walter Donaldson. MS. Adv. Lib. W. 6. 26. p. 21. According to this account, one of his ancestors was Elizabeth Hay, daughter of George earl of Errol.

[2] In the attested pedigree already quoted, we find mention made "Walteri Donaldson, Armigeri, Utriusque Juris Doctoris apud Ruppellam in Gallia;" but as Rochelle was not the seat of a university, we cannot but suspect the accuracy of the statement. A college, including a principal and four regents, was established there in the year 1561; but it did not obtain the privileges of a university, and had no law faculty, and no professor of law. (Expilly, Dictionnaire Géographique, Historique, et Politique des Gaules et de la France, tom. vi. p. 354.)

[3] M'Crie's Life of Melville, vol. ii. p. 420.

[4] Bayle, Dictionaire Historique et Critique, tom. ii. p. 1013.

[5] Epistolæ doctorum Virorum ad Jo. Scotum, N° 227. MS. Adv. Lib. In the pedigree, she is described as the legitimate daugh-

Donaria || Donatists.

DONARIA, among the ancients, in its primary signification, meant the places where the oblations offered to the gods were kept; but it was afterwards used to denote the offerings themselves, and sometimes, though improperly, the temples.

DONATION (*Donatio*), an act or contract by which a man transfers to another either the property or the use of the whole or a part of his effects as a free gift.

DONATISTS, ancient schismatics in Africa, so denominated from their leader Donatus. This sect arose in the year 311, when, in the room of Mensurius, who died in that year on his return to Rome, Cæcilian was elected bishop of Carthage, and consecrated by the African bishops alone, without the concurrence of those of Numidia. The people refused to acknowledge him, and set up in opposition Majorinus, who, accordingly, was ordained by Donatus bishop of Casæ Nigræ. The Donatists were condemned, in a council held at Rome, two years after their separation; again, in another held at Arles the year following; and a third time at Milan in 316, before Constantine the Great, who deprived them of their churches, sent their seditious bishops into banishment, and even punished some of them with death. Their cause was espoused by another Donatus, called the Great, the principal bishop of that sect, who, with numbers of his followers, was exiled by order of Constans. Many of them were punished with great severity. However, after the accession of Julian to the throne in 362, they were permitted to return, and restored to their former liberty. But Gratian published several edicts against them, and in 377 deprived them of their churches, and prohibited all their assemblies. Yet notwithstanding the severities which they suffered, it appears that towards the close of this century they had a very considerable number of churches; but about the same time they began to decline, on account of a schism among themselves, occasioned by the election of two bishops, in the room of Parmenian, the successor of Donatus; one party elected Primian, and were called *Primianists*, and another Maximian, and were called *Maximianists*. Their decline was also precipitated by the zealous opposition of St Augustin, and by the violent measures which were pursued against them by order of the Emperor Honorius, at the solicitation of two councils held at Carthage, the one in 404, and the other in 411. Many of them were fined, the bishops were banished, and some were put to death. This sect revived and multiplied under the protection of the Vandals, who invaded Africa in 427, and took possession of this province; but it sunk again under new severities, when their empire was overturned in 534. Nevertheless they remained in a separate body till the close of this century, when Gregory, the Roman pontiff, having used various methods for suppressing them, his zeal at length succeeded, and there are few traces to be found of the Donatists after this period. They were distinguished by other appellations, as *Circumcelliones*, *Montenses* or *Mountaineers*, *Campites*, *Rupites*, and so on. They held three councils, or conciliabules, one at Cyrta in Numidia, and two at Carthage.

The errors of the Donatists, besides their schism, consisted in holding that baptism conferred out of the church, that is, out of their sect, was null (for which reason they rebaptized those who joined their party from other churches, and re-ordained their ministers), and that theirs was the only true, pure, and holy church, all the rest of the churches being regarded as prostitute and fallen.

Donat || Doncas

Donatus seems likewise to have inclined to the doctrine of the Arians, with whom he was closely allied; and accordingly St Epiphanius, Theodoret, and some others, accused the Donatists of Arianism; nor is it improbable that the charge was well founded, because they were patronized by the Vandals, who maintained that doctrine. But St Augustin affirms that the Donatists, in this point, kept clear of the errors of their leader.

DONATIVE (*Donativum*), a present made by any person, and called also *gratuity*.

The Romans made large donatives to their soldiers, and hence the soldiers in time became the masters of the Romans. Julia Pia, wife of the Emperor Severus, is called on certain medals *mater castrorum*, because of the care she took of the soldiery, by interposing for the augmentation of their donatives.

Donative was properly a gift made to the soldiery, as *congiarium* was a gift made to the people. Salmasius, in his notes to Lampridius's Life of Heliogabalus, in mentioning a donative which that emperor gave of three pieces of gold per head, observes, that this was the common and legitimate rate of a donative. Casaubon, in his notes on the Life of Pertinax by Capitolinus, observes, that Pertinax made a promise of 3000 denarii to each soldier, or upwards of L.97 sterling. The same author writes, that the legal donative was 20,000 denarii; that it was not customary to give less, especially to the prætorian soldiers; and that the centurions had double, and the tribunes more in proportion.

Donative, in the canon law, a benefice given and collated to a person by the founder or patron, without either presentation, institution, or induction by the ordinary.

DONATO, a town of Italy, in the grand duchy of Parma, at which is a medicinal bath. It contains 2200 inhabitants.

Donato, a town of Italy, in the province Terra di Lavoro, of the kingdom of Naples, with 2390 inhabitants.

DONATORY, in *Scotch Law*, that person to whom the king bestows his right to any forfeiture which has fallen to the crown.

DONATUS, a schismatic bishop of Carthage, founder of the sect of Donatists. His followers honoured him like a god. He died about the year 368.

Donatus, *Ælius*, a grammarian, who lived at Rome about the middle of the fourth century. He was one of St Jerome's masters, and composed commentaries on Terence and Virgil.

DONAUESCHINGEN, a city of Baden, in the circle of the Lake. The source of the Danube is here in the court of the palace of the Prince of Furstenburg, who is the chief proprietor. The city walls are destroyed. It contains 350 houses, with 2083 inhabitants employed in various handicraft trades.

DONAWERTH, a bailiwick in the circle of Upper Danube, of the kingdom of Bavaria. It extends over seventy-four square miles, or 47,360 English acres, and contains one city and twenty-eight villages, with 8353 inhabitants. It is a fertile district, and yields good corn, tobacco, and fruit. The capital, of the same name, is on the Danube, and contains 503 houses, and 2431 inhabitants, who are employed in manufactures from wool, hemp, and flax.

DONCASTER, a large town in the wapentake of Strafforth and Tickhill, in the county of York, 158 miles from London. It is a well-built town, and occupies a fine situa-

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ter "Joannis Goffan de Mostancells prope seden, et Joan. de Hen." For *seden*, we must apparently read *Sedanum*. The entire transcript, which is in the hand-writing of Robert Myln, is far from being accurate. In the preceding line, Donaldson's wife is called Hoffan. Her real name appears to have been Goffin.

ondra-
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onegal.

tion on the river Don, which is thus far navigable. It is celebrated for the wealth of its corporation, the races which are annually held here, and for its magnificent church. These attractions have drawn many residents, who subsist on moderate fortunes. The first power-looms were attempted here near forty years ago. There is some trade by the river, and a large market held on Saturday. The inhabitants amounted in 1801 to 5697, in 1811 to 6935, in 1821 to 8544, and in 1831 to 10,801.

DONDRAHEAD, a low point of land which forms the southern extremity of the island of Ceylon, adjacent to which is a populous village, where are still to be seen the remains of a Hindu temple, which bears marks of having once been a magnificent structure, and contiguous to it a smaller one dedicated to Boodha. Long. 80. 40. E. Lat. 5. 50. N.

DONEGAL, the most north-western county in the province of Ulster, in Ireland, is bounded on the north and west by the Atlantic Ocean, on the east by the counties of Londonderry and Tyrone, and on the south by those of Fermanagh and Leitrim, and by the ocean. It contains 1,165,107 acres, or 1820 square miles, of which not more than 520,736 acres are arable, the remainder, amounting to 644,371 acres, being mountain and bog. In shape it somewhat resembles a rhomboidal quadrangle, indented on its maritime sides by numerous deep bays and inlets; its longer diameter, measured in a north-eastern direction from Tellen Head to Malin Head, being eighty-five miles; its shorter, extending in a south-eastern line, from Bloody Farland Point to the town of Lifford, forty-two miles.

According to Ptolemy, the Erdini and Venicnii were its ancient inhabitants. During the earlier period of its history, subsequently to the time of Henry II., it was more generally known by the name of Tyrconnell, and comprised the country of the O'Doherties, and that of two branches of the M'Swineys, besides whom the O'Gallaghers, O'Clerys, O'Donells, O'Boyles, and M'Canmeys, were leading families or septs. It is now divided into the six baronies of Bannagh, Boylagh, Innishowen, Kilmacrenan, Raphoe, and Tyrhugh, which are subdivided into fifty-nine parishes, besides four parts of parishes, the remainders of which extend into the adjoining counties. In the commencement of the reign of James I. the number of parishes was eighty-nine.

The county comprises the whole of the episcopal see of Raphoe, and a small part of that of Derry. The cathedral, which is built in Raphoe, a town otherwise of little notoriety, serves also for the parish church. Four clergymen's widows are lodged and maintained in the town upon a foundation of a bishop of the name of Foster, who also founded a free school here, and erected a building for a library, the books of which are a bequest from Dr Hall of Trinity College, Dublin. The diocese contains thirty-seven parishes, in which there are thirty-three churches. The total of the glebe land throughout the diocese is estimated at 11,370 acres of ground of every quality, giving an average of 307 acres to each parish. The bishop's income, according to a return made to parliament in 1831, is L.5379. 14s. 1d. The barony of Innishowen, and the adjoining district, in the vicinity of the city of Londonderry, are in Derry diocese.

The face of the country in the south and east is comparatively level; all the western and northern regions are mountainous, interspersed, however, with valleys and occasional expanses of good land. The most fertile and improved part is the barony of Raphoe, containing the towns of Raphoe, Lifford, and Stranorlar, and embracing a tract about twenty miles long by twelve broad. The soil is good for potatoes, oats, barley, and flax; but wheat, though it thrives in some parts, particularly along the course of the Finn river, is not much cultivated. The southern extremity of the county, in which the town of Ballyshannon stands, can also boast of some rich soil. The mountainous district, which spreads over more than one half of the county, after sloping from Belleek, on the borders of Fermanagh, in the south, to Barnesmore Hills northwards, turns westwards along the sea coast, by Killibegs, to the great promontory of Tellen Head; thence it spreads northwards over the waste expanse of the Rosses, and round by the north coast to Lough Swilly, and by Londonderry through Innishowen barony to Malin Head and Greencastle, where it is interrupted by Lough Foyle, but shows itself again in the northern parts of the counties of Londonderry and Antrim. The highest of these mountains is that of Arragh, which rises 2220 feet above the level of the sea, and is remarkable, not only for its superior elevation, but for one of the whin-dikes that are to be met with in Ireland only near the northern coasts; the dike rising forty feet perpendicularly, like a partition wall. Muckish Mountain, in Kilmacrenan barony, and Slieve Snaght, in Innishowen, are also of considerable height.

Donegal.

The soil is in general light, with a gravelly subsoil; though in some parts, as in the neighbourhood of Ballyshannon and Donegal, in the south, it is deep and rich, chiefly resting on a bed of limestone. The mountainous districts, though presenting little to excite the speculations of the agriculturist, possess much to attract the attention of the admirer of nature and the investigations of the scientific inquirer. The rugged precipitous declivities, intersected by winding bays and lakes imbedded in the valleys, exhibit an ever-changing variety of picturesque and magnificent scenery. The geological aspect of these regions affords indications of internal wealth which give ample grounds for regret that they have been so seldom made the subject of scientific research. The minerals as yet discovered are lead and iron. Mines of the latter of these metals were formerly wrought in the parish of Templecarne, until relinquished in consequence of the failure of timber for fuel. Manganese, yellow pyrites, and clay for potteries and brick-making, are also found. Siliceous sand, raised in Muckish Mountain, was conveyed in large quantities to Belfast for the manufacture of glass. Indications of coal have been observed near Lough Swilly, and at Inver on the southern coast.

The rivers, with the exception of the Foyle, which forms the boundary between this county and Tyrone and Londonderry, though numerous, are of very inferior size. The branches of the Foyle which rise in Donegal are the Derg, the Finn, and the Swilly, all of which originate in the central part of the county. The river itself, augmented by their contributions, and by those of several other branches from Tyrone and Londonderry, proceeds in a northern direction, and discharges itself into the southern extremity of Lough Foyle, at the city of Londonderry. It is navigable for vessels of large burden to this place, where their farther progress is prevented by a bridge; and thence by lighters of fifty tons as far as Lifford. Boats of fourteen tons can proceed up the Finn River as far as Castlefinn. The Erne flows from Lough Erne through the southern extremity of the county into Ballyshannon Bay. Its navigation is prevented by a fall of twelve feet in the neighbourhood of Ballyshannon, and by another of thirty feet at Belleek, on the confines of Fermanagh. The Guibarra, the Awen Ea, and the Eask, are the only other rivers of any note.

Lakes are numerous but small. Lough Derg, situate in Tyrhugh barony, between the counties of Tyrone and Fermanagh, is the most celebrated, yet not so much on account of its size, which is insignificant, or its scenic beauties, of which it possesses little, as from an island in it, named St Patrick's Purgatory, which is one of the most celebrated places of resort for pilgrims and devotees in Ireland. The extent of the island is less than an acre. The cave styled the Purgatory is formed of freestone; it is sixteen feet in length, two and a quarter in breadth, and so low that a man cannot stand upright in it. Several attempts made by the Roman Catholic hierarchy and by the government to prevent the performance of the ceremonies annually practised here have failed; it still continues to be a favourite place of worship. Loughs Eask, Ea, Gartan, Fearn, Finn, and Veagh, are worthy of note only as being the sources of some of the rivers which irrigate the country.

The bays and smaller inlets of the sea are numerous. Ballyshannon harbour, the most southern of them, is small, and has a bar at its mouth, as has Donegal and Inver harbours farther west. Killibegs harbour is well sheltered, and capable of receiving large vessels. On the western coast are Bruckles or M'Swiney's Bay, and Tellen harbour, suitable for small vessels; and on the north is Sheep Haven, within which is Dunfanaghy Bay, where the largest ships may lie in safety, as they may also in Mulroy Bay, farther east. Still farther eastwards is Lough Swilly, a capacious basin, plunging deep into the land, of easy access, and fit for vessels of any burden. Lough Foyle, the boundary between Donegal and Londonderry, may be more properly considered to belong to the latter county.

The islands of Arran constitute a small archipelago on the western coast, near the district called the Rosses. The herring fishery was carried on here with great spirit about fifty years ago, but is now nearly extinct, in consequence of the fish deserting the coast. A town called Rutland was built on Innismacdurn, one of these islands, for curing and exporting the fish. Tory Island lies off the northern coast, about eight miles from shore. The inhabitants have little intercourse with the rest of the county; they maintain themselves chiefly by fishing and making kelp. An engagement between an English and French squadron took place near this island in 1798. On Ennistrahul Island, off Malin Head, there is a lighthouse. Inch Island, in the southern extremity of Lough Swilly, is of considerable size.

The following table affords a correct view of the names, extent, and population of the islands along the coast of Donegal, as far as their points have been ascertained, commencing with the most southern.

Name.	Situation.	Extent in Acres.	Population.
1. Dromore.......	Donegal Bay......	......	13
2. Rosmore.......	Donegal Bay......	......	......
3. Innisduff.......	Killibeg's Harbour	......	16
4. Rockliburn....	Tellen Head.......	......	......
5. Ronanish......	Daurus Head......	......	......
6. Inniskeel.......	....	.. ...	5
7. Inniskerah.....	....		47
8. Eddernish......	Templecroan parish	......	11
9. Eighter.........	Ditto...............	......	42
10. Innisal.........	Ditto...............	......	32
11. Innisdurn or Rutland	Ditto...............	183	173
12. Inniscoo.......	Ditto...............	......	53
13. Tully............	Ditto...............	......	44
14. Duck............	Ditto...............	......	5
15. Islandcroan...	Ditto...............	......	Uninhab.
16. Arranmore....	Ditto............ ..	2500	1010
17. Illanganna....	Ditto...............	......	......
18. Cruit or Croit..	Ditto...............	......	335
19. Owey..........	Ditto...............	......	76
20. Innisfree.......	Templecroan parish	180	171
21. Gola...........	Ditto...............	......	36
22. Innismana......	Ditto...............	......	5
23. Innisirhir......	Ditto...............	......	6
24. Innisinny......	Ditto...............	......	6
25. Reinrenny.....	Ditto...............	......	14
26. Innisbofin......	Bloody Farland Point	400	252
27. Innisduh or Dowey...	Ditto...............	......	22
28. Innisbeg.......	Ditto...............	......	Uninhab.
29. Tory...........	Ditto...............	1200	296
30. Reagh or Ray	Mulroy Bay........	......	33
31. Inch............	Lough Swilly......	2000	1094
32. Aughnish......	Ditto...............	......	18
33. Big..............	Ditto...............	......	15
34. Manor Cunningham...	Ditto...............	......	Uninhab.
35. Clonmess......	Sheephaven........	......	Uninhab.
36. Seal.............	Malin Head........	......	Uninhab.
37. Ennistrahul...	Ditto...............	......	......

The returns of the population, made at several periods by different authorities, give the following result:—

1789.........	Gewas P. Bushe, Esq.........	140,000
1812.........	Parliamentary census.........	No return.
1821.........	Ditto............................	248,270
1831.........	Ditto............................	298,194.

The last of these returns gives an average of one individual to every four acres, or one family to every twenty-four acres; but if the arable land alone be considered, the average will be reduced to an individual to every two acres, or one family to twelve acres.

The representation in parliament is limited to the two county members. In the Irish parliament it had no less than twelve members; two for the county, and two for each of the boroughs of Ballyshannon, Donegal, Killibegs, Lifford, and Johnstown. The following table shows the variations of the constituency arising from the disfranchisement of the forty-shilling freeholders in 1829, and the subsequent alterations arising out of the provisions of the reform act:—

Number of Electors of the various rates of Suffrage.

Year.	L.100.	L.50.	L.20.	L.10.	40s.	Total.
1st Jan. 1829,	......	52	19	......	2310	2381
1st Jan. 1830,	......	35	65	567	......	667
1st May 1831,	......	811	92	66	......	969
1st Jan. 1832,	......	...	...	...	......	1458

The preservation of the peace is entrusted to a force of six chief and ninety petty constables, acting under the authority of the magistrates, and maintained at an expense of L.5840, being an average of somewhat more than L.60 a man by the year.

The parliamentary returns as to the state of education in 1821 and 1824–26 give the following results:—

	Boys.	Girls.	Unascertained.	Total.
1821...........	5866.........	3655.........	—	9521
1824–26........	7991.........	5474.........	337.........	13,802

Of the number in the latter of these returns, 4055 were of the established church, 6603 were Roman Catholics, 3058 dissenters, and eighty-six whose religious persuasion had not been stated. The total number of schools was 399; of these, 258, containing 7764 pupils, were wholly maintained by the fees of the pupils; eighty-eight schools, containing 4738 pupils, were supported by the voluntary contributions of societies or individuals; and but fifty-three schools, containing 3007 pupils, received grants of public money through the agency of a public board. A grammar school was founded in the town of Raphoe by James I., and endowed with a large grant of lands, which it still continues to enjoy under the regulations of commissioners appointed by the crown. Major Robinson, the son of a clergyman in Donegal town, bequeathed a large property for the maintenance of a school in every parish in the diocese of Raphoe, from which every teacher was to receive an annual salary of L.15.

The manners and habits of the people differ much, according to the local circumstances of the district they inhabit. The lowland and fertile districts are chiefly peopled by an industrious and comfortable yeomanry, composed of small farmers and artizans whose modes of life differ little from those in similar circumstances in the adjoining counties. In the mountainous and less cultivated tracts the want of a free intercourse, and the consequent tardy spread of manufacturing and agricultural improvement, have occasioned a corresponding tardiness in refinement of manners. Yet, so far as the state of crime may lead to a conclusion on this point, the population, though backward in the knowledge of the useful arts, are stained with few of the vices which indicate a demoralized state of society. Out of the total number of committals in 1830, amounting to 781, there were but 406 convictions; but three of these were capital, for horse stealing, and were commuted to transportation for life, and four were for transportation for seven years. Of the remainder, ninety were for illicit distillation, and thirty-seven for riotous assemblages, arising in many cases from the previously named offence. The nature of the country peculiarly favours the operations of the unlicensed distiller; but late statutes, mitigating the demoralizing severity of the revenue code, have already in some degree checked the practice. The houses, particularly in the mountainous parts, are poor. Little attention is paid to cleanliness. The pigs and other cattle, if any, are housed in them along with the family. The fuel is everywhere turf; the food potatoes and oaten bread, with milk and butter occasionally, and fish if near the sea. The men are clothed in home-made frieze, the women chiefly in cheap cottons. The Irish language still maintains its ground in the retired parts, though its use is every year diminishing. Adepts in the language consider the dialect spoken in this county as the purest known.

The modes of agriculture present little peculiar to the county. The spade still supplies the place of the plough in those parts where the rocky nature of the soil prevents the profitable application of the latter implement. In the southern parts a narrow spade with a long handle, and a resting place for the foot only on one side, is in common use. It is called a loy, and is peculiarly adapted to stiff clayey soils. Potatoes are planted with an implement called a steveen or kibbin, formed of a stake about four feet long, shod with iron, and having near the point a cross rest for the foot to act on when forcing it into the ridge; and the seed is dropt into the hole thus made. The cattle which are grazed on the coarse mountain pastures are subject to a kind of rheumatic affection called the cruppan. The animal becomes crippled, and, in the more aggravated stages of the disorder, is totally deprived of the use of its limbs; the hair on the back starts up, and atrophy succeeds, which terminates in death. The means of cure found most successful is the removal of the diseased animal to soil of another quality. If, however, it should remain for a year on the soil which cures this disorder, it is liable to be attacked by another, called the galar, which causes a discharge of blood, followed by death unless prevented by a transfer to the pastures which had produced the former complaint. Horses are not subject to this latter malady. Feeding on cabbage and sea-rack has been suggested as a means for preventing the ravages of the cruppan. On the shores of Innisfree, one of the islands of North Arran, a species of grass, called by the inhabitants sweet-grass, springs up twelve feet under tide-mark of spring tides. It grows to the length of two or three yards, and is about the breadth of a compressed wheaten straw. At the lowest ebb of the spring tide the cattle run instinctively from the mountains to feed on this herb, as the greatest luxury, and persevere in so doing regularly at the particular period when the recess of the water leaves the plant exposed. In the mountain farms the fences are very bad, being formed of low turf ditches. In many cases the use of fences is disregarded, as a person is either sent to herd the cattle, or they are confined by tethers. The care generally taken to house cattle, in order to prevent the attacks of the cruppan, and to collect manure, renders the want of fences less injurious.

The manures in the neighbourhood of the sea are chiefly sea-weed, shelly sand, and house dung. Although the tract from Ballyshannon to Killibegs abounds with limestone and marl, the use of these as manures is not so great as their value, and the facilities of procuring them, would lead those unacquainted with the habits of the people to expect. Irrigation is general, and much encouraged by the landlords. Farming societies have been formed, and premiums offered, in order to excite a spirit of emulation in introducing improved modes of agriculture.

The herring fishery was carried on about fifty years ago to a great extent, and with considerable success, in the district of the Rosses, on the western coast. In the years 1784–85 the winter fishing produced L.40,000, and supplied cargoes for 300 vessels each year. Such was the success, that a fishing town, named Rutland, with suitable stores and curing houses, was built on the island of Innismacdurn; but the fishery shortly after declined, and has never regained its former character. The decay has been attributed to the summer fishing of what are called sprats, but thought to be the young herrings, which are thus carried off in myriads in a less profitable shape, and the full-grown fish deterred from the coast. Still, however, the fishery is carried on, though on a very reduced and fluctuating scale. The white fishery has latterly been more profitable. The following table will show the progress of both kinds, and the state of the fishing vessels during the period that the fisheries of Ireland were under the superintendence of a board empowered to make grants and loans of public money for their improvement.

Number of Vessels and of Men registered and employed in the Fisheries of Donegal.

	Decked.	Half Decked.	Open Sail.	Row Boats.	Men.
1822	5	0	9	505	4628
1823	1	0	13	1092	5789
1824	1	0	15	1114	5900
1825	3	1	16	892	4693
1826	1	0	17	987	5245
1827	0	0	17	1050	5484
1828	0	0	19	1125	5943
1829	0	0	19	1187	6361
1830	0	0	21	1259	6633

Number of Barrels of Herrings, and Cwts. of White Fish, marked for the Production Bounty, with the amount of Bounty granted.

BARRELS HERRINGS.				CWTS. WHITE FISH.						
Years.	Gutted with a Knife.	Gutted otherwise.	Bounty.	Cod.	Ling.	Hake.	Haddock.	Glassen.	Total Cwts.	Bounty.
1822	346	122	L.99 5 9	40	26	71	...	82	219	L.47 9 0
1823	766	20	131 16 10	224	75	201	...	127	627	131 19 0
1824	1488	6	323 12 7	196	52	728	...	66	1042	222 1 8
1825	934	...	203 1 10	747	138	1783	4	347	2272	640 19 9
1826	1821	9	366 6 9	263	155	3695	6	279	4398	874 14 1
1827	1981	...	299 16 6	1546	280	3019	...	2342	7187	1215 4 0
1828	2083	...	247 0 6	893	72	2885	...	628	4478	1052 2 0
1829	...	...		1952	148	3186	...	2176	7462	1831 12 0
1830	356	...	17 16 6	4126	181	3740	...	3461	11508	1636 6 0

The fishery board also granted money in aid of building fishing piers at Green Castle in Lough Foyle, and Doaghbeg in Lough Swilly. In the project for the plantation of Ulster, drawn up in the early part of the reign of James I., twenty-five places in this county are named as being approved stations for the salmon, herring, and ling fishery. The principal salmon fishery at present is at Ballyshannon. Whale and sun-fish have been taken near the coast.

Manufactures never extend much beyond what the immediate demand of the population calls for. They are chiefly confined to linens and coarse woollens called friezes, of which latter a light blue is the favourite colour.

Numerous ruins of ancient castles along the coast prove that much attention was formerly paid to the defence of the country from invasion, or, what was more to be dreaded, piratical depredations. The principal are, Kilbarron Castle, near Ballyshannon; Donegal Castle, built by O'Donell; Burt and Inch Castles, both built in Lough Swilly, by Sir Cahir O'Dogherty, to whom is also attributed the erection of Green Castle on Lough Foyle. Near the Castle of Doe, or M'Swiney's Castle, at Horn Head, is a natural perforation in the roof of a cave, wrought by the workings of the ocean into the overhanging cliff. It is called M'Swiney's Gun. When the wind blows due north, and the tide is at half flood, the gun is seen to spout up jets of sea water to a great height, attended with explosions which are said to be heard in favourable weather at more than twenty miles distance. Culmore Fort, on the coast of Lough Swilly, is still maintained as a military station, at least so far as to afford a respectable income to some military person who performs the nominal duties of governor there.

Traces of religious houses, some however existing only in traditionary or documental records, are also numerous. Ashroe Abbey, on the Erne river, near Ballyshannon, was of great extent. The ruins of that of Donegal also afford proofs of its ancient grandeur. But its memory will be held in greater veneration by the lovers of antiquity for another reason. In it was written the celebrated collection of ancient Irish annals, still known by the name of the Annals of the Four Masters, compiled in the year 1632, by Michael O'Clery and his learned coadjutors, fellow brothers in that house, by the instigation and at the expense of Fergal O'Gara, lord of Moy O'Gara and Coolavin, in the county of Sligo. The original of this curious and highly valuable manuscript is now lodged in the library of the Royal Irish Academy.

The towns in this county are few and insignificant. Lifford, the county town, is situated near its south-eastern extremity, on the river Foyle, and communicates by a bridge with Strabane, on the eastern bank of the same river, insomuch that it might almost be considered rather as a suburb of this more populous town, than as the metropolis of a county. Its population in 1821 amounted only to 976 souls. It can boast of no public buildings but those which owe their existence to the rank for which its position is so ill adapted, as attendance at the assizes here must be extremely inconvenient to residents in most of the other towns, which are chiefly near the sea-coast, at the other extremities. The buildings are a court-house, a prison, and an infirmary.

The reason given for fixing on a situation for the county town so inconvenient to the resident inhabitants, was, that the judges and barristers were saved the trouble of travelling far into a county in which the roads at that time were few and ill constructed, and the accommodation in the inns very inferior. The other towns of any consequence, with their population in 1821, are as follows:

Name.	Population.	Name.	Population.
Ballyshannon	3831	Ramelten	1247
Letterkenny	2458	Ballybofey	920
Raphoe	1433	Donegal	696

Ballyshannon, situate at the embouchure of the Erne, which is here crossed by a bridge of nine arches, is worthy of notice for its trade, the chief articles of which are corn and salmon; for the remains of antiquity in its immediate vicinity; and for the picturesque scenery with which it is surrounded, and which is much heightened by the salmon leap across the river.

DONGOLA, or DANKALA, a town on the Nile, and capital of the district of Nubia. It stands on the declivity of a dry, arenaceous hill, and the streets are almost choked with sand brought down from the mountains behind by the floods. The houses are low and ill built. The castle is situated in the middle of the town, and is spacious, but badly fortified. The horses of Dongola are highly prized; they are remarkably beautiful, and their riders are very skilful. When the Mamelukes were expelled from Egypt, a party of those who escaped took possession of Dongola, and erected there a species of petty sovereignty. Their number, however, does not exceed 500, with from 3000 to 6000 negro slaves. Long. 32. 0. E. Lat. 19. 20. N.

DONKAW, a circle in the Russian government of Riasan, bounded on the north by Skopin, on the north-east by Miahsh, on the east by Ranenburg, on the south by Tambow, and on the west by Tula. It is watered by the river Don, and has but little wood, but some good arable land, producing rye and other corn, and feeding black cattle. The inhabitants amount to 75,500. The chief town, of the same name, is situated on the Don, and contains six churches, a monastery, 351 houses, and 2100 inhabitants.

DONNE, Dr John, a poet and divine, was born in the city of London in 1753. His parents were of the Catholic religion, and used their utmost efforts to keep him firm in the same persuasion; but an early examination of the controversy between the church of Rome and the Protestants determined him to adhere to the creed of the latter. He travelled into Italy and Spain, where he made many useful observations, and learned the languages of both countries to perfection. Soon after his return to England, Sir Thomas Egerton, keeper of the great seal, appointed him his secretary, and in this post he continued during five years. He married privately Anne, the daughter of Sir George Moore, then chancellor of the garter, and niece to the lord keeper's lady, in consequence of which he was dismissed from his place and thrown into prison. But he was afterwards reconciled to Sir George by the good offices of Sir Francis Wooley. In 1612 he accompanied Sir Robert Drury to Paris. During this time many of the nobility solicited the king to give him some secular employment. But his majesty, who took pleasure in his conversation, had engaged him in writing his *Pseudo-Martyr*, printed at London in 1610; and he was so highly pleased with that work, that, in 1614, having prevailed on the author to enter into holy orders, he appointed him one of his chaplains, and procured him the degree of doctor of divinity from the university of Oxford. In 1619 Dr Donne attended the Earl of Doncaster in his embassy into Germany. In 1621 he was made dean of St Paul's; and the vicarage of St Dunstan in the West soon afterwards fell to him. Besides the above work, he wrote, 1. Devotions upon emergent Occasions; 2. The Ancient History of the Septuagint, translated from the Greek of Aristeas, 1633, in 12mo; 3. Three volumes of Sermons, 1640, 1649, 1660, folio; 4. A considerable number of Poems; and other works.

Donne's writings show him to have been a man of wit and learning; but his greatest excellence consisted in satire. Lord Falkland, no mean judge, styles him one of the most witty and most eloquent of modern divines. His reputation as a poet was higher in his own time than it has been since. Dryden, with his usual judgment and discrimination, characterises him as "the greatest wit, though not the best poet, of our own nation;" and adds, that "he affects metaphysics, not only in his satires, but in his amorous verses, where nature only should reign, and perplexes the minds of the fair sex with nice speculations of philosophy, when he should engage their hearts, and entertain them with the softnesses of love." Donne's numbers, if they may be so called, are certainly the most rugged and uncouth of any of our poets; yet he was certainly not ignorant nor unskilled in the higher attributes of style, for he wrote elegantly in Latin, and displays considerable taste in some of his smaller pieces and epigrams.

DONNINGTON, a market-town of the hundred of Kirton, in the county of Lincoln, 106 miles from London, and situated in a fenny district, having a water communication with Boston. The market is on Saturday. The inhabitants amounted in 1801 to 1321, in 1811 to 1528, in 1821 to 1638, and in 1831 to 1759.

DONSKAIA, a fortress of Asiatic Russia, situated on the brook Taschle, the first of a chain of posts established between the Sea of Azof and the Caspian. It contains about forty houses; and adjacent to it is a village of Cossacks. It is 116 miles north-north-west of Ekaterinograd.

DOOMSDAY Book. See Domesday Book.

DOONAH, a town of Hindustan, in the province of Gundwana, thirty miles south from the town of Gurrah. Long. 80. 3. E. Lat. 22. 48. N.

DOONDEAKERA, a town of Hindustan, in the province of Oude, situated on the north-east side of the Ganges. The adjacent country abounds with game and wild cattle of a small breed. Long. 80. 40. E. Lat. 26. 12. N.

DOORNICK. See Tournai.

DOORYGHAUT, a town of Hindustan, in the province of Allahabad, and district of Gazypoor, situated on the south side of the Goggrath, and seventy miles north-east from Benares. Long. 83. 31. E. Lat. 26 15. N.

DOORYDROOG, a fortress of the south of India, in the province of Mysore, situated on a rock. Long. 77. 25. E. Lat. 13. 27. N.

DOOSHAK, a town of Persia, the capital of the province of Seistan, situated in an open country, about eight or nine miles from the river Heermund or Helmund. The modern city is small, but compact; and the ruins cover a vast extent of ground. It is populous, has a good bazar, and the inhabitants, dressed in the Persian manner, have a more civilized appearance than the other natives of Seistan, who are either Patan or Belouche shepherds, and live a wandering life, pitching their tents amidst the ruins of ancient palaces. The neighbouring country produces wheat and barley in sufficient quantities to be exported to Herat. The pasturage is also good and abundant. This place is called also Julallabad, and is governed by an independent prince, who calls himself king of Seistan. Long. 61. 13. E. Lat. 31. 26. N.

DOR, the English name of the common black beetle. Some apply the term also to the dusty beetle, which flies about hedges in the evening.

DORADO, in *Astronomy*, a southern constellation, not visible in our latitude. It is also called *xiphias*.

DORAK, or Felahi, a town of Persia, in the province of Kuzistan, situated on two branches of the river Jerahi, in low and marshy ground. It is surrounded by walls about two miles in circumference, built of mud, sixteen feet in thickness, and flanked at regular distances with round towers. It contains few houses within the walls, as the majority of the people, amounting to 8000, prefer living in the suburbs, under the shade of date trees. The palace of the scheik covers a large space of ground, but is in reality a miserable structure, built of bricks dried in the sun, and rapidly going to decay. It is celebrated for its manufacture of Arabian cloaks, which are exported in great numbers all over Arabia and Persia, but it has little other trade. It is seventy-five miles south of Shuster.

DORAN, a town of Arabia, in the county of Yemen, the residence of a chief or governor. It was formerly surrounded by a wall with three gates. It is twenty-eight miles south of Sana. Long. 44. 4. E. Lat. 14. 55. N.

DORAT, a town of the department of the Upper Vienne, in France, on the river Sèvre. It is in an agreeable situation, contains 349 houses, and 2264 inhabitants, who are mostly makers of hats. Long. 1. 1. E. Lat. 46. 10. N.

DORCHESTER, a town in Oxfordshire, in the hundred of the same name, fifty-two miles from London, on the banks of the Thame. It was formerly the see of a bishop, and the cathedral, which still remains, is used as the parish church. The inhabitants amounted in 1801 to 777, in 1811 to 754, in 1821 to 854, and in 1831 to 866.

Dorchester, a town, the capital of the county of Dorset, 120 miles from London. It rises gradually from the banks of the Frome, and is a well-built town, formerly celebrated for its breweries of strong beer, but now with little trade, and no manufactures. It was a Roman station, and near it are an amphitheatre and two camps constructed by that nation, together with the remains of their wall. The assizes and elections are held here. The market is held on Saturday. It returns two members to parliament, chosen by the householders and freeholders; but the adjoining parish of Fordington has now been added to it. The inhabitants amounted in 1801 to 2402, in 1811 to 2546, in 1821 to 2743, and in 1831 to 3033.

DORDOGNE, a department of France, formed out of the country of the ancient Perigord and a small part of Limousin. It is bounded on the north by Upper Vienne, on the east by Corrèze and Lot, on the south by Lot and Lot Garonne, on the west by the Gironde and Lower Charente, and on the north-west by the department of Charente. Its extent is 3740 square miles, or, according to the royal almanack, 898,274 hectares. Its surface consists of mountains, many small hills, and narrow valleys. The soil in general is stony, and by no means fruitful. The calcareous hills are mixed with sandy and clayey soils abounding in flints. It is well watered both by rivers and small streams, of which more than 1400 are enumerated in the statistical and topographical description of the department. The agriculture is in a backward state, the chief corn is maize, which forms the principal bread of the people; but of late the great extension of the potato culture has provided a useful substitute for bread. The chestnut woods, which are said to occupy one fifth of the surface, furnish also a large portion of the subsistence of the inhabitants. Sheep and goats are bred in considerable numbers, and large herds of swine are supported near the chestnut woods. Some districts yield a good white wine; but the whole quantity produced is inconsiderable. The chief exports consist of wine, chestnuts, wall and hazelnuts, nut oil, truffles, cattle, wool, and leather. The manufactures are few. Some iron wares are made, from mines in the department. The inhabitants amount to 424,113, of whom 8500 are Protestants. The language is a patois of Italian and French. The capital of the department is the city of Perigueux.

DORHEIM, a circle in the province of Hanau, in the duchy of Hesse-Cassel, comprising two market-towns, two villages, and 3812 inhabitants. The chief place, of the same name, situated on the river Wetter, contains 1194 inhabitants.

DORIA, ANDREW, a gallant Genoese sea officer, born in 1466. He entered into the service of Francis I. of France, but preserved that spirit of independence which is so natural to a sailor and a republican. When the French attempted to render Savona, long the object of jealousy to Genoa, its rival in trade, Doria remonstrated in a high tone against the measure; and this bold action, represented by the malice of the courtiers in the most odious light, irritated Francis to such a degree that he ordered his admiral Barbesieux to sail for Genoa, then in the hands of the French troops, to arrest Doria, and to seize his galleys. But Doria got a timely hint of this rash order; retired with all his galleys to a place of safety; and, whilst his resentment was warm, closed with the offers of the emperor Charles V. returned his commission with the collar of St Michael to Francis, and hoisted the imperial colours. To deliver his country, now weary alike of the French and the imperial yoke, from the dominion of foreigners, was Doria's highest ambition; and the favourable moment had presented itself. Genoa was afflicted with the pestilence, and the French garrison being ill paid and greatly reduced, the inhabitants were sufficiently disposed to second his views. He sailed to the harbour with thirteen galleys, landed five hundred men, and made himself master of the gates and the palace with very little resistance. The French governor with his feeble garrison retired to the citadel, but was soon forced to capitulate; upon which the people ran together, and levelled the citadel with the ground. It was now in Doria's power to have rendered himself the sovereign of his country; but, with a magnanimity of which there are few examples, he assembled the people in the court before the palace, disclaimed all preeminence, and recommended to them to settle what form of government they chose to establish. The people, animated by his spirit, forgot their factions, and fixed that form of government which, with little variation, subsisted until the year 1815. This event happened in 1528. Doria lived to a great age, respected and beloved as a private citizen; and he is still celebrated in Genoa by the most honourable of all appellations, the father of his country, and the restorer of its liberty.

DORIANS, a people of Greece, who derived their origin from those districts in which the Grecian nation bordered towards the north upon numerous and dissimilar races of barbarians. According to Herodotus, they were from early times one of the chief races of that nation, which, in fact, was composed of Dorians and Ionians; the one of Hellenic and the other of Pelasgic origin, the former a migratory and the latter an aboriginal race. In this definition it is assumed that the Pelasgi were Greeks and spoke the Grecian language in its elder form; an opinion in support of which many arguments might easily be produced. But all the races whose migrations took place at a comparatively late period, such as the Achæans, Ionians, and Dorians, particularly the last, were not sufficiently numerous or powerful to effect a complete change in the customs of a barbarous population: many districts, as Arcadia and Perrhæbia, remained entirely Pelasgic, without being inhabited by any nation not of Grecian origin: the most ancient names either of Grecian places, or those mentioned in the traditions of the Grecian race, belonged indeed to a different era of the dialect, but not to a different language: and, lastly, the great similarity between the Latin and the Greek can only be explained by supposing the Pelasgic language to have formed the connecting link. The Dorians are mentioned in ancient legends and poems as having been established in one extremity of the great mountain chain of Upper Greece, namely, at the foot of Mount Olympus; but there are, nevertheless, many reasons for supposing that, at a period still earlier than that to which these monuments refer, they dwelt at its other extremity, reaching to the farthest limit of the Grecian nation. Indeed the Doric Hylleans had a tradition that they came originally from those northern districts which bordered on the Illyrians, and were afterwards occupied by that people; a tradition, we may observe, which many facts and circumstances unite to confirm, or at least to render highly probable. Be this as it may, however, the earliest ascertained seat of the Dorians was the district of Mount Olympus. But, either from a restless and wandering disposition, or impelled by the pressure of some northern hordes, they seem to have migrated from this district into Crete, that is, from one end of the Grecian world to the other; thus presenting a striking anomaly in the history of the ancient colonies. The earliest trace of this circumstance is found in the Odyssey, where it is mentioned that the "thrice divided" (τριχάϊκες) Dorians formed part of the population of Crete. Though originally inhabiting a mountainous region, they appear, in course of time, to have become, as it were, the Normans of Greece, and to have sought settlements wherever they could find them. But the most important, and the most fertile in consequences, of all the migrations of the Grecian races, and that which continued even to the latest period to exert its influence upon the Greek character, was the expedition of the Dorians into the Peloponnesus. This circumstance is mentioned by Herodotus, who states that, under Deucalion, they dwelt in Phthiotis, and in the time of Dorus, the son of Helen, inhabited the country at the foot of Ossa and Olympus, called Hestiæotis;

that, afterwards, being driven from Hestiæotis by the Kadmeans, they dwelt under Mount Pindus, and were called the Macednian nation; that thence they again migrated to Dryopis, and from Dryopis passed into the Peloponnesus, where they were called the Doric race. The traditionary name of the expedition in question is "the Return of the descendants of Hercules," who are admitted to have been of Doric origin; and, in process of time, successive conquests were effected by them in the Peloponnesus, until the whole of that country was at length subdued and occupied by the Dorians. Argos was captured by this people; Sicyon was conquered from Argos, Phlius from Sicyon, and Cleonæ from Argus. The Dorians expelled the Ionians from Epidaurus, and afterwards reduced Ægina and Trœzen; they appear also to have made themselves masters of Corinth and Megara; and, under Aristodemus, they conquered Laconia, which soon afterwards rose into great importance among the states of Greece. In due time, Doric colonies from Argos, Epidaurus, and Trœzen established themselves on the south-west coast of Asia Minor; and other colonies of the same race also settled in different parts of the same country, where, at a very early period, we find them forming a league against the Ionians, whom they had either encroached upon or expelled. In fact, there is nothing so remarkable in the history of this remarkable race as its extraordinary propagation and diffusion. In course of time it spread itself on all sides, from Greece to Asia Minor, Byzantium, Syracuse, and the country which sweeps round the Gulf of Tarentum, including the territory afterwards known by the name of Magna Græcia, with Crotona, Locri, and Lyctus, to say nothing of Chalcis, Solium, Ambracia, Anactorium, Leucadia, Corcyra, Epidamnus, Apollonia, Potidæa, Chalcedon, Trogilus, Thapsos, Selinus, and other places, which it conquered or colonized. It is remarkable that, wherever any portion of Doric invaders or settlers proceeded, they not only carried along with them, but gave a permanent ascendancy to the peculiarities and characteristics of their race. Their religion, their laws, their literature, their manners, and in short all that distinguished them as a separate people, appear to have taken root wherever they pitched their tents; and it is by the vestiges which still remain of their migrations, settlements, and power, that we are enabled to trace with some degree of certainty events which either took place before the commencement of authentic history, or in regard to which history, tradition, and even fable, are alike silent. The limits of this article, however, preclude our entering into details, which in fact would require volumes for their full development and illustration. We shall therefore confine ourselves to some general remarks on the character of the Dorians, deduced from the masterly analytical investigations of Professor Müller in his *History and Antiquities of the Doric Race;* a work not more distinguished for its almost boundless erudition, than for the critical sagacity and philosophic spirit which is displayed in it throughout.

And the first peculiarity in the Doric character which we shall notice, is the tendency which it exhibited to produce uniformity and unity. Every individual was destined to remain within those limits which were prescribed by the will of the whole; every one was bound to obey in his own place. All the smaller associations were regulated on the same principle; there was a gradation of power, but never independent equality. The Dorians, also, had little inclination to admit the customs of others, and a strong desire to disconnect themselves from foreigners; their instinct seems to have been to adhere scrupulously to their own national habits, and to preserve that distinct individuality of national character which appears to have given them so decided an ascendency over all the races amongst which they intermingled or settled. They loved independence, and knew well how to maintain and defend it. A calm and steady courage was the natural quality of the Dorians; and though they sometimes yielded to the impetuosity of excitable and enthusiastic enemies, their fortitude and pertinacity commonly secured them the victory, and almost always prevented defeat from degenerating into disaster. As they were not ready to receive, neither were they prone to communicate, outward impressions; and hence, both in their poetry and prose, the narrative is often concealed by expressions of the feeling, and tinged as it were with the hue and colour of the mind. They endeavoured always to condense and concentrate their thoughts, which was the cause of the great brevity and obscurity of their language; and as their attention was turned to the past rather than the future, they cherished an ardent attachment to the usages and manners of their forefathers, as embodied and preserved in their actual institutions. Hence the Dorians preserved most rigidly, and represented most truly, the customs of the ancient Greeks. They were not a stationary, far less a retrograding people; but the advances which they made were slow, and all their changes imperceptible.

With the desire to attain uniformity, for which the Dorians were distinguished, there was also combined in their character another remarkable peculiarity; namely, a love for measure and proportion. Their works of art are conspicuously marked by this attention to singleness of effect; and every thing discordant or useless was pruned off with an unsparing hand. Their moral system also prescribed the observance of the proper medium in all things; and it was in this that the temperance which so distinguished them consisted; it was the synonyme, not of abstinence, but of moderation. One great object of the worship of Apollo, which the Dorians introduced into Greece, was to maintain undisturbed the balance of the mind, and to remove every thing calculated to disquiet the thoughts, inflame the passions, or overcloud the serenity of the soul. The nature of this singular race seems to have required an equal and regular harmony; and for this reason dissonances, even if combined into harmony, were by no means suited to their taste. The national song was doubtless not remarkable for soft or pleasing melody; and the general accent of the language had the tone and character of command, without any of that delicacy or flexibility which are required in Elysian airs or Lydian measures. But the Dorians were contented with themselves, and with the powers to which they owed their existence and their happiness; in almost every sense, they were a self-concentred race, living in themselves and for themselves; they looked not to future, but to present existence, and they loved their own laws, religion, institutions, manners, customs, literature, and arts, too much to envy those of other nations, or even to desire to imitate them. Man was the chief and almost only object which attracted their attention. This feeling may be detected in their religion, which was always unconnected with the worship of any natural object, and originated solely from their own reflections and conceptions; and to the same source may perhaps be traced their aversion to mechanical and agricultural labour, a feeling which belongs and is indeed natural to minds of a contemplative turn. In a word, the whole Doric race bears the stamp and character of the male sex among nations; the desire of assistance and connection, of novelty and curiosity, the characteristics of the weaker sex, being directly opposed to the nature of the Dorians, which, from first to last, was marked by severe simplicity, inflexible independence, subdued strength, and unquenchable nationality. (See Müller's *History and Antiquities of the Doric Race*, English translation, Oxford, 1830, 2 vols. 8vo.)

(A.)

DORIC, in general, any thing belonging to the Dorians.

Doric, in *Architecture*, is the second of the five orders, being that between the Tuscan and Ionic. See Architecture.

Doric *Dialect*, one of the five dialects, or forms of speech, which prevailed among the Greeks. It was first used by the Lacedæmonians, and particularly by those of Argos; and thence it passed into Epirus, Libya, Sicily, and the islands of Rhodes and Crete. In this dialect wrote Archimedes and Theocritus, who were both of Syracuse, as likewise Pindar.

In strictness, however, we should rather define Doric the manner of speaking peculiar to the Dorians, and which afterwards came to prevail among the Lacedæmonians and other states. Some even distinguish between the Lacedæmonian and Doric; but in reality, setting aside a few particularities in the language of the Lacedæmonians, these dialects were the same; as indeed is shown by Rulandus in his treatise *De Lingua Græca ejusque Dialectis*.

Besides the authors already mentioned as having written in the Doric dialect, we might add Archytas of Tarentum, Bion, Callinus, Simonides, Bacchylides, Cypselas, Alcmeon, and Sophron.

Most of the medals of the cities of Græcia Magna and Sicily savour of the Doric dialect in their inscription: thus, ΑΜΒΡΑΚΙΩΤΑΝ, ΑΠΟΛΛΩΝΙΑΤΑΝ, ΑΧΕΟΡΟΝΤΑΝ, ΑΧΥΡΙΤΑΝ, ΗΡΑΧΛΕΩΤΑΝ, ΤΡΑΧΙΝΙΩΝ, ΘΕΡΜΙΤΑΝ, ΚΑΥΛΟΝΙΑΤΑΝ, ΚΟΠΙΑΤΑΝ, ΤΑΥΡΟΜΕΝΙΤΑΝ. These names indicate the countries in which the Doric dialect was used.

The general rules of this dialect are laid down by the grammarians of the Port-Royal; but they are much better explained in the fourth book of Rulandus, where he even notes the minuter differences of the dialects of Sicily, Crete, Tarentum, Rhodes, Lacedæmon, Laconia, Macedonia, and Thessaly. The omega abounds everywhere in the Doric; but this dialect bears so close a conformity to the Æolic, that many reckon them but one. (See Müller's *History and Antiquities of the Doric Race*, vol. ii. appendix.)

Doric *Mode*, in *Music*, the first of the authentic modes of the ancients. Its character is severity tempered with gravity and joy; and it was proper upon religious occasions, as also used in war. Plato admires the music of the Doric mode, and judges it proper for preserving good manners, from being masculine in its character; on which account he allows it in his commonwealth. The ancients had likewise their subdoric or hypodoric mode, which was one of the plagal modes. Its character was also very grave and solemn, and it begins a fourth lower than the Doric.

DORING, or Daring, among sportsmen, a term used to express a method of taking larks, by means of a clapnet and a looking glass. For this sport there must be provided four sticks very straight and light, about the size of a pike; and two of these must be about four feet nine inches long, and all notched at the edges or the ends. At one end of each of these sticks there is fastened another of about a foot long on one side; and on the other side a small wooden peg about three inches long. Then four or more sticks are prepared, each of them one foot in length; and every one of these must have a chord of nine feet long fastened to it at the end. Each should be provided with a buckle for the commodious fastening on of the respective sticks when the net is to be spread. A cord must also be provided, having two branches. The one must be nine feet and a half, and the other ten feet long, with a buckle at the end of each; the rest of the cord must be twenty-four yards long. All these cords, as well the long ones as those about the sticks, must be well twisted, and of the thickness of one's little finger. The next thing to be provided is a staff four feet long, pointed at one end, and with a ball of wood at the other, for carrying these conveniences in a sack or wallet. There should also be carried a spade to level the ground where there may be any little irregularities, with two small rods, each eighteen inches long, and having a small rod fixed with a pack-thread at the larger end of one of them. To these are to be tied some pack-thread loops, in order to fasten the legs of some larks; and there must also be reels, that the birds may fly a little way up and down. When all this is done, the looking-glass is to be prepared in the following manner. Take a piece of wood about an inch and a half thick, and cut it in the form of a bow, so that there may be about nine inches space between the two ends; and let it have its full thickness at the bottom, that it may receive into it a false piece, in the five corners of which there are to be set in five pieces of looking-glass. These must be so fixed as to dart their light upwards; and the whole machine must be supported on a moveable pin, with the end of a long line fixed to it, and made in the manner of the children's plaything called an apple and a plumstone; so that one end of the cord being carried through a hedge, the barely pulling it may set the whole machine of the glass a turning. This and the other contrivances are to be placed in the middle between the two nets. The larks fixed to the place, and termed *calls*, with the glittering of the looking-glasses as they twirl round in the sun, invite the other larks down; and the cord which communicates with the nets, and goes through the hedge, gives the person behind an opportunity of pulling up the nets, so as to meet over the whole, and take every thing that is between them. The places where this sort of sporting succeeds best are open fields remote from any trees and hedges, except one by way of shelter for the sportsman; and the wind should always be either in the front or back, for if it blows sidewise, it prevents the playing of the net.

DORKING, a market-town of the hundred of Wooton, in the county of Surrey, twenty-four miles from London. It is in a good situation, at the junction of two valleys, on a gentle elevation. There is a fine church, formerly collegiate. The market is held on a Thursday. The inhabitants amounted in 1801 to 3058, in 1811 to 3259, in 1821 to 3812, and in 1831 to 4711.

DORMANS, a city of the department of the Marne, in France, on the left bank of the river Marne, with 428 houses, and 2275 inhabitants, who carry on a great trade both in corn and in wine of Champagne.

DORMANT, in *Heraldry*, is used for the posture of a lion, or any other beast, lying along in a sleeping attitude, with the head on the fore paws; by which it is distinguished from the *couchant*, where, though the beast is lying, yet he holds up his head.

DORMER, in *Architecture*, signifies a window made in the roof of a house, or above the entablature, being raised upon the rafters.

DORMITORY, a gallery in convents or religious houses, divided into several cells, in which the religious sleep or lodge.

DORNBERG, a circle in the grand duchy of Hesse-Darmstadt, comprising the town of that name, and twenty-seven villages, with 1093 houses, and 7732 inhabitants.

DORNBIRN, a market-town of the circle of Bregentz, and Austrian province of Tyrol. It stands on the river Fussach, and is a flourishing place, owing to its manufactories of muslins and cotton cambrics, and its mills for spinning flax. It contains more than 4000 inhabitants.

DORNOCH, a royal burgh of Scotland, in the county of Sutherland. It is situated on the northern coast of the Frith of Dornoch, on a low sandy beach, nearly opposite the burgh of Tain, which lies on the south side of the frith.

It is of considerable antiquity, and was formerly the seat of the bishops of Caithness, who had here a spacious castle. The parish church is part of the cathedral, which is supposed to have been erected in the eleventh century. Dornoch, although the seat of the county courts, is a mere village, with little or no trade. The population of the town and parish amounted in 1821 to 3100, and in 1831 to 3380.

Dornoch Frith, an arm of the sea on the eastern coast of the Highlands of Scotland, serving as the boundary between the counties of Ross and Sutherland for several miles. It is twelve miles broad at its mouth, and here has more the character of a bay than of a frith. It gradually becomes narrower, till, within three miles west from the town of Dornoch, its breadth decreases to two miles. Above this point it becomes much broader, forming an inner harbour or bay. There are several ferries upon this frith, and near its head it is crossed by an iron bridge, where also the rivers Oykel and Shin empty their waters.

DOROBAT, a small town of Arabia, in the country of Yemen, the capital of a district situated on the crest of a mountain, remarkable for a prison excavated from the rock, where malefactors are secured by long chains. It is twelve miles west of Taas.

DORONINSK, a town of Asiatic Russia, in the government of Irkutsk, situated on the river Ingoda, 208 miles east-south-east from Irkutsk.

DORPAT, a circle in the Russian province of Livonia, but formerly of Esthonia. It extends over 3420 square miles, and contains a population of 137,415 souls, in two cities and twenty parishes, with 206 noble residences, and 15,331 peasants' dwellings. The chief place, the city of the same name, is situated on the great Embach. It is an open city, built in the German style, and by far the best constructed of any place in Livonia. It has a Greek and a Lutheran church, 1200 houses, and about 10,000 inhabitants. It is chiefly remarkable on account of its university, which is the best in Russia, both as regards its professors, and the appropriate collections necessary for instruction in the higher branches of science, particularly of astronomy. There are also good preparatory schools. Long. 26. 37. 45. E. Lat. 58. 22. 47. N.

DOROGOBUSH, a circle in the European Russian government of Smolensko. It occupies both sides of the river Dnieper, and is tolerably fruitful and well cultivated. The chief place is the city of the same name. It is the seat of a bishop; is neatly built, mostly of stone; and contains 3990 inhabitants, who chiefly subsist by the trade on the river Dnieper.

DOROHOE, a circle of Moldavia, in the northernmost part of that principality, watered by the rivers Pruth, Sireth, Schiga, and Bascheu. The capital is of the same name. It is situated on the side of a lake, is a large but not compact town, and, like the other towns in Moldavia, is filthy and badly built. It contains many churches and monasteries, has a weekly market, and is the seat of the court of law for a part of the province.

DORSETSHIRE, an English county, situated on the south-western coast. In British times, and previous to the landing of Cæsar, it was inhabited by the Durotriges and Morini, two appellations derived from the British language, and signifying dwellers on the coasts of the ocean. By the Romans this county constituted a portion of *Britannia Prima;* and the Saxons called it Dorsetta (a word having the same meaning as the above British appellation), and included it in the kingdom of Wessex. Kingston Hall and Corfe Castle are mentioned as royal residences.

On the north Dorsetshire is bounded by Somersetshire and Wiltshire, on the east by Hampshire, on the west by Devonshire and a part of Somersetshire, while the British Channel bounds it on the south. The irregularities of its form prevent its being compared to any determinate figure; the northern boundary has a considerable angular projection in the middle; the southern coast runs out in various points and headlands; and the western coast inclines towards Devonshire, with an irregular line. Its greatest length from north to south is about thirty-five miles, and its breadth from east to west fifty-five; its circumference, including about 775,000 acres, is nearly 160 miles.

Dorsetshire is divided into thirty-four hundreds, containing more than 390 parishes, nine boroughs, and twenty-two market-towns, the principal of which are Dorchester, Bridport, Sherborne, Lyme-Regis, Shaftesbury, Wareham, Weymouth, Melcombe Regis, Poole, and Blandford. This county formerly returned twenty members to the House of Commons; but by the recent law it will only elect thirteen, viz. three for the county, two for Dorchester and for Poole, and the two boroughs of Weymouth and Melcombe Regis, now formed into one, will elect two members; Bridport, Lyme, Shaftesbury, and Wareham, each of which towns returned two, will in future elect but one. Corfe Castle has been disfranchised. Dorsetshire forms part of the see of Bristol. Its bishop was established at Sherborne by Henry the Eighth, but was shortly added to the diocese of Bristol. In remote times it had been a part of the sees of Oxford, of Salisbury, and of Winchester successively.

The surface of Dorsetshire is hilly and uneven. A great portion of the county has the appearance of downs, open and uninclosed portions, covered with sheep. More sheep are pastured in the neighbourhood of Dorchester than in any other district, though great numbers of both sheep and oxen are fed in the valley of Blackmore, which is celebrated as rich pasture land, containing upwards of 170,000 acres. There are also in this district several orchards, producing excellent cider. On the south-western side there are many vales of great luxuriance; but on the south-eastern there is much waste land, dreary and barren, hardly supporting, even in the summer months, a few sheep and cattle, and supplying the neighbouring villages with heath for fuel. Even in this region, however, cultivation is advancing, and detached portions are improved. The turnpike-roads in this county are numerous, rendering travelling easy and commodious.

These downs are principally of a light chalky soil, with a turf remarkably fine, producing hay, in the inclosed parts, of an excellent quality, on which beasts will thrive well in winter without any other food. About Bridport the lower lands are mostly a deep rich loam; but on the hills, throughout the western district, the soil is a sandy loam, intermixed with flint, well adapted for the growth of beech. To the north of Sherborne, where is some of the best land in the county for the plough, it is a stone brack, which is the case in the Isle of Portland and the Isle of Purbeck. In the centre of the county the soil is good and the land well managed.

Dorsetshire is not a well-wooded county; and, in general, native timber is scarce and dear. In some local spots, where the land is cold and wet, such as Duncliff in the vale of Blackmore, Heycombe Wood in the vale of Sherborne, and others of a similar nature, some plantations may be seen.

The air of Dorsetshire is remarkably mild and salubrious; which, added to the beauty of its scenery, has obtained for it the appellation of the Garden of England. Weymouth has long been celebrated as a fashionable watering-place; and, owing to the general calmness of the sea there, its pleasant situation, and its commodiousness for bathing, it has, through the frequent visits of the royal family, risen to great consequence.

The chief port in the county is Poole, situated on an estuary formed by the mouth of the Frome. Its entrance is defended by Brownsea Castle, and it is very secure in all winds. It is the chief place for equipping ships for the Newfoundland fishery; and considerable trade is carried on from it with Spain, Portugal, and the Mediterranean. Swanage, Weymouth, Bridport, and Lyme have harbours capable of admitting small vessels only.

The rivers of Dorsetshire are the Frome, the Stour, the Piddle, and the Ivel. The Frome rises in the north-western part of the county, near Evershot; and, passing by Dorchester, reaches Poole, and falls into its bay. The Stour enters this county from Wiltshire, near Gillingham, and, pursuing a southern and south-eastern direction, enters Hampshire. The Piddle rises in the north, and, flowing to the south-east, unites with Poole Bay. The Ivel, anciently Yoo, has its origin from several springs near Horethorn, in a hill north-east from Sherborne, from which town it flows into Somersetshire, and falls into the Parret.

Although neither coal nor any metallic ores have ever been worked in Dorsetshire, the stone quarries of Purbeck and Portland have long been celebrated. Purbeck, though called an island, is more properly a peninsula, of an irregular oval form, about twelve miles in length and seven in breadth. The soil is altogether calcareous, and for the most part a continued mass, either of white or a brownish limestone, the latter having a mixture of sea-shells. The quarries on the south side of the isle afford an inexhaustible fund of natural curiosities. The best quarries are at Kingston, Worth, Langton, and Swanwick. The Swanwick stone is white, full of shells, takes a polish, and looks like alabaster. About Wareham and Morden is found a stone of an iron colour, called fire-stone. Near Dunshay, marble of various colours, blue, red, gray, and spotted, is dug up; but all of a coarse grain. Much of the stone of this district was used in the building of St Paul's Cathedral, Westminster Bridge, and Ramsgate Pier, and may be discovered in many of our ancient cathedrals, churches, grave-stones, and monuments. One of the most valuable products of Purbeck is a white clay used for making pipes, and very extensively applied to the manufacture of China. Large quantities of it are dug, and many vessels loaded with it for Staffordshire, at Russell Quay, within the port of Poole.

The rocks in the Isle of Portland rise frequently to 100 or 150 feet in height, and large masses lie scattered on the shore. These are composed of calcareous grit, containing moulds or larox of various shells, and emitting, when rubbed with steel, a bituminous smell. The grit is cemented together by a calcareous paste. The quarries are scattered among these rocks, more or less, in every part of the isle; but those of most repute are at Kingston. At this place there is a pier, whence upwards of 6000 tons of stone, on an average, are supposed to be shipped off annually. The first stratum in these quarries is about one foot of blackish or reddish earth; then six feet of stone, not fit for exportation. Below this is the bed of good stone, ten or twelve feet deep, and beneath it flint or clay. The stratum of stone that is worked for sale lies nearly parallel with the upper surface of the island, and without much earth or rubbish on it. When the beds are cleared, the quarrymen proceed to cross-cut the large flats, which is done with wedges. The beds being cut into distinct lumps, are squared by the hammer to the largest size which it will admit; and blocks are thus formed from half a ton to six or eight tons weight. The colour of the Portland stone, or free stone as it is sometimes called, from the freedom with which it may be broken into any shape, is well known, as almost white, and as composing the materials of the most splendid erections in London, as well as in other parts of the British empire.

The general practice and management of tillage in this county is less attended to than any part of agriculture; for it appears to be the plan of the farmers to put the seed into the ground with as few ploughings as possible. The sowing of wheat is often effected with one ploughing; and symmetry and neatness are so much disregarded, that, in small pieces of land, the ploughman will vary three or four yards from a straight line. The plough used is called a *sull*, and is long, large, and heavy, with one small wheel at the side of the beam, and worked by four horses or six oxen, two abreast. In the neighbourhood of the towns, land lets for from forty to fifty shillings the acre; and, in general, arable land from twenty to thirty.

Barley is found to make the best returns; and from 10,000 to 12,000 bushels of salt are annually made in some of the towns. Flax and hemp are objects of great importance about Bridport, Bradford, and Beminster. The seed is imported from Riga, and the average crop is from fifty to sixty dozen pounds per acre, worth from four shillings and sixpence to seven shillings per dozen. It is a precarious crop, depending very much on the season; and hence the quantity cultivated has of late years been gradually diminished.

The sheep of Dorsetshire have long been celebrated. They are horned, white faced, with long small white legs, the carcass rather long and thin, the mutton fine grained and of good flavour, weighing per quarter, in wethers at three years and a half old, from sixteen to twenty pounds. Their wool is fine and short; and the breed has the peculiar property of producing lambs at any period. The stock of the county is supposed to be 800,000, of which number 150,000 are annually sold and sent out of the county. The produce of the wool yearly is estimated at 90,000 weight, of thirty-one pounds each.

The breed of horses is not particularly regarded. The oxen are principally of the red Devon breed, crossed with the Hampshire and Wiltshire; and are frequently employed in agriculture. Cows are much used for the dairy, very little account being made of their size or colour, if they produce much milk. Butter is the greatest produce, though some cheese is also manufactured.

The mackerel fishery is of considerable consequence to this county. Vast numbers are taken near Abbotsbury, and along the shore from Portland to Bridport. The season for taking them is from the middle of March till midsummer, in nets or seines. Herrings and other fish common in these seas are also taken in abundance.

The manufactures of Dorsetshire are not extensive. The principal are those of flax and hemp, in the neighbourhood of Bridport and Beminster, and also on a smaller scale in the Isle of Purbeck; of all sorts of buttons, chiefly at Blandford, and to a smaller extent at Shaftesbury; and of a sort of flannel or coarse woollen cloth, called swanskin, at Sherminster. At Stalbridge is a manufacture for spinning silk, and at Sherborne is another upon a larger scale. Some worsted stockings are made at Wimborne.

On the extended downs in the neighbourhood of Dorchester several tumuli are thrown up in all directions, proving this town to have been an important place in British times. Maiden Castle, situated on the apex of a hill about one mile south of the town, is undoubtedly the remains of an original British fortress. Nearly two miles north-west of Kingston-Hall, in the parish of Shapwicke, is a celebrated encampment called Bradbury Rings, which occupies the summit of a considerable eminence. This camp is of a circular form, with treble ramparts and ditches, having two entrances, one on the north-east and another on the western side. The circumference of the outer rampart is nearly a mile. In the parish of Lullworth is another British fortification, consisting of three ramparts and ditches, including an area of about five acres. It is generally called Flowers' Barrow, from the prevalence of these ancient sepulchres within its compass. Many of these barrows have been opened, and found to contain burnt bones, corroded metal, and remains of ancient warlike instruments. A barrow was opened some years ago at Stowborough, in which a body was discovered in an excavated oak trunk, wrapped in folds of skin. Between three and four miles from Corfe Castle eastward is Nine Barrow Down, an eminence which derives its name from the nine large barrows situated on it in a line. About a mile from Winterbourn Abbas is a small druidical circle, the diameter of whose area is twenty-eight feet; and the adjacent downs are much fuller of Celtic barrows than even Salisbury Plains. There is an endless field in many parts of the country for those fond of British antiquities.

The *Via Iceniana*, or Icennine Way, enters the county near Woodyates; and passing through Dorchester, takes its course to Seaton in Devonshire. There are several smaller ways proceeding from Dorchester, Winborne Minster, and some other places in the county. The Roman stations in Dorsetshire appear, from the best authorities, to have been, *Londinis*, now Lyme-Regis; *Canca-Arixa*, Charmouth; *Durnovaria*, Dorchester; *Vindogladia*, Winborne; *Clavinio*, Weymouth; *Morinio*, Wareham; and *Bolclannio*, Poole. Near Dorchester are the remains of a Roman amphitheatre, which is computed to have held nearly 13,000 spectators. A large circular entrenchment may be traced upon Woodbury Hill, supposed to have been the *Castra Stativa* of the Romans. On Hambledon Hill is another encampment; and also the remains of what has been thought to be a labyrinth. In the parish of Rampisham a beautiful tessellated pavement, about fourteen feet by ten, was discovered in 1799; and in the vale between Maiden-Newton and Frampton, at the distance of 150 yards from the river Frome, another of much larger dimensions was found in 1794. At Sturminster-Newton are the ruins of a castle, in the form of the letter D.

The remains of ancient castles are numerous in Dorsetshire. The principal are the following: Corfe, whose ruins are large, and allowed to be the noblest and grandest in the kingdom; Abbotsbury, a little north of East Bexington; Brownsea Castle, in the island of the same name; and Portland Castle.

The abbeys whose ruins may yet be discovered are those of the monastery of Benedictines at Cranborne, a part of which now forms the parish church, one of the oldest in the county; Cerne Abbey, said to be founded by St Augustin, the remains of which are not many, but interesting; Abbey Milton, whose church is now converted into a private chapel; and the monastery of Shaftesbury, the ruins of which are discernible near the mansion of Sir Thomas Arundel. Some parts of the cloister and domestic buildings of the Abbey of Sherborne are now occupied by silk-machinery; besides inconsiderable remains of several more.

The church of Fordington is partly in the Saxon style; that of Corfe is Gothic. The churches of Dorchester, Sherborne, Millbourne, St Andrew, Rapisham, Weymouth, and Shaftesbury, are all venerable buildings; but Dorsetshire cannot boast of many instances of ancient ecclesiastical buildings.

Amongst the modern erections of this county should be mentioned the new jail of the county town. It was built according to Howard's plan, under the direction of Bradburn the architect. In its external appearance it is peculiarly handsome and characteristic; and the interior possesses every convenience appropriate to its destination.

The principal noblemen and gentlemen's seats of Dorsetshire are, Eneombe, the seat of the Earl of Eldon; Grange, that of John Bond, Esq.; Moer Critchel, that of C. Sturt, Esq.; Parnham, that of Sir William Oglander, Bart.; Lullworth Castle, that of Cardinal Weld; Abbey Milton, that of Dawson Damer, Esq.; Sherborne Castle, that of the Earl of Digby; Kingston Hall, that of H. Bankes, Esq.; and Bridehead, that of E. Williams, Esq.

This county affords the following titles to different noble families; Earl of Dorchester, to the family of Carleton; Earl of Sherborne, to the family of Dutton; Earl of Shaftesbury, to that of Ashley Cooper; Viscount Bridport, to that of Hood; Duke of Portland, to that of Bentinck; Duke of Dorset, to that of Sackville; and Earl Digby, to that of Digby.

The inhabitants of this county were estimated in 1700 at 90,000, and in 1750 at 96,000. By the four decennial censuses, they appear to have been as follows: in 1801 115,319, in 1811 124,693, in 1821 144,499, and in 1831 150,400. The annual value of the real property of the county, according to the assessment of 1815, was L.698,395.

DORSIFEROUS PLANTS, among botanists, such as are of the capillary kind, without stalks, and which bear their seeds on the back side of their leaves.

DORT, or **DORTRECHT**, a circle in the province of Holland, in the Netherlands, divided into the four cantons of Dort, Old Beaverland, Ridderkerk, and Stryen, and containing 51,361 inhabitants.

DORT, a city of Holland, the capital of the circle of the same name, situated on the rivers Merve and Biesbosch. It is celebrated from the theological synod held there in the years 1618 and 1619. It is a place of great trade, especially in Rhine wine, timber, flax, stock-fish, and train-oil; and there are many refineries for sugar and salt, distilleries of Geneva, and mills for spinning cotton, wool, and flax. It contains 3954 houses, and 17,387 inhabitants. Long. 4. 33. 12. E. Lat. 51. 47. 52. N.

DORTMUND, a circle in the Prussian province of Westphalia, in the government of Arensberg. It extends over 180 square miles, or 51,200 acres, and comprehends five cities, one market-town, and several villages, with a population of 32,509 persons.

DORY HARBOUR, a harbour on the northern coast of Papua. At this harbour are neither fowls nor goats; but wild hogs, fish, greens, fruit, &c. Wood is plentiful, and the wild nutmeg grows in the vicinity. Long. 134. 35. E. Lat. 48. S.

DORYPHORI (from δορυ, *spear*, and φερω, *I bear*), an appellation given to the life-guardmen of the Roman emperors. They were held in such high estimation as frequently to have the command of armies conferred on them. It was usual also for commanders-in-chief to have their doryphori or life-guard to attend them.

DOSITHEANS (*Dosithei*), an ancient sect among the Samaritans in the first century of the Christian era.

Mention is made by Origen, Epiphanius, Jerome, and various other Greek and Italian fathers, of one Dositheus, the chief of a faction among the Samaritans; but the learned are not all agreed as to the time when he lived. St Jerome, in his dialogue against the Luciferians, places him before the time of our Saviour; and in this he is followed by Drusius, who, in his answer to Serrarius, places him about the time of Sennacherib, king of Assyria. But Scaliger contends that he was posterior to our Saviour's time; and in effect Origen intimates that he must have been contemporary with the apostles, observing that this man endeavoured to persuade the Samaritans that he was the Messiah foretold by Moses.

Dositheus had many followers; and his sect subsisted at Alexandria in the time of the patriarch Eulogius, as appears from a decree of that patriarch published by Photius. In this decree Eulogius accuses Dositheus of abusing the ancient patriarchs and prophets, and of attributing to himself the spirit of prophecy; makes him contemporary with Simon Magus; and accuses him of corrupting the Pentateuch in various places, as well as of composing several books directly contrary to the law of God.

Archbishop Usher conceives Dositheus to have been the author of all the changes made in the Samaritan Pentateuch, which he infers on the authority of Eulogius. But all that we can justly gather from the testimony of Eulogius is, that Dositheus corrupted the Samaritan copies since used by that sect. This corruption, however, did not pass into all the copies of the Samaritan Pentateuch now in use amongst us, which vary but little from the Jewish Pentateuch; and hence we are to understand the passage in a Samaritan chronicle, where it is said that Dousis or Dositheus altered several things in the law of Moses, in the sense here indicated. The author of that chronicle, who was a Samaritan by religion, adds, that the high priest sent several Samaritans to seize Dousis and his corrupted copy of the Pentateuch.

Epiphanius takes Dositheus to have been a Jew by birth, and to have abandoned the Jewish party for that of the Samaritans. He imagines him likewise to have been the founder of the sect of the Sadducees. But this seems inconsistent with his being later than our Saviour; and yet the Jesuit Serrarius agrees to make Dositheus the master of Sadok, from whom the Sadducees were derived.

Tertullian, in mentioning the same Dositheus, observes that he was the first who dared to reject the authority of the prophets, by denying their inspiration. But he charges as a crime peculiar to that sectary, what in reality was common to the whole sect, who never allowed any but the five books of Moses to be of divine inspiration.

DOSSER, a sort of basket to be carried on the shoulders of men. It is used in carrying the surplus earth from one part of a fortification to another where it is wanted. There are likewise small carts and wheel-barrows for the same use.

DOTIS, a market-town of Hungary, in the circle of Farther Danube. It is situated on the river Tata, near a small lake. There is an ancient castle and keep belonging to Prince Esterhazy. It contains two Catholic and one Lutheran church, a synagogue, two monasteries, 850 houses, and 8580 inhabitants. It is a place of considerable trade. Long. 18. 13. 6. E. Lat. 47. 38. 45. N.

DOUAY, an arrondissement in the department of the North, in France, extending over 450 square miles, divided into thirteen cantons, and these subdivided into 146 communes, containing 183,560 inhabitants. The city which gives its name to the arrondissement is on the river Scarpe, which is divided into several channels in passing through it. The fortifications are strong, and more easily defended, from the ease with which the environs may be inundated. It is a large but not well-built city, containing 2730 houses, and 18,460 inhabitants. It was once celebrated as the place of education of Catholic priests for the British dominions. It is now the seat of large manufactories of various kinds. Long. 2. 59. 42. E. Lat. 50. 22. 12. N.

DOUBLE; two of a sort, one corresponding to the other.

Double Children, Double Cats, &c. See Monster.

Double Employment, in *Music*, a name given by Rameau to the two different modes in which the chord of the sub-dominant may be regarded and treated, namely, as the fundamental chord of the sixth superadded, or as the chord of the great sixth, inverted from a fundamental chord of the seventh. In reality the chords carry exactly the same notes, are figured in the same manner, and are employed upon the same chord of the tone, in such a manner that frequently we cannot discern which of the two chords the author employs, except by the assistance of the subsequent chord, which resolves it, and which is different in these different cases.

To make this distinction, we must consider the diatonic progress of the two notes which form the fifth and the sixth, and which, constituting between them the interval of a second, must one or the other constitute the dissonance of the chord. Now this progress is determined by the motion of the bass. Of these two notes, then, if the superior be the dissonance, it will rise by one gradation into the subsequent chord, the lower note will keep its place, and the higher note will be a superadded sixth. If the lower be the dissonance, it will descend into the subsequent chord, the higher will remain in its place, and the chord will be that of the great sixth.

With respect to the composer, the use which he may make of the double employment is to consider the chord in its different points of view, that he may thence know how to make his entrance to it, and his exit from it; so that having, for instance, arrived at the chord of the superadded sixth, he may resolve it as a chord of the great sixth, and reciprocally.

D'Alembert has shown that one of the chief uses of the double employment is, that we may be able to carry the diatonic succession of the gamut even to an octave, without changing the mode, at least whilst we rise; for in descending we must change it. Of this gamut, and its fundamental bass, an example will be found in Rousseau's *Musical Dictionary*. It is evident, according to the system of Rameau, that all the harmonic successions which result from it are in the same tone; for, in strictness, no other chords are there employed but three, namely, that of the tonic, that of the dominant, and that of the sub-dominant; which last, in the double employment, constitutes the seventh from the second note, and is employed upon the sixth.

With respect to what D'Alembert says in his *Elements of Music* (p. 70), and repeats in the *Encyclopédie* (article *Double Emploi*), that the chord of the seventh *re fa la ut*, though we should even regard it only as an inversion of *fa la ut re*, cannot be followed by the chord *ut mi sol ut*, Rousseau declares, "I cannot be of his opinion in this point." The proof which he gives in support of this dissent is, that the dissonance *ut* of the first cannot be resolved in the second. And this is true, since it remains in its place; but in the chord of the seventh, *re fa la ut*, inverted from the chord of the superadded sixth, *fa la ut re*, it is not the *ut*, but the *re*, which is the dissonance; and consequently it ought to be resolved in ascending upon *mi*, as it really does in the subsequent chord; so that this procedure in the bass itself is forced, which, from *re*, cannot without an error return to *ut*, but ought to ascend to *mi*, in order to resolve the dissonance.

D'Alembert afterwards shows that this chord *re fa la ut*, when preceded and followed by that of the tonic, cannot be authorized by the double employment; and this is likewise true; because, in fact, this chord, though figured with a 7, is not treated as a chord of the seventh, neither when we make our entrance to it nor our exit from it; or at least that it is not necessary to treat it as such, but simply as an inversion of the superadded sixth, of which the dissonance is the bass; in which case we ought by no means to forget that this dissonance is never prepared. Thus, though in such a transition the double employment is not in question, and though the chord of the seventh be no more than apparent, and impossible to be resolved by the rules, this does not hinder the transition from being proper and regular.

This inversion of the chord of the sixth superadded, which transfers the dissonance to the bass, has been censured by Rameau, who, taking it for a fundamental chord, the chord of the seventh, which results from it, rather chose to make the fundamental bass descend diatonically, and resolve one seventh by another, than to unfold this seventh by an inversion. But Rousseau has dissipated this error, and many others, in some papers which long ago passed into the hands of D'Alembert when he was composing his *Elements of Music*. In other respects, the double employment cannot be used with too much reserve, and the greatest masters are the most temperate in putting it in practice.

Double Fichy, or *Fiché*, in *Heraldry*, the denomination of a cross, when the extremity has two points; in contradistinction to fiché, where the extremity is sharpened away to one point.

Double Octave, in *Music*, an interval composed of fifteen notes in diatonic progression, and which, for that reason, is called a *fifteenth*. It is, says Rousseau, an interval composed of two octaves, called by the Greeks, *disdiapason*.

It deserves, however, to be remarked, that in intervals less distant and compounded, as in the *third*, the *fifth*, the *simple octave*, and so on, the lowest and highest extremes are included in the number from whence the interval takes its name. But, in the *double octave*, when termed a fifteenth, the simple number of which it is composed gives the name. This is by no means analogical, and may occasion some confusion. We should rather choose, therefore, to run any hazard which might occur from uniformly including all the terms of which the component intervals consist, and call the *double* octave a sixteenth, according to the general analogy.

DOUBLET, among lapidaries, implies a counterfeit stone, composed of two pieces of crystal, and sometimes glass softened, together with proper colours between them; so that they make the same appearance to the eye as if the whole substance of the crystal had been tinged with these colours.

The impracticability of imparting tinges to the body of crystals, while in their proper and natural state, and the softness of glass, which renders ornaments made of it greatly inferior in wear to crystal, offer inducements to the introduction of colouring the surface of crystal wrought in a proper form, in such a manner that the surfaces of two pieces so coloured being laid together, the effect may appear the same as if the whole surface of the crystal had been coloured. The crystals, and sometimes white transparent glass so treated, were called *doublets*, and at one time prevailed greatly in use, on account of the advantages with respect to wear which such doublets had, when made of crystal, over glass, and the brightness of the colours which could with certainty be given to counterfeit stones in this way, when coloured glass could not be procured, or at least not without a much greater expense. Doublets have not indeed the property which the others have, of bearing to be set transparent, as is frequently required in drops of ear-rings and other ornaments; but when mounted in rings, or used in such a manner that the sides of the pieces where the joint is made cannot be inspected, they have, when formed of crystal, the title to a preference over the coloured glass; and the art of managing them is therefore, in some degree, of the same importance with that of preparing glass for counterfeiting gems, and is properly an appendage to it, as being entirely subservient to the same intention. The manner of making doublets may be shortly described.

Let the crystal or glass be first cut by the lapidaries in the manner of a brilliant, except that, in this case, the figure must be composed of two separate stones, or parts of stones, formed in the manner of the upper and under parts of a brilliant, if it was divided into a horizontal direction, a little lower than the middle. After the two plates of the intended stone are thus cut, and fitted so exactly that no division can appear when they are laid together, the upper part must be polished ready for setting; and then the colour must be put betwixt the two plates by the following method. Take of Venice or Cyprus turpentine two scruples; and add to it one scruple of the grains of mastich chosen perfectly pure, free from foulness, and previously powdered. Melt them together in a small silver or brass spoon, ladle, or other vessel, and add to them gradually any of the coloured substances mentioned below, but well powdered; stirring them together as the colour is put in, that they may be thoroughly commixed. Then warm the doublets to the same degree of heat as the melted mixture, paint the surface of the lower part, and put the upper one instantly upon it, pressing them to each other, but taking care that they may be conjoined in the most perfectly even manner. When the cement or paint is quite cold and set, the redundant part of it, which has been pressed out of the joint of the two pieces, should be gently scraped off the side, till there be no appearance of any colour on the outside of the doublets; and they should then be skilfully set; observing to carry the mounting over the joint, that the upper piece may be well secured from separating from the under one.

The colour of the ruby may be best imitated by mixing a fourth part of carmine with some of the finest crimson lake that can be procured. The sapphire may be counterfeited with very bright Prussian blue, mixed with a little crimson lake, to give it a cast of the purple. The Prussian blue should not be very deeply coloured, or but little of it should be used, otherwise it will give a black shade that will be injurious to the lustre of the doublets. The emerald may be well counterfeited with distilled verdigris, to which is added a little powdered aloes. But the mixture should not be strongly heated, or kept long over the fire after the verdigris has been added. The resemblance of the garnet may be made with dragon's blood; which, if it cannot be procured of sufficient brightness, may be helped by a very small quantity of carmine. The amethyst may be imitated with the mixture of some Prussian blue with the crimson lake; but the proportions can only be regulated by direction, as different parcels of the lake and Prussian blue vary extremely in the degree of strength of the colour. The yellow topazes may be counterfeited by mixing the powdered aloes with a little dragon's blood, or by good Spanish arnotto; but the colour must be very sparingly used, or the tinge will be too strong for the appearance of that stone. The chrysolite, hyacinth, vinegar garnet, aqua-marine, and other such weaker or more diluted colours, may be formed in the same manner, by lessening the proportions of the colours, or by compounding them together corresponding to the hue of the stone to be imitated; for which purpose it is proper to have an original stone, or an exact imitation of one, at hand when the mixture is made, in order to adapt the colours to the effect desired.

There is an easy method of distinguishing doublets, which is only to behold them betwixt the eye and light, in such a position that the light may pass through the upper part and corners of the stone; when it will easily be perceived that there is no colour in the body of the stone.

DOUBLETS, a game on dice within tables. The men, fifteen in number, are placed thus: Upon the six, cinque, and quatre points, there stand three men a piece; and upon the trey, deuce, and ace, only two. He who throws highest has the benefit of throwing first, and what he throws he lays down, and so does the other; what the one throws and has not, the other lays down for him, but on his own account; and thus they proceed until all the men are down, and then they bear, as it is called. He who is first down bears first, and will doubtless win the game if the other throws not doublets to overtake him; which he is sure to do, since he advances or bears as many as the doublets make, namely, eight for two fours.

DOUBLING, in the military art, is the putting of two ranks or files of soldiers into one. Thus, when the word of command is *double your ranks*, the second, fourth, and sixth ranks march into the first, third, and fifth, so that the six ranks are reduced to three, and the intervals between the ranks become double what they were before.

DOUBLING, among hunters, is when a hare keeps in plain fields, and winds about in order to deceive the hounds.

Doubling, in the manège, is a term applied to a horse, who is said to double his reins, when he leaps several times together, in order to throw his rider. Thus it is said, "the ramingue doubles his reins, and makes pontlevis."

Doubling, in *Navigation*, the art of sailing round or passing beyond a cape or promontory, so that the cape or point of land separates the ship from her former situation, or lies between her and any distant observer.

DOUBLON, or DUBLOON, a Spanish and Portuguese coin, being the double of a *pistole*.

DOUBS, a department of France, formed out of the ancient province of Franche-Comté, and the lordship of Mompelgard, to which in 1816 were added the cantons of Montbeliard and Audincourt, which were taken from the department of the Upper Rhine. It is bounded on the north by the departments of the Upper Rhine and Upper Saone, on the east and south by Switzerland, and on the west by the department of Jura. It extends over 2230 square miles, and the inhabitants amount to 242,597. The divisions are four arrondissements, and the subdivisions twenty-seven cantons and 633 communes. It is generally a mountainous country; the ranges traverse it in different directions, but none exceeds 2000 feet, and they are all of calcareous formation. Between the mountains are picturesque and fertile valleys, with the exception of which the whole department may be described as an ungrateful soil, and nearly one fifth of the surface is covered with scanty woods. The land on the hills scarcely ever brings even oats to perfect ripeness; but in some parts the pasture land is good, and especially for the dairy; and many calves are bred for the neighbouring departments. The sheep are few, but the goats are numerous. There are some iron mines and iron works, and some small manufactures made from iron, besides articles made of wood, which comprise the industry of the district. The wine of late years has increased both in quality and in quantity. The capital is Besançon.

DOUBTFUL ISLAND lies in the South Pacific Ocean, in long. 141. 38. W. and lat. 17. 20. S. It was so named by Captain Cook, and was seen by the French navigator Bougainville. There is another small island of this name near the south coast of New Holland, so called by Captain Vancouver, from his uncertainty whether it was connected with the Continent. Long. 119. 49. E. Lat. 34. 23. S.

DOUBTING, the act of withholding assent from any proposition, on suspicion that we are not thoroughly apprised of its merits, or from not being able peremptorily to decide between the reasons for and against it. Doubting is distinguished by the schoolmen into two kinds, *dubitatio sterilis*, and *dubitatio efficax*. The former is that where no determination ensues; and in this manner doubted the Sceptics and Academics, who withheld their assent from every thing. The latter is followed by judgment, which distinguishes truth from falsehood; and such is the doubting of the Peripatetics and the Cartesians. The *dubitatio efficax* perpetually inculcates the deceitfulness of our senses, and teaches us that we are to doubt of every one of their reports till they have been examined and confirmed by reason. On the other hand, the Epicureans teach that our senses always tell truth; and that if we deviate ever so little from them, we come within the province of doubting.

DOUDEVILLE, a market-town of the department of the Lower Seine, with 386 houses and 2984 inhabitants.

DOUDPOOR, a town of Hindustan, in the province of Gundwana, possessed by independent Goand chiefs. It is thirty-five miles south by east from Bustar. Long. 83. 10. E. Lat. 19. 36. N.

DOUPARRA, a town of Hindustan, in the south of India, and district of Commin. It is eighty-seven miles north from Cudapah. Long. 79. 4. E. Lat. 15. 43. N.

DOUGLAS, GAVIN, bishop of Dunkeld, was the third son of Archibald earl of Angus, and of Elizabeth the daughter of Robert Lord Boyd, who for some time filled the office of high chamberlain. He appears to have been born in 1474, or the ensuing year. With the place of his birth or education we are not acquainted, but we may suppose his course of study to have been suitable to his profession. Having entered into holy orders, he was collated to the rectory of Hawick;[1] and as the dormant energies of the human mind are awakened by external objects, his early residence amid the fine pastoral scenery of Teviotdale may have had a strong tendency to cherish in his imagination the seeds of genuine poetry. In the year 1509, we find him described as provost of the collegiate church of St. Giles in Edinburgh.[2] This preferment was in the gift of the crown: it placed him in a situation of no small dignity and emolument, and he appears to have held it with his other benefice. It was while he occupied these less elevated stations that he composed the very ingenious works which have rendered his name so conspicuous in the literary annals of his country.

His father, who is sometimes denominated the great earl of Angus, and sometimes *Bell-the-cat*, followed the standard of James the Fourth when he invaded England; but finding his prudent counsels disregarded, he excused himself on account of his advanced age, and withdrew from the army. His two eldest sons, George and William, together with about two hundred gentlemen of the name of Douglas, perished in the fatal battle of Floddon-field. This calamity to the nation in general, and to his own family in particular, made so deep an impression on his heart, that having retired to St Mains, a religious house in Galloway, he died there within the space of twelve months.[3] His title and estates descended to his grandson Archibald, a young nobleman whose personal attractions were so unrivalled that he speedily obtained the tender regard of the widowed queen, and their nuptials were solemnized before she had completed the year of mourning. This precipitate match, which had been concluded without the concurrence of the principal nobility, excited general indignation: the queen was no longer willingly acknowledged as regent; the pre-eminence of her husband rendered him odious in the eyes of the more powerful subjects; and the house of Douglas was involved in persecutions which this resentful spirit of jealousy excited.

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[1] Alexandri Myln Vitæ Episcoporum Dunkeldensium, p. 72. Edinb. 1823, 4to.

[2] Keith's Catalogue of the Scottish Bishops, p. 93.

[3] Hume's History of the Houses of Douglas and Angus, p. 235. Edinb. 1644, fol.

Among those who perished at Floddon were the archbishop of St Andrews, the bishop of the Isles, the abbot of Kilwinning, the abbot of Inchaffray, and other warlike sons of the church. The archbishop of St Andrews, Alexander Stewart, who was the king's natural son, and a young man of very promising talents, had likewise held the abbacies of Aberbrothock and Dunfermline, together with the priory of Coldingham. In a letter addressed to Pope Leo the Tenth, the queen, after extolling Gavin Douglas as second to none in learning and virtue, earnestly requested that he might be secured in the possession of the abbacy of Aberbrothock, till his singular merit should be rewarded by some more ample preferment.[1] After the death of the late primate, William Elphinstone, bishop of Aberdeen, had been nominated to the vacant see; but his modesty or infirmities induced him to decline this splendid offer, and the queen afterwards attempted to elevate Douglas to the primacy. Confiding in the royal nomination, and in the influence of his own family, he took possession of the archiepiscopal palace; but his claims were disputed by two powerful rivals, John Hepburn, prior of St Andrews, and Andrew Foreman, bishop of Moray in Scotland, and archbishop of Bourges in France. Hepburn having prevailed upon the canons to elect him to the see, laid siege to the castle, and after meeting with some resistance, expelled the retainers of his competitor; nor did the earl of Angus, with a party of two hundred horse, succeed in his attempt to recover the possession of this strong hold.[2] In the mean time, Foreman, who was a person of great influence, found means to obtain from Rome a grant of the archbishopric of St Andrews, and the other preferments which had been held by the late primate.[3] Douglas, actuated by a decent spirit of moderation, resolved to abandon the pursuit of this high object of ecclesiastical ambition; but the other competitors seem to have been alike insensible to motives of private virtue and of public decorum. Foreman being afraid to publish the papal bulls, prevailed upon Lord Hume, by bestowing on his brother the priory of Coldingham, to undertake the support of his cause; and this border chieftain enabled him to appear at Edinburgh, attended by ten thousand men in arms. Having performed the necessary ceremony, they hastened to St Andrews in order to complete their pious task, but they found the prior sufficiently prepared for their reception: in the castle and in the cathedral he had placed so considerable a garrison, that Foreman was unwilling to hazard an attack, and deemed it more prudent to adjust their claims by an amicable negociation; it was finally stipulated that he should be put in quiet possession of the primacy, that Hepburn should receive a yearly pension from the bishopric of Moray, and should retain such rents as he had already levied from the archbishopric of St Andrews.[4]

From this negociation Douglas derived no advantage; and, to complete the measure of his disappointments, the abbacy of Aberbrothock, which he had regarded as secure, was transferred to James Beaton, archbishop of Glasgow, and chancellor of the kingdom. The death of George Brown, bishop of Dunkeld, which occurred in the month of January 1515, presented him with new prospects, and exposed him to new mortifications. The queen nominated him to the vacant see, and, as is supposed, by the intervention of her brother the king of England, obtained a papal bull in his favour. But, in the mean time, the earl of Athole had induced the chapter to postulate his brother Andrew Stewart, prebendary of Craig, who had not yet taken subdeacon's orders.[5] The enemies of the queen did not neglect this opportunity of disgracing an individual so nearly allied to her husband: Douglas was cited before the competent judges, and was accused of having violated the laws, by procuring bulls from Rome. Such practices had indeed been prohibited by several statutes, but these had very seldom been enforced. Of this offence he was however convicted; and being committed to the charge of his former rival Hepburn, he was successively confined in the castles of Edinburgh, St Andrews, and Dunbar, and again in that of Edinburgh. Before the period of his trial, the queen's party had almost entirely lost its influence: the duke of Albany, who was the grandson of James the Second, and the cousin of the late king, arrived from France on the 10th of May, and within the space of about two months was declared regent of the kingdom. A compromise at length took place between the two parties: Douglas obtained his liberty after an imprisonment of more than twelve months; and his claim to the bishopric was secured by Beaton's mediation with the new regent. He was consecrated at Glasgow by the same prelate, who defrayed the expenses attending this ceremony; and having paid a visit to the metropolitan city of St Andrews, he proceeded to Dunkeld, where the clergy and laity testified the utmost joy at the arrival of so noble, learned, and pious a bishop. The bulls having with the usual solemnities been read at the high altar, he retired to the residence of the dean, George Hepburn, by whom he was suitably entertained. The episcopal palace was still occupied by the retainers of Stewart; and the bishop finding next day that they had likewise seized the tower of the cathedral, was obliged to perform divine service at the deanery. In the afternoon he held a consultation with the nobility, gentry, and clergy, by whom he was attended; but their deliberations were speedily interrupted by the intelligence that Stewart had taken up arms, and was advancing to support his adherents; and at the same time they were alarmed by the commencement of a fire from the palace and the cathedral. Lord Ogilvy, with the eldest son of the earl of Crawford, and many other friends, including a considerable number of ecclesiastics, with the dean among the rest, immediately began to prepare for action; and messengers having been dispatched to the neighbouring districts, his party was next day strengthened by the arrival of a formidable reinforcement of armed men. Stewart, who did not find himself strong enough to hazard an attack, retired into the woods. His retainers, who garrisoned the palace and the cathedral, were now summoned to surrender, under the pain of excommunication; and on their refusing to obey this summons, the bishop's servants, led by a valiant prebendary, and by James Carmichael, took possession of the cathedral. Intimidated by this event, those who occupied the palace requested that a truce might be granted, and the sentence of excommunication delayed for a few hours; but when the stipulated time had elapsed, they still refused to surrender. The interference of the regent at length enabled Douglas to take possession of his palace without the effusion of blood; a circumstance, as one of his biographers has remarked, which "was certainly very acceptable to the good bishop; who in all the actions of his life discovered a gentle and merciful disposition, regulating the warlike and heroic spirit of his family by the excellent laws of the Christian religion."[1] After these events, Stewart hastened to the court, accompanied by his brother the earl; and Douglas having likewise made his appearance, their respective claims were taken into consideration by the regent and council. It was finally agreed that Stewart should relinquish his pretensions to the see of Dunkeld, but should retain such rents as he had already levied, and should be confirmed in the possession of the two benefices of Alyth and Cargill, under the condition of paying the bishop a certain annual contribution in grain.[2] Although Douglas had so recently been punished for soliciting bulls from Rome, yet the regent did not scruple to apply to the pope for a ratification of this agreement: in a letter dated on the 28th of September 1516, he entreated his holiness that all informalities might be removed, and the stipulations rendered valid by his sanction.[3]

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[1] Epistolæ Regum Scotorum, vol. i. p. 183. Edinb. 1722-4, 2 tom. 8vo.

[2] Buchanani Rerum Scoticarum Hist. p. 256. Pinkerton's Hist. of Scotland, vol. ii. p. 124.

[3] Epistolæ Regum Scotorum, vol. i. p. 269.

[4] Buchanan. p. 257. Lindsay's Cronicles of Scotland, vol. ii. p. 291.

[5] It may not be unnecessary to remark, that in the popish church there are seven orders; namely, those of porter, lector, exorcist, acolyte, subdeacon, deacon, and priest; and that no person can regularly be elected a bishop, unless he has at least taken subdeacon's orders. Although he cannot be elected, he may however be postulated by the chapter; and if this postulation is admitted by the pope, he is then considered as elected and confirmed. "Postulatio est ejus, qui eligi non potest, in prælatum concors capituli facta petitio." (Lancelotti Institutiones Juris Canonici, lib. ii. tit. viii.) There are other canonical impediments, which we need not enumerate; for Stewart's disqualification is particularly specified by Myln.

Having at length been installed in his cathedral, he was speedily called from the discharge of his episcopal functions. During the ensuing year, an ambassador arrived from France, with a proposition for the renewal of the ancient league between the two kingdoms; and it was thought expedient that the duke of Albany should himself repair to Paris, accompanied by Bishop Douglas, and by Patrick Panter, chancellor of Dunkeld, and secretary of state. The negociation having been brought to a satisfactory conclusion, the bishop was employed to convey the earliest intelligence to Scotland.[4] His professional duties seem again to have been interrupted during some part of the year 1518: in the British Museum there is an original letter, signed by the earl of Angus and others, and recommending him to the English king as a proper person to transact certain affairs in which they were concerned.[5] Though thus exposed to occasional distractions, he yet presided over his diocese with exemplary piety. The various troubles in which he was formerly involved had not merely prevented him from accumulating riches, but had even encumbered him with debts; yet the benevolence of his disposition prompted him to perform many acts of charity and munificence.[6] The revenues of this see are represented as ample,[7] and he was again so fortunate as to fix his residence in a delightful part of the country: the situation of Dunkeld, which no intelligent lover of our early literature can visit without recollecting the name of Douglas, has a romantic beauty of which it is difficult to convey an adequate idea.

When the duke of Albany was preparing to quit the kingdom, he delegated his authority to the archbishops of St Andrews and Glasgow, and the earls of Arran, Angus, Argyle, and Huntley: but the predominating power of Angus excited the apprehensions or the jealousy of his colleagues; and they resolved to unite their strength with the view of circumscribing the influence of so formidable a rival. On the 29th of April 1520, Arran with many others of the nobility assembled at Edinburgh in the house of Archbishop Beaton: they formed the resolution of instantly seizing the person of Angus, whose power, they pretended, was so exorbitant that, while he continued at liberty, his fellow-subjects could enjoy no security. Aware of their hostile intentions, he requested his uncle the bishop of Dunkeld to mitigate their resentment, and persuade them to adopt a more lawful method of redress. He accordingly addressed himself to the archbishop, whom he found in the church belonging to the monastery of the black friars, and entreated him to act the part of a peacemaker: the crafty and turbulent prelate protested that he was at once ignorant of their designs, and unable to prevent them from being carried into execution; and to confirm this averment, he made a solemn appeal to his conscience, but having too forcibly applied his hand to his breast, he discovered to his indignant companion, that his sacred habit concealed a coat of mail. "My Lord," exclaimed the bishop, "I perceive your conscience is not good, for I hear it *clattering*," that is, telling tales. He next accosted Sir Patrick Hamilton, requesting him to interpose with his brother the earl of Arran: this gentleman was inclined to peaceable measures, when the earl's natural son Sir James, a man of a ferocious disposition, rudely upbraided him with cowardice. This charge he repelled with indignation; and having drawn his sword, he rushed furiously into the street, where the earl of Angus had stationed a numerous body of his retainers: perceiving him advance before the other assailants, the earl called aloud to his followers to save Sir Patrick Hamilton's life; but in the heat of battle it is difficult to spare those who are eager to destroy, and he was speedily slain, together with the eldest son of the earl of Eglintoun. The encounter, which was long and fierce, was at length decided by the interference of some of the citizens, who were favourably disposed to the queen, and therefore espoused the cause of her husband. Seventy-two of his antagonists perished in the battle. During this scene of disgraceful violence, the bishop of Dunkeld had retired to his chamber, and spent the anxious interval in a manner suitable to the profession; but when the contest was decided, he hastened to prevent the wanton effusion of blood. The archbishop, who appears to have been personally engaged, had taken refuge behind the altar of Black-friars church, and the rocket was already torn from his shoulders, when the interposition of Douglas saved his life.[8]

The duke of Albany, after an absence of upwards of four years, returned to Scotland in 1521; and one of his earliest measures was to reduce the inordinate power of the Douglasses. Angus and his principal adherents, having been summoned to answer for their violent proceedings, fled for refuge to the Kirk of Steill. The bishop of Dunkeld was dispatched to London as their accredited agent, and was instructed to represent their safety as necessarily connected with that of their young sovereign.[1] At the court of Henry the Eighth, where his poetical talents had probably found many admirers, he experienced a gracious reception; and the king is said to have provided for his maintenance by the grant of a liberal pension.[2] He now contracted a friendship with Polydore Virgil, who was engaged in composing a history of England. The recent publication of Mair's history of Scotland, in which he ventured to expose the Egyptian fables of his predecessors, had excited the indignation of such of his countrymen as delighted to trace their origin to the daughter of Pharaoh. Douglas was studious to warn his Italian friend against the opinions of this worthy doctor of the Sorbonne;[3] and presented him with a brief commentary, in which he pursued the fabulous line of our ancestry from Athens to Scotland; nor was a poet to be easily induced to relinquish so fine a tissue of romantic narrative. This tract, which was probably written in Latin, seems to have shared the common fate of the manuscripts entrusted to Polydore; who, in order to secure the errors of his work from detection, is said to have destroyed many valuable monuments of antiquity.[4] Vossius has stated that Douglas wrote a history of Scotland, consisting of several books;[5] but Bishop Bale, to whose authority he refers, only mentions a single book;[6] and it is evident that the historical work to which both these writers and Dempster[7] allude, is merely the brief commentary quoted by Polydore Virgil.

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[1] Sage's Life of Douglas, p. 7.

[2] Myln, Vitæ Episcoporum Dunkeldensium, p. 75.

[3] Epistolæ Regum Scotorum, vol. i. p. 222.

[4] Leslæus de Rebus gestis Scotorum, p. 385–9. Pinkerton's Hist. of Scotland, vol. ii. p. 165.

[5] Pinkerton's List of the Scotish Poets, p. xcv.

[6] Myln, p. 75.

[7] Winton's Cronykil of Scotland, vol. i. p. 167. Pinkerton's Hist. of Scotland, vol. ii. p. 127. The bishopric of Dunkeld was reckoned the third see in the kingdom.

[8] Buchanan. p. 261. Lindsay's Cronicles of Scotland, vol. ii. p. 285. Hume's Hist. of the Houses of Douglas and Angus, p. 245.—Lindsay refers this event to the year 1515, but other historians, with greater probability, add five years to the number. The encounter was long remembered in Edinburgh by the name of *Cleanse the Causey.*

While the accomplished prelate was thus employed in England, his enemies were not inactive in Scotland. His mission to the English king furnished a sufficient pretext for accusing him of treason: on the 21st of February 1522 he was declared a traitor, and the revenues of his see were placed in a state of sequestration; the king's subjects were prohibited, under the pain of treason, from affording him any pecuniary assistance, or maintaining with him any correspondence either by letters or messages. An account of these proceedings was transmitted to the pope, accompanied with a remonstrance against the nomination or recommendation of the traitor Gavin Douglas to the archbishopric of St Andrews and the abbacy of Dunfermline, or to either of those preferments.[8] The extent of his influence had manifestly excited the alarm of Beaton, who was determined at all hazards to secure these ample prelacies, recently become vacant by the death of Foreman. Nor were these the only expedients to which he resorted: as chancellor of the kingdom, he addressed a letter to the king of Denmark, entreating him to represent Douglas to the sovereign pontiff as a person altogether unworthy of his favour and protection.[9] Beaton became archbishop of St Andrews, and Douglas died in exile. He had been cited to appear at Rome, and, according to his own declaration, he intended to obey the summons;[10] but in the course of the same year, and before he began to decline from the vigour of manhood, he was seized with the plague, and speedily fell a victim to its dreadful contagion.[11] He died at London in 1522, and was interred in the Savoy church, on the left side of Thomas Halsay, bishop of Leighlin in Ireland; whose monument also contained a short inscription of his name and addition.[12] The character which he left behind him was that of a "man learned, wise, and given to all vertue and goodness."[13] With the splendour of his birth and the dignity of his person he united many accomplishments and many virtues. Although he lived in an age of lawless violence, and was connected with a powerful and turbulent family, he was uniformly distinguished by the moderation of his conduct.[14] The fruits produced by the celibacy of the Romish clergy are sufficiently known: the bishop of Dunkeld left a natural daughter, from whom Semple of Foulwood derived his lineage.[15] Transgressions of this nature were so common, that they must almost have ceased to be regarded as criminal: Patrick Hepburn, bishop of Moray, had two sons legitimated in one day, and five daughters in another.

It is the secular learning of Bishop Douglas that has chiefly attracted the attention of posterity; but Myln, who was one of the canons of his cathedral, represents him as eminently skilled in divinity and the canon law. He was perhaps the most learned of the early Scottish poets. Among the ancient poets, his favourites were apparently Virgil and Ovid; among the Christian fathers, his favourite was St Augustin, whom he denominates the chief of clerks. Of the Latin language his knowledge was certainly extensive; and as he states that Lord Sinclair had requested him to translate Homer, we may venture to infer that he was not unacquainted with Greek. It is highly probable that he had completed his education on the continent, and had thus given his studies a more elegant and classical direction. Nor were his talents less conspicuous than his learning. In all his writings he evinces an excursive fancy, with much of the fervour of genius. His allegorical sketches are efforts of no common ingenuity; but what chiefly renders his works interesting is the frequent occurrence of those picturesque and characteristic touches, which can only be produced by a man capable of accurate observation and original thinking. He exhibits perpetual vestiges of a prolific and even exuberant imagination, and his very faults are those of superabundance rather than deficiency. In his descriptions, which are often admirable, he occasionally distracts the attention by a multiplicity of objects, nor is he sufficiently careful to represent each new circumstance in a definite and appropriate manner. His style is copious and impetuous, but it cannot be commended for its purity. In his translation of Virgil he professes to be scrupulous in rejecting Anglicisms, and indeed his diction is often remote from that of the English poets: but he has imported many exotic terms from another quarter; his familiarity with the Latin language betrays itself in almost every page of his writings. His verses, though less smooth and elegant than those of Dunbar, are not unskilfully constructed.

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[1] In the British Museum, Calig. B. vi. 223, there is an original paper, dated "at the Kirk of the Steill," 14 December 1521, and containing "Instructions and Commissioun for my Lord of Dunkeld, to be schawin vnto the Kyngis Grace of Ingland, on the behalf of my Lord of Anguss, his kyn and frendis, Lord Hwme, Lord Sommervel, thar kyn and frendis." This document states that, for the fulfilment of the articles mutually agreed upon, the said lords are bodily sworn upon the gospels, "befor a reuerend fader, Gawin Bischop of Dunkeld, and Thomas Lord Dacre."

[2] Holinshed's Chronicles, vol. iii. p. 872.

[3] Polydori Virgilii Anglica Historia, p. 52. edit. Basil. 1556, fol.

[4] Peacham's Compleat Gentleman, p. 51. edit. Lond. 1634, 4to.—"He is said to have borrowed books out of the publick library at Oxford, without taking any care to restore them: upon which the university (as they had good reason) declined lending any more, till forced to it by a mandate which he made a shift to procure from the king. In other places he likewise pillaged the libraries at his pleasure; and, at last, sent over a whole ship-load of manuscripts to Rome." (Nicolson's English Historical Library, p. 70.)

[5] Vossius de Historicis Latinis, p. 686.

[6] Balei Scriptores Britanniæ, cent. xiv. p. 218.

[7] Dempsteri Hist. Ecclesiast. Gent. Scotor. p. 221.

[8] Epistolæ Regum Scotorum, vol. i. p. 328.

[9] Ibid. vol. p. 333.

[10] Pinkerton's Hist. of Scotland, vol. ii. p. 194.—In a letter from the bishop of Bath to Cardinal Wolsey, dated at Rome on the 19th of March, the following passage occurs: "The bishope of Dunkell his servant is come; and I doo the best I cane to helpe and assist hyme in his masters causes, accordyng your grace is commandment." (H. Ellis's Original Letters, second series, vol. i. p. 316.) See likewise p. 323. The earl of Morton was accused of treason, and, among other grounds, "for the tresonable counsale, help, supportacioun, and assistance, gevin to Gawyne bischop of Dunkeld, in his tresonable passing in Ingland:" but an act of parliament, passed in 1524, declared the charge against him, "in all the punctis it contenit, vane, vntrew, and had na veritie." (Acts of the Parliaments of Scotland, vol. ii. p. 290.)

[11] Polydori Virgilii Anglica Historia, p. 53.—According to Hume's calculation, he had reached the forty-sixth year of his age in 1520. His testament may be found in the appendix to Mr Riddell's Reply to the Misstatements of Dr Hamilton, in his late *Memoirs of the House of Hamilton corrected*. Edinb. 1828, 4to. On the 19th of September 1522, it was proved by one of the executors, Matthew Geddes, vicar of Tippermuir, his chaplain. The inventory of the bishop's goods was taken "apud hospitium Domini Dacris." In the British Museum, Calig. B. i. 27, there is an original letter from Douglas to Lord Dacre, in which he says, "our houssys ar of the auld allyat." Mr Riddell has suggested that the testament makes no allusion to the pension mentioned by Holinshed; and that "the bishop seems to have been reduced to straits, as he is obliged to pawn some of his silver plate." But as his mission to England was considered as treasonable, he had an obvious reason for avoiding the mention of an English pension; and in most cases there is no great difficulty in supposing a man's expenses to exceed his income.

[12] Weever's Ancient Funeral Monuments, p. 446.

[13] Spotswood's Hist. of the Church of Scotland, p. 101.—This historian states that "he died of the plague at London in Savoy house."

[14] Buchanani Rerum Scoticarum Historia, p. 262.

[15] Hume's Hist. of the Houses of Douglas and Angus, p. 220.

Of Douglas's original compositions the longest is the *Palice of Honour;*[1] an allegorical poem which displays much versatility of fancy and a ready command of striking imagery. Still however it is to be considered as a Gothic structure, and as exhibiting many of the peculiarities which belong to that order: ancient and modern usages, classical and Christian subjects, are almost constantly blended together; and a nymph of Calliope's train expounds the scheme of human redemption. This poem appears to have been composed in 1501, when the author was twenty-six or twenty-seven years of age. It has been surmized that Douglas's work is probably founded on the *Sejour d'Honneur* of Octavien de St Gelais.[2] The titles have indeed an obvious resemblance to each other, but there is little or no affinity in the plan and execution of the two poems. The successive appearance of the different courts described in the Palice of Honour, may possibly remind some readers of the Triumphs of Petrarch, in which various shadowy trains succeed each other in a somewhat similar manner; but notwithstanding these different suggestions, Douglas's poem must still be regarded as entitled to the praise which belongs to an original design.

King Hart, another allegorical poem of the same author, exhibits a very ingenious adumbration of the progress of human life.[3] It is a singular composition, and may remind the reader of Phineas Fletcher's *Purple Island;* a work which furnishes a striking example of the misapplication of fine poetical talents. From the occurrence of several incorrect passages, it has been supposed to be one of Douglas's earliest performances. Incorrect passages we may expect to find in all the vernacular poetry of that age; and the versification appears to us superior to that of the Palice of Honour. As he has not enumerated it among his early works, we may perhaps venture to conclude that it was written after his translation of Virgil. The heart, being the fountain of vital motion, is here personified as man himself, and is conducted through a great variety of adventures.

But the most remarkable of Douglas's works is perhaps his translation of the Æneid.[4] In the original poems which accompany it, he has fortunately specified the origin and progress of this undertaking: he there informs us that it was begun at the request of his cousin Lord Sinclair, whom he represents as a zealous collector of books, and protector of science and literature; and that it was the labour of only sixteen months, being completed on the 22d day of July 1513, about twelve years after he had composed the Palice of Honour. This task must apparently be understood to comprehend, not merely a version of Virgil's twelve books, but likewise of the supplementary book of Mapheus Vegius, together with the original poems which he has interspersed in the volume. Whether we consider the state of British literature at that period, or the rapidity with which he executed so extensive a work, it is impossible to withhold from this version a large share of our approbation. In either of the sister languages, few translations of classical authors had hitherto been attempted. Even in England, it has been remarked, no metrical version of a classic had yet appeared; except of Boethius, who scarcely merits that appellation.[5] On the destruction of Troy, Caxton had published a kind of prose romance, which he professes to have translated from the French; and the English reader was taught to consider this motley composition as a version of the Æneid. Douglas bestows severe castigation on Caxton for his perversion of the classical story; and affirms that his work no more resembles Virgil than the devil resembles St Austin. He has however fallen into one error which he exposes in his precursor; proper names are so completely disfigured in his translation, that they cannot be recognized without some degree of difficulty. In various in-

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[1] The Palis of Honoure, compeled by Gawyne Dowglas, Bysshope of Dunkyll. Imprinted at London in Fletstret, at the sygne of the Rose garland, by Wyllyam Copland. 4to. This edition, which is without a date, was probably printed about the same time with the author's translation of Virgil. They are uniformly printed, and both title-pages have the same ornamental border. Another early edition bears the following title: " Heir beginnis ane treatise callit the Palice of Honovr, compylit be M. Gawine Dowglas, Bischop of Dunkeld. Imprentit at Edinburgh be Iohne Ros for Henrie Charteris, anno 1579. *Cum Privilegio Regali.* 4to. The epistle " To the Reidar" begins thus: " Quhen we had sene and considderit the diuers impressiones befoir imprentit of this notabill werk, to haue bene altogidder faultie and corrupt, not onlie that quhilk hes bene imprentit at London, bot also the copyis set furth of auld amangis our selfis." Copland's edition is however the earliest which bibliographers have been able to trace. The Edinburgh edition has lately been reprinted for the Bannatyne Club. Edinb. 1827, 4to.

[2] Le Seiour d'Honneur, composé par reuerend Pere en Dieu Messire Octouien de Sainct Gelaiz, Euesque d'Angoulesme, nouuellement imprimé. Paris, 1519, 8vo.

[3] King Hart was first printed in Mr Pinkerton's Ancient Scottish Poems, vol. i. Lond. 1788, 2 vols. 8vo.

[4] The xiii. bukes of Eneados of the famose poete Virgill, translatet out of Latyne verses into Scottish metir, bi the Reuerend Father in God, Mayster Gawin Douglas, Bishop of Dunkel, & vnkil to the Erle of Angus: euery buke hauing hys perticular Prologe. Imprinted at London, 1553, 4to. Another edition, with a life of the translator by Sage, and a glossary by Ruddiman, appeared after a long interval. Edinb. 1710, fol.

[5] Warton's Hist. of English Poetry, vol. iii. p. 112.

stances, he has been guilty of modernizing the notions of his original: the Sibyl, for example, is converted into a nun, and admonishes Æneas, the Trojan baron, to persist in counting his beads.

Douglas's translation of Virgil is certainly executed with no mean ability; it is the effort of a bold and energetic writer, whose knowledge of the original language,[1] and prompt command of a copious and variegated phraseology, qualified him for the performance of so arduous a task. It is indeed to be regretted that he did not devote a much longer period to this undertaking: he might thus have been enabled to render his versification more terse and finished; but the work, in its present state, is a singular monument of his genius and industry. One of his principal objects was to write in plain and intelligible language, so that his favourite poet might be readily understood by his countrymen; and by keeping this object constantly in view, he has frequently attained to less elevation of style than might have been expected. His translation possesses one merit which he probably did not contemplate: as a version of a well-known classic, it presents an ample fund of philological information; and Ruddiman's excellent glossary has long recommended it to all those who have paid any particular attention to the etymology of the Scottish language. The felicity of this translation has been very warmly commended by another Scottish prelate, Dr Lesley, the celebrated bishop of Ross; who, in enumerating its various excellencies, has stated that it always renders one verse by another. But this regularity of correspondence, for which it has likewise been praised by Dempster, must not be too literally understood; and it may be proper to recollect that the verses of the two poets, although they might be equal in number, could not be equal in length, as a hexameter line may consist of seventeen, and cannot consist of fewer than thirteen syllables.

The bishop of Dunkeld's version of the Æneid seems to have suggested a similar plan to the earl of Surrey, who translated the second and fourth books into English. In this translation he has exhibited the earliest specimen of blank verse that occurs in the history of English poetry. Dr Nott has remarked that "we meet with so many expressions which Surrey has evidently borrowed, with so many lines adopted with hardly any other alteration than that which the difference of the dialect, and the measure made necessary, and so many taken without any alteration at all, that all doubt ceases. It becomes a matter of certainty that Surrey must have read and studied the Scottish translation before he began his own."[2] This assertion he has verified by a long series of parallel passages, which it is impossible to read without acquiescing in his opinion.

The several books of Douglas's translation are introduced by prologues, which, in the opinion of Warton, are often highly poetical, and shew that his proper walk was original poetry. They have likewise received warm commendation from Hume of Godscroft, who was himself a scholar and a poet. "In his prologues before every book," he remarks, "where he hath his liberty, he sheweth a natural and ample vein of poesy, so pure, pleasant, and judicious, that I believe there is none that hath written before or since, but cometh short of him. And, in my opinion, there is not such a piece to be found as his prologue to the eighth book, beginning *Of drevilling and dreams*, &c. at least in our language."

These are the only works of Bishop Douglas with which we are now acquainted. On concluding his translation of Virgil, he avowed a resolution to devote his future days to the service of the commonwealth and the glory of God. The earliest of his poetical performances appears to have been a translation of Ovid *De Remedio Amoris;* but of this translation no copy is known to be extant.

> Lo thus, followand the floure of poetry,
> The battellis and the man translate haue I,
> Quhilk zore ago in myne undantit zouth,
> Unfructuous idilnes fleand, as I couth,
> Of Ovideis Lufe the Remede did translate,
> And syne of hie Honour the Palice wrate.

Bale mentions another of his compositions under the title of "Aureæ Narrationes;" which Sage supposes to be the short commentary noticed in the concluding address to Lord Sinclair:

> I haue also ane schorte commend compyld,
> To expone strange historiis and termes wylde.

This comment, as the same biographer conjectures, may have been merely a brief explanation of the classical mythology. If we may rely on the authority of Bale and Dempster, he likewise composed comedies; but both these writers are apt to multiply books as well as authors. Another biographer is inclined to suppose that he may have written the Flowers of the Forest, a song which displays no small portion of pathetic simplicity. "It may be conjectured," says Mr Scott, "that he was the author of that celebrated elegaic song, which describes the devastation occasioned by the battle of Flowdon, in that part of the country with which he had long been well acquainted."[3] It was published by Mr Lambe in the year 1774, and is described by him as an old Scottish song;[4] and Mr Ritson, who thought it "as sweet and natural a piece of elegaic poetry as any language can boast," had no hesitation in believing it to have been composed immediately after the battle of Floddon-field;[5] a decision which sufficiently evinces that, notwithstanding his confidence in his own judgment, and his undisguised contempt for almost all his predecessors, his critical opinions on such subjects were very far from being infallible. According to a more authentic account, the tune and two detached verses of this song are ancient; and all the others were composed by a lady connected with the county of Roxburgh.[6] The language and versification are evidently of a more recent date than the year 1513; nor could such a composition be safely referred to any period preceding the last century. (x.)

DOUGLAS, a town of Scotland, in Lanarkshire, lying on the south side of the Douglas water, on the road between Edinburgh and Ayr. It is a place of great antiquity, and possesses at present one or two manufactories of cotton; but it is chiefly celebrated for a great annual fair which is held here in the church-yard. The population of the town and parish amounted in 1821 to 2195, and in 1831 to 2542.

DOUGLAS, a sea-port town of the Isle of Man, situated on the south-eastern shore, and occupying the banks of two small streams. The streets, though irregular, possess some good houses. This is the principal town of the island. It has a safe and spacious harbour, which is defended by a strong fort. Long. 4. 44. W. Lat. 58. 52. N.

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[1] See however the remarks of Francis Junius, which are contained in a letter published in "The Life, Diary, and Correspondence of Sir William Dugdale," p. 383. Lond. 1827, 4to.

[2] Nott's Dissertation on the State of English Poetry before the Sixteenth Century, p. cciv.

[3] J. Scott's Life of Douglas (p. xxvi.), prefixed to his Select Works. Perth, 1787, 12mo.

[4] History of the Battle of Floddon, with notes by Robert Lambe, Vicar of Norham upon Tweed, app. p. 129. Berwick upon Tweed, 1774, 12mo.

[5] Ritson's Ancient Songs, p. 117.

[6] Scott's Minstrelsy of the Scottish Border, vol. iii. p. 127.—This lady is elsewhere said to have been Jane Elliot, who was born at Minto in the year 1726.

DOULEIA (*Δουλεια*), among the Athenians, a kind of punishment by which the criminal was reduced to the condition of a slave. It was never inflicted upon any except the *ατιμοι, sojourners* and *freed servants.*

DOULENS, an arrondissement of the department of the Somme, in France, extending over 310 square miles, and divided into four cantons and eighty-nine communes, containing 52,626 inhabitants. The capital is a town of the same name, situated at the junction of the two rivers the Authie and the Grouche. It contains 460 houses and 1323 inhabitants.

DOUNE, a village of Scotland, in the southern part of Perthshire, pleasantly situated on the northern bank of the Teith. It consists of three streets radiating from a centre, where stands the market-cross. Its general appearance was much improved in 1826 by the erection of a parish church in the Gothic style, with a handsome tower. In the immediate vicinity is an extensive cotton manufactory.

DOUR, a town in the circle of Mons, and province of Hennegau, in the Netherlands. Near to it are some very extensive coal mines. The inhabitants amount to 4549.

DOURDAN, a market-town of France, in the department of the Seine and Oise, situated on an elevation overlooking the river Orge, with 450 houses and 2592 inhabitants.

DOUW, GERHARD, a celebrated painter, was born at Leyden in 1613, and received his first instruction in drawing and design from Bartholomew Dolendo, an engraver, and also from Peter Kouwhoorn, a painter on glass. At the age of fifteen he became a disciple of Rembrandt; and in that famous school he continued for three years, at the expiration of which he found himself qualified to study nature, the most unerring director.

From Rembrandt he learned the true principles of colouring, and obtained a complete knowledge of the chiaroscuro; but to that knowledge he added a delicacy of pencil, and a patience in working up his colours to the highest degree of neatness, superior to any other master. He therefore was more pleased with those pictures of Rembrandt which were painted in his youth than with those by which he was distinguished in his more advanced age; because the first seemed finished with more care and attention, the latter with more boldness, freedom, and negligence, which was quite opposite to the taste of Douw. But although his manner appears so different from that of his master, yet it was to Rembrandt alone that he owed that excellence in colouring by which he triumphed over all the artists of his own country.

His pictures are usually of a small size, with figures so exquisitely touched, so transparent, so wonderfully delicate, as to excite astonishment as well as pleasure. He designed every object after nature, and with an exactness so singular, that each object appears as perfect as nature itself, in respect to colour, freshness, and force. His general manner of painting portraits was by the aid of a concave mirror, and sometimes by looking at the object through a frame with many exact squares of fine silk. But the latter custom is disused, as the eye of a good artist seems a more competent rule, though the use of the former is still practised by painters in miniature.

It is almost incredible what sums have been given and are given at this day for the pictures of Douw, even in his own country, as also in Italy and every polite part of Europe; for he was exceedingly curious in finishing them, and patiently assiduous beyond example. Of that patience Sandrart gives a very strong proof in a circumstance which he mentions relative to this artist. Having once, in company with Bamboccio, visited Gerhard Douw, they could not forbear admiring the prodigious neatness of a picture which he was then painting, and in particular noticed a broom, at the same time expressing their surprise at the excessive neatness of the finishing of that minute object; upon which Douw told them he would spend three days more in working on that broom before he should account it entirely complete. In a family picture of Mrs Spiering, the same author observes, that the lady sat five days for the finishing of one of her hands that leaned on an arm chair. For this reason not many would sit to him for their portraits; and he therefore indulged himself mostly in works of fancy, in which he could introduce objects of still life, and employ as much time on them as suited his own inclination. Houbraken states, that his great patron Mr Spiering allowed him a thousand guilders a year, and paid besides whatever he demanded for his pictures, having purchased some of them for their weight in silver; but Sandrart, with more probability, assures us, that the thousand guilders a year were paid to Gerhard, on no other consideration than that the artist should give his benefactor the option of every picture he painted, for which he was immediately to receive the utmost he demanded. This great master died in 1674, aged sixty-one.

DOVE. See ORNITHOLOGY.

DOVE ISLAND, a small island in Torres Strait, on the north coast of New Holland, about a mile and a half in circuit. The fragrance of the trees and shrubs with which it is covered perfumes the air.

Dove-Tailing, in carpentry, is the manner of fastening boards together by letting one piece into another in the form of the tail of a dove. The dove-tail is the strongest of the assemblages or joinings, because the tenon, or piece of wood which is put into the other, goes widening to the extreme, so that it cannot be drawn out again, by reason that the extreme or tip is bigger than the hole.

DOVER, a sea-port in the hundred of Bensborough, in the county of Kent, seventy-two miles from London. It is built at an opening between two cliffs, and the streets run in a circular form under the western hill. The old streets are narrow, but of late years many new parts have been added on the eastern shore, which are handsome and airy. It is defended by forts and an ancient castle. The harbour has been formed by means of great labour and expense, and is dry at low water, but, when entered, safe. As the principal place by which communication with the Continent is kept up, it contains numerous inns and hotels, and the trade of the town arises in a great measure from casual visitors and travellers. Dover had formerly five churches, which are now reduced to three. It is governed by a corporation, with a mayor at the head of it. Two members are returned to parliament, formerly elected by the freemen, but now householders have also votes. There are markets on Wednesday and Saturday. The inhabitants amounted in 1801 to 14,845, including the liberty, in 1811 to 9074, in 1821 to 10,327 in the borough alone, and in 1831 to 11,924.

DOVER STRAITS, the narrow channel between Dover and Calais, which separates our island from the opposite Continent. These celebrated straits are only twenty-one miles wide in the narrowest part. From the pier at Dover to that at Calais is twenty-four.

DOVER, a post-town of New Hampshire, and capital of the county of Strafford. It is situated on the western side of the Piscataqua, and the Cochecho flows through it. This river has several large falls, which afford a considerable water power, which has much facilitated the progress of manufactures here. Dover has thus been rendered one of the most flourishing towns in the state. It contains a court-house, a jail, a bank, an academy, three places of public worship, and other public buildings. The greater part of the timber exported from the state is brought to this town. Dover owns considerable shipping; it is the oldest town in the state, having been settled in the year 1623 by two Englishmen. The population amounted in 1826 to 4160. It lies sixty miles north of Boston. Long. 70. 54. W. Lat. 43. 13. N.

Dover, a post-town of Delaware, in the county of Kent, and seat of the government of the state. It is situated on Jones' Creek, seven miles above its entrance into Delaware Bay. The town is well built, chiefly of brick, and carries on a considerable trade with Philadelphia in flour. Long. 75. 30. W. Lat. 39. 10. N.

DOWAGER, *Dotisca* (a widow endowed, or that has a jointure), a title, or addition, applied to the widows of princes, dukes, earls, and persons of high rank only.

Queen dowager is the widow of the king, and as such she enjoys most of the privileges belonging to her as queen consort.

DOWER (*Dotarium* or *Dos*), a portion of lands or tenements which a widow enjoys for life from her husband in case she survive him, and which at her death descends to their children.

DOWLETABAD, a celebrated city and fortress of Hindustan, in the province of Aurungabad, deemed impregnable by the natives. The fort stands on the summit of a mountain, which is surrounded with several stone walls, the lowest of which incloses the town. The two lower fortifications are in this manner completely commanded by the upper. Like all the other hill forts of India, it is unhealthy, but is still considered as the key of the Deccan. This place, though it be remarkably strong, has been frequently taken. When the Mahommedan powers carried their arms into this part of the Deccan, about the year 1203, it was the residence of a powerful rajah, and was plundered of immense riches. In 1306 it was reduced by Mallek Naib, the emperor of Delhi's general. In the early part of the fourteenth century, the Afghan emperor Mahommed III. attempted to render this place, as its present name implies, the "abode of prosperity," and with this view he endeavoured to force the inhabitants of Delhi to quit their habitations and to emigrate to the Deccan; but he was unable to carry this violent scheme into effect. About the year 1595 Dowletabad surrendered to Ahmed Nizam, shah of Ahmed Muggur; and on the fall of his dynasty it was taken possession of by Mallek Amber, an Abyssinian slave. His successors reigned till 1634, when it was taken by the Moguls, and is now comprehended in the territories of the Nizam, but has much declined since the foundation of Aurungabad in its vicinity. Long. 76. 2. E. Lat. 19. 52. N. The district of Dowletabad is situated chiefly between the 19th and 20th degrees of north latitude, and extends along the north side of the Godavery.

Down.

DOWN, a county in the eastern part of the province of Ulster, in Ireland, is bounded on the north by the county of Antrim and Carrickfergus Bay, on the east by the Northern Channel and the Irish Sea, on the south by the same sea, and on the west by the county of Armagh. It measures, in its greatest length, from Cranfield Point in the south to Gray Point in the north, fifty-one miles, and in breadth, from the junction of the Newry Canal with the Bann near Portadoun, to Ballyhalbert Point in the Ardes, forty miles, comprehending an area of 611,404 acres, or 955 square miles, of which 502,677 acres are cultivable, 108,569 are mountain and bog, and 158 are covered with water.

This county was anciently inhabited by the tribes of the Vinderii and Voluntii. After the arrival of the English, who early formed a settlement here under the guidance of the celebrated John de Courcey, the principal families were a branch of the Oheils, distinguished by the name of Clanneboy, the M'Guinnesses, and the M'Artans, of Irish descent, and the Whites and Savages, descendants of the English settlers. Queen Elizabeth made it shire ground, but at what particular period of her reign has not been precisely ascertained. It is now divided into the eight baronies of Ardes, Castlereagh, Dufferin, Upper Iveagh, Lower Iveagh, Kinalearty, Lecale, and Mourne, and the lordship of Newry. These are again subdivided into fifty-seven parishes, and five parts of parishes, the remainders of which are in some of the adjoining counties.

According to the ecclesiastical arrangements of Ireland, the county comprises the diocese of Down, the greater part of that of Dromore, and the lordship of Newry. The former of these dioceses contains forty-nine parishes, consolidated into thirty-four benefices, having thirty-one churches. The cathedral was fixed at Downpatrick by James I., with a chapter consisting of a dean, four dignitaries, and three prebendaries; but in consequence of its subsequent decayed state, Charles II. erected the church of Lisburn into the cathedral of the united dioceses of Down and Connor. The part of Dromore diocese included in this county contains 21 parishes. Its cathedral is in the town of Dromore; also within the same limits, and near it, is the bishop's palace. The lordship of Newry is exempt from episcopal jurisdiction, a privilege which it enjoys from having appertained to a monastery before the reformation. The proprietor of the lordship exercises episcopal jurisdiction in his peculiar court, granting marriage licenses, probates of wills, &c. under the ancient monastic seal.

As far as inequality of surface is essential to scenic beauty, this county has strong claims to it, as it presents every variety of plain, hill, and mountain. The plains are chiefly confined to the vicinity of the rivers; the hills occupy by much the greater portion of the soil, insomuch that its appearance has been quaintly compared to a dish of spinach set over with eggs cut in two; and the mountains are piled together in one immense mass in the barony of Mourne in the south. The summit of Slieve Donard, the highest, is 2809 feet above the level of the sea. Slieve Croob and Slieve-na-boly, to the north of the principal group, and in a great degree detached from it, are also of considerable elevation.

The Mourne Mountains give rise to the four principal rivers, the Bann, the Lagan, the Ballynahinch, and the Newry water. The first-named of these rivers flows north-eastward by Banbridge and Portadoun into Lough Neagh. The Lagan, after flowing northwards, takes an eastern direction, and passing by Lisburn and Belfast, separates the counties of Down and Antrim. The Ballynahinch discharges itself into the southern extremity of Strangford Lough. The Newry water is an insignificant stream, except where it is affected by the influence of the tide, and would be wholly undeserving of special notice, were it not that it has been made the commencement of a communication by water with Lough Neagh. The Newry navigation, the first canal completed in Ireland, commences at Fathom, two miles and a half below Newry, to which town it conveys vessels drawing nine or ten feet water. From Newry to the Bann is a canal for twelve miles, navigable for boats of from forty to sixty tons. Its summit-level is sixty-five feet above the sea, and twenty-two above the surface of Lough Neagh. The navigation thence to the lake is carried on in the river, a distance of nine miles, whence a communication by water to Belfast is maintained by the Lagan navigation. The chief trade on the Newry Canal is the import of bleaching materials, flax seed, iron, timber, and foreign produce; the exports are grain, yarn, linen, cottons, and coal in small quantities.

Lakes, properly so called, are numerous, but insignificant in extent. Strangford Lough, otherwise called Lough Cone, is a spacious gulf, extending ten miles northwards into the land, and affording a secure roadstead to large vessels in its interior. Strangers, however, are unwilling to have recourse to it, through an apprehension that the rapid current of the tide, which rushes through the narrow strait between Portaferry and Strangford at the rate of eight or ten miles an hour, might drive them on some sunken rocks near its entrance. This gulf is studded with numerous islands, some beautifully wooded, others affording rich pasturage, but none inhabited. Bangor, Killough, and Ardglass, have each a harbour for fishing boats and small craft. An artificial harbour has been constructed at Donaghadee for the accommodation of the packet-boats to Scotland; but the introduction of steam navigation has rendered it comparatively useless. Near the coast of the Ardes, a long narrow peninsula between Strangford Lake and the sea, are the Green Island, Bird Island, and Burr Island; and at the entrance of Carrickfergus Bay is a group of three, called the Copeland Islands, upon one of which stands a lighthouse. There is another lighthouse on a sunken reef, called the Sonth Rock, near the northern entrance of Strangford Lough.

The predominating soil is a loam of little depth, but good in quality. In most places it is intermixed with considerable quantities of stones of various sizes; a circumstance easily accounted for, as quarries are to be found everywhere not far from the surface. Clay is mostly confined to the eastern coast of the Ardes, and to the northern parts of Castlereagh. Of sandy soil the quantity is small, and chiefly on the sea coasts near Dundrum, where in some places its abundance and shifting nature have prevented any attempt at improvement. Moor grounds are mostly confined to the skirts of the mountains. Bogs, though frequent, are scarcely sufficient to form a supply of fuel to the numerous and increasing population. The husbanding and apportioning of them among the tenantry forms no small part of an agent's or land-steward's duties. There are several quarries of fine freestone. The best is that on Scrabo Hill, where a very close-grained and clear-coloured stone is raised. The quarries of Kilwarlin afford flags of large dimensions, varying in hue from a clear stone colour to a brownish red; the former are superior in beauty and hardness. Slates are raised in several parts; and though they cannot compete with the Welsh in lightness and colour, they are superior in hardness and durability. Limestone is not very general. Large blocks of a yellowish magnesian species are found near Hollywood, but this kind is not used for manure, except where the white is not easily attainable. Near Comber, on the shores of Strangford Lough, is a very hard and sparkling kind of reddish granular limestone. But the greatest magazine of this most valuable mineral is found in the vicinity of Moira. It is supposed to be a continuation of that mass which is perceptible, with little interruption, from Magilligan, in Londonderry, round the headlands of Antrim, to the range of mountains that lie north of Lisburn, whence turning westward, it is lost in the acclivities that border the Lagan between Moira and Magheralin. Here the quarries lie very near the surface. They consist of horizontal strata intermixed with flints, in some cases stratified, in others in detached pieces of various form and size. It is not unusual to see three of these large flints, like rollers, each a yard long and twelve inches in diameter, standing perpendicularly over one another, and held together by a narrow neck of limestone, funnel-shaped, as if they had been poured in a liquid state into a cavity formed to receive them. Various kinds of shells and other marine exuviæ are found in this stone. Granite occurs in many places in detached masses, but the great body of it is confined to the southern and western regions, chiefly in the barony of Mourne. Yet though it is here the prevailing mineral, it does not wholly exclude the schist or slate, which is often seen in contact with it, raising itself from out of the middle of a surrounding mass of the former stone, which is itself in turn imbedded, or, as it were, set in the schist.

The mineral springs found here are of two qualities, sulphuro-chalybeate and purely chalybeate. The most celebrated of the former kind is at the foot of Slieve Croob Mountain, about two miles from Ballynahinch. In appearance, taste, and effects, it strongly resembles the waters of Aix-la-Chapelle. It is used both externally and internally, and has been found peculiarly effective in scorbutic affections. The town is much frequented in summer by invalids to enjoy its benefits. The chalybeate springs are numerous, and widely scattered through the county. The richest is that of Granshaw, in the Ardes. An alum spring has been discovered near Clough.

According to an account of the number of houses taken in 1751, the population, at an average of 5$\frac{3}{4}$ths to a house, amounted to 110,800, and, by a similar account, taken in 1791, to 220,519, thus doubling in forty years. Beaufort estimates it in the following year at 201,500. Dubourdieu, in 1802, states it to be 226,632. According to the parliamentary returns in 1812, 1821, and 1831, it increased progressively to 287,290, 325,410, and 352,571, having more than trebled itself in a period of eighty years.

The state of education, as collected from the parliamentary returns in 1821 and 1824–26, is as follows:—

	Boys.	Girls.	Sex not ascertained.	Total.
1821	13,081	64,65	......	19,564
1824–26	13,456	83,75	997	22,828

Of the total number contained in the latter of these returns, 4347 were Protestants of the established church, 6120 were Roman Catholics, and 11,615 dissenters; the religious persuasion of the remaining 411 was not ascertained. The number of schools was 550; of which ninety-four, containing 6667 pupils, were educated by grants of public money; sixteen, containing 972 pupils, by the voluntary contributions of societies and individuals; the remaining 440, containing 15,595 pupils, were pay schools. The diocesan grammar school of Down is now formed into a joint district school for Down and Dromore.

The presbyterian form of worship predominates, especially in the towns and low country. In the mountainous part the Roman Catholic religion prevails to a very great extent.

During the existence of the Irish parliament this county returned fourteen members, two for the county at large, and two for each of the boroughs of Downpatrick, Bangor, Killyleagh, Hillsborough, Newry, and Newtownarder. Since the union it is represented by four members, two for the county, one for Downpatrick, and one for Newry. The reform act has made no change in this respect. The state of the constituency, as affected by the changes made by the disfranchisement of the forty-shilling freeholders in 1829, and the subsequent alterations which terminated in the reform act, is as follows:—

	L.50.	L.20.	L.10.	40s.	Total.
1st Jan. 1829,	713	176	...	10,775	11,664
1st Jan. 1830,	720	252	1,018	...	1,990
1st Jan. 1831,	267	189	1,058	...	1,514
1st May 1832,	887	338	1,902	...	3,127
1st Jan. 1833,	...	...	...	...	3,127

The land is very unequally portioned out among the inhabitants. There are many landed proprietors, mostly resident, each of whom holds large tracts in his own hands. Under these is a numerous tenantry of every grade, from those who deem themselves entitled to rank on an equal footing in society with the proprietors of the soil, to the holders of a few acres, who depend on their manual labour for the support of their families. The connection of all ranks hence arising has had a great effect upon the state of society. The great bulk of the population is orderly and industrious; their dwellings are better constructed and furnished than those of a similar class in most other parts of Ireland. The small farmers form a respectable body, honest, yet quickwitted and clever in their dealings, as might be expected from the density of the population, the constant intercourse, and the frequent traffic carried on in fairs and market. They are anxious to secure and to enjoy such of the comforts of life as are attainable by a vigorous exertion of industry and intellect. The processes of agriculture, owing in a great degree to the example set by the resident gentry, are as skilfully carried on as in any part of the united kingdom. The fields are well laid out and fenced, the crops laid down in a judicious succession, the progress of their growth carefully attended to, and the harvest well saved and secured. The most improved implements of husbandry are generally known, and their value is duly appreciated. The crops commonly cultivated are wheat, rye, bear, barley, oats, peas, flax, and potatoes. Barley is extensively grown, particularly in the light soil of Lecale. Green crops are also in general use. Much attention is paid to the culture of grass, particularly on the borders of the larger rivers, where extensive tracts of fine meadow land are annually enriched, by the overflowing of the banks, with deposits of the finer particles of mould washed down from the higher grounds. Lime and marl are in general use as manure. Horned cattle are principally reared for dairies, and therefore the same attention to figure and flesh is not paid as in some other agricultural districts. The resident gentry are, however, laudably emulous in the improvement of their respective stocks. The breed of horses is also an object of much attention. In the reign of James II. a public body was incorporated under the name of the Royal Corporation of Horsebreeders of Down, under whose auspices races are held annually at Downpatrick and at the Maze near Hillsborough. Some of the best racers in Ireland have been bred in this county. The native breed of sheep is confined to the mountains. They are a small hardy race, mostly horned, but in some instances not so. Though born in the mountains, they are removed during the first winter after birth to the more genial atmosphere of the lower country, and brought back on the return of spring. Many of this breed are well made and finely woolled. It is also much prized for the delicacy of its mutton. The various other kinds of sheep have been much improved by judicious crosses from the best British breeds. Hogs are reared in great numbers, chiefly for the Belfast market, where the large exportation occasions a constant and brisk demand for them. Hams of very superior quality are prepared from them in that town. Rabbits form a part of farm stock in the sandy southern tracts. Bees are found to thrive well, and hives have been constructed for the purpose of saving the honey without destroying the swarm.

Manufactures are carried on largely in the neighbourhood of Belfast and Newry. Several of the smaller towns also support some branches on a smaller scale. The linen manufacture still continues to be much attended to, but by no means so extensively as formerly; it is more and more superseded by the cotton every year. The finer fabrics of linen were the object of particular attention. The woollen manufacture is confined to a coarse cloth wrought solely for home consumption. Kelp is made in large quantities along the shores.

The fisheries are by no means so extensive or flourishing as the great scope of sea-coast might lead to suppose. Belfast market is chiefly supplied from Carrickfergus, yet fish of every description abounds. Shoals of herrings frequently go up Strangford Lough, but they are not so much esteemed as those caught in the open sea. Smelts are taken in large quantities at the entrance of the same lough. The fishing for sand-eels at Newcastle is deemed to be of importance sufficient to require a code of regulations, adopted and enforced by the people themselves, to prevent the injuries and losses resulting from indiscriminate fishing. Shell-fish abound along the rocky shores, particularly in the neighbourhood of the Copeland Islands. Oysters are dredged at Ringhaddy, Carlingford, and Bangor. Mussels in inexhaustible numbers cover the shallow banks that stretch out before Holywood. They are chiefly consumed by the families in the immediate neighbourhood.

Several remains of antiquity, supposed to be coeval with the rudest ages of society, are to be found in this county. At Slidderyford, near Dundrum, is a group of pillar stones, consisting of ten or twelve, forming a circle. They are from eight to ten feet in height. A remarkable cairn stands on the summit of Slieve Croob. It is nearly eighty yards in circumference at the bottom and fifty at the top, forming a platform, on which several cairns of various heights and dimensions are erected. Another cairn near the village of Anadorn was found to cover a cave containing ashes and a number of human bones. Several cromlechs or stone altars have been discovered at various times. The most remarkable is in the Giant's Ring, on the summit of a hill between Lisburn and Belfast. The altar is formed of an unwrought stone seven feet long by six and a half broad, resting in an inclined position on several rude pillars from two to three feet high. It stands nearly in the centre of an enclosure about one third of a mile in circumference, formed of a rampart of earth about twenty feet high, sloping in on each side, and broad enough at the top for two persons to ride abreast upon it. Near Downpatrick is a rath or mount of earth three quarters of a mile in circumference. Its exterior consists of three artificial ramparts, the largest of which is thirty feet broad. The number of monastic ruins is also considerable. The most ancient and celebrated is the Abbey of Downpatrick, where the three favourite saints of the Irish, St Patrick, St Columb, and St Bridget, are said to have been buried. Near the abbey was a round tower, which was thrown down some years ago, when the abbey, now converted into the cathedral church, was rebuilding. Beneath the foundation of the tower a wall was found to proceed, crossing it, and extending to the main building of the abbey. Struel Wells, to the east of Downpatrick, merit notice from their connection with former religious observances. They are four in number, each covered by a stone vault, and having the water conveyed from the others by subterraneous aqueducts. Great numbers assemble here at midsummer's eve, and on the Friday before Lammas, to perform religious ceremonies, chiefly consisting of penances, and to obtain recovery from their bodily complaints. The ruins of many castles, particularly upon the coast, are still visible. Amongst the most remarkable is Greencastle, built on an islet in the barony of Mourne, and intended to maintain a communication between the English settlers in this county and those in the county of Louth. This castle was considered of such importance that no person but one of English birth was permitted to be constable of it. Dundrum Castle, erected on a rock near a small harbour in a bay of the same name, still preserves considerable vestiges of its former grandeur. At Ardglass are the remains of considerable fortifications.

Downpatrick, the county town, is situated at the extremity of the southern branch of Strangford Lough. It is said to owe its name to St Patrick, the founder of the abbey here, in which he was interred. The town, which consists of four streets meeting in the bottom of a valley formed by hills of some elevation, comprehends a surface of 1486 acres, and contains a population of 4780, according to the latest return. Vessels coming to the town are obliged to discharge their cargoes at the Quoill Quay, about a mile distant. The public buildings are, the cathedral, the court-house and assembly rooms, the jail, the barracks, the parish church, the Catholic chapel, some dissenting meeting-houses, the county infirmary, and the fever hospital. Near the court-house is an asylum for clergymen's widows, and an hospital for the decayed tenants of the Southwell estate. Two miles from the town is the race course, under the superintendence of the corporation of horsebreeders. The town is an ancient manor, governed by a seneschal. Previously to the reform act it was the most open borough in Ireland, as all persons who payed scot and lot, or boiled a pot in the town, were electors. Newry, situated in the south-western extremity, and extending into the adjoining county of Armagh, is of much greater size and of more commercial importance than Downpatrick. It covers 2500 acres, contains 13,370 inhabitants, and ranks as the twelfth of the principal towns of Ireland as to population. Situated at the extremity of Carlingford Bay, and connected by its canal with Lough Neagh and the Tyrone collieries, it enjoys peculiar advantages. Even in the earlier periods of British domination it maintained a high position, from being at the extremity of the pale, and serving as the key to the then unsubdued and generally hostile province of Ulster. In 1641 the town was taken and cruelly treated. In 1689 it was again stormed and reduced to ashes by the Duke of Berwick, to secure his retreat from Duke Schomberg. The public buildings are, a court-house, jail, exchange, assembly rooms, custom-house, theatre, and several places of worship. The environs of this town are of great beauty. The prospect towards the Bay of Carlingford is magnificent, and the villages of Narrow-water and Rosstown on its northern coast are objects of much interest to numerous visitors. The lordship, of which mention has been already made, is the property of the Needham family.

Harris's *History of the County of Down;* Dubourdieu's *Statistical Survey of Down;* Shaw Mason's *Parochial Survey;* Rutty's *Mineral Waters;* Nimmo's *Sailing Directions; Parliamentary Reports on Population, Education, and State of the Poor.*

Down, the fine feathers on the breasts of several birds, particularly of the duck kind. Those of the eider duck are the most valuable. These birds pluck the down from their breasts and line their nests with it. Three pounds of this down may be compressed into a size scarce larger than one's fist; yet it is afterwards so dilatable as to fill a quilt five feet square. That found in the nests is most valued, and termed *live down;* it is infinitely more elastic than that plucked from the dead bird.

DOWNHAM, a town in the hundred of Clackclose, in the county of Norfolk, eighty-four miles from London, and situated on the borders of Cambridgeshire. The river Ouse, which receives the Cam, runs near it. It has markets on Mondays and Saturdays. The inhabitants amounted in 1801 to 1512, in 1811 to 1771, in 1821 to 2044, and in 1831 to 2198.

DOWNTON, a town in the hundred of the same name, in the county of Wilts, ninety miles from London. There was a castle here in former times. It has some trade in making paper, and in linen goods. It is an ancient burgage tenure borough belonging to the Earl of Radnor, and one of those recently disfranchised. The inhabitants amounted in 1801 to 2426, in 1811 to 2624, in 1821 to 3114, and in 1831 to 3652.

DOWNIE, a town of Central Africa, on the Niger. It has a manufactory of pottery ware, which is neatly made, and sold to advantage in the neighbouring countries. It lies twenty miles west-south-west of Timbuctoo.

DOWNS, a bank or elevation of sand, which the sea gathers and forms along its shores, and which serves it as a barrier. The word is formed from the French *dune,* or the Celtic *dun,* a mountain. Charles de Visch (*Compend. Chronolog. Exord. et Progress. Abbat. Clariss. B. Mariæ, de Dunis*) says, *Vallem reperit arenarum collibus, quos incolæ* Duynen *vocant, undique cinctam.*

Downs is particularly applied to a famous roadstead for ships along the eastern coast of the county of Kent, from Dover to the North Foreland, where both the outward and homeward bound ships frequently make some stay, and squadrons of men of war rendezvous in time of war. It affords excellent anchorage, and is defended by the castles of Deal, Dover, and Sandwich.

DOWRY, the money or fortune which the wife brings her husband in marriage; it is otherwise called *maritagium,* or marriage goods, and differs from dower. See Dower.

DOXOLOGY, a hymn used in praise of the Almighty, and distinguished by the title of *greater* and *lesser.* The lesser doxology was anciently only a single sentence, without response, running in these words, "Glory be to the Father, and to the Son, and to the Holy Ghost, world without end, Amen." Part of the latter clause, "As it was in the beginning, is now, and ever shall be," was inserted some time after the first composition. Some read this ancient hymn, "Glory be to the Father, and to the Son, with the Holy Ghost;" and others, "Glory be to the Father in or by the Son, and by the Holy Ghost." This difference of expression occasioned no dispute in the church till the reign of the Arian heresy; but when the followers of Arius began to make use of the latter as a distinguishing character of their party, it was entirely laid aside by the Catholics, and the use of it was enough to bring any one under suspicion of heterodoxy. The doxology was used at the close of every solemn office. The western church repeated it at the end of every psalm, and the eastern church at the end of the last psalm. Many of their prayers were also concluded with it, particularly the solemn thanksgiving or consecration prayer at the eucharist. It was also the ordinary conclusion of their sermons. The greater doxology, or angelic hymn, was likewise of much consequence in the ancient church. It began with these words, which the angels sung at our Saviour's birth, "Glory be to God on high," &c. It was chiefly used in the communion service, and in private devotions. Both the doxologies have a place in the church of England, the former being repeated after every psalm, and the latter used in the communion service.

DRABLER, in nautical language, a small sail in a ship, which is the same to a bonnet as a bonnet is to a course, and is only used when the course and bonnet are both too shoal to clothe the mast.

DRABS, in the salt works, a kind of wooden boxes for holding the salt when taken out of the boiling pan. The bottoms of these are made shelving or inclining forwards, in order that the briny moisture of the salt may drain off.

DRACHM, a Grecian coin, of the value of sevenpence three farthings. Drachm is also a weight used by our physicians, containing sixty grains, or three scruples, or the eighth part of an ounce.

DRACO, a celebrated lawgiver of Athens. When he exercised the office of archon, he framed a code of laws for the use of his fellow-citizens, which, on account of their severity, were said to be written in letters of blood. By them idleness was punished with as much severity as murder, and death was denounced against the one as well as the other. The rigour of this code of laws induced a certain Athenian to ask of the legislator why he had been so severe in his punishments; upon which Draco answered, that as the smallest trangression had appeared to him deserving of death, he could not find any punishment more rigorous for atrocious crimes. These laws were at first enforced, but they were often neglected on account of their excessive severity; and Solon totally abolished them, excepting that one which punished a murderer with death. The popularity of Draco was uncommon; but the gratitude of his admirers proved fatal to him. When he appeared at the theatre, he was received with repeated applause; and the people, according to the custom of the Athenians, showed their respect to their lawgiver by throwing garments upon him. But this was done in such profusion, that Draco was soon hid under them, and smothered to death by the kindness of his fellow-citizens. He lived about 624 years before the Christian era. See the article Attica.

Draco, in *Astronomy*, a constellation of the northern hemisphere.

DRACONARIUS, in *Antiquity*, Dragon-bearer. Several nations, as the Persians, Parthians, and Scythians, bore dragons on their standards; and hence the standards themselves were called *dracones*, or dragons. The Romans are generally supposed to have borrowed the same custom from the Parthians; but Casaubon thinks they took it from the Daci; while Codin is of opinion that they owe it to the Assyrians.

The Roman *dracones* were figures of dragons painted in red upon the flags, as appears from Ammianus Marcellinus; but amongst the Persians and Parthians they were, like the Roman eagle, figures in full relievo; so that the Romans were frequently deceived, and took them for real dragons.

The soldier who bore the dragon or standard was called by the Romans *draconarius*, and by the Greeks δρακοναριος and δρακοντειοφορος; for the emperors carried the custom with them to Constantinople.

DRACONTIC Month, the time of the revolution of the moon from her ascending node, called *caput draconis*, to her return thither.

DRAGOMAN, or Drogueman, a term of general use throughout the East for an interpreter, whose office it is to facilitate intercourse between the orientals and occidentals. Dragomans are kept by the ambassadors of Christian nations residing at the Porte.

The word is formed from the Arabic *targeman* or *targiman*, of the verb *taragem*, he has interpreted. From *dragoman* the Italians formed *dragomano*, and, with a nearer relation to its Arabic etymology, *turcimano;* whence comes *trucheman*, as well as *dragoman* and *drogueman*.

DRAGON, in *Astronomy*. See Draco.

Dragon's Head and Tail (*caput et cauda draconis*), are the nodes of the planets, or the two points in which the ecliptic is intersected by the orbits of the planets, and particularly that of the moon, making with it angles of five degrees and eighteen minutes. One of these points looks northward, the moon beginning then to have north latitude; and the other southward, where she commences south. Thus her deviation from the ecliptic seems, according to the fancy of some, to make a figure like that of a dragon, whose belly is where she has the greatest latitude, the intersection representing the head and tail, from which resemblance the denomination arises. But these points abide not always in one place, but have a motion of their own in the zodiac, and retrograde 3 minutes 11 seconds per day, completing their circle in 18 years 225 days; so that the moon can be but twice in the ecliptic during her monthly period, and at all other times she will have a latitude or declination from the ecliptic. It is about these points of intersection that all eclipses happen. They are usually denoted by these characters, ☊ dragon's head, ☋ dragon's tail.

DRAGONNEE, in *Heraldry*. A lion dragonée is where the upper half resembles a lion, whilst the other half goes off like the hinder part of a dragon. The same may be said of any beast as well as a lion.

DRAGOON, in military affairs. See Army.

DRAGOONING, one of the methods used for converting refractory heretics, and bringing them within the pale of the true church. The following is the method of dragooning the French Protestants, after the revocation of the edict of Nantz, under Louis XIV. as described in a French work translated in 1686. "The troopers, soldiers, and dragoons, went into the Protestants' houses, where they marred and defaced their household stuff, broke their looking glasses, and other utensils and ornaments, let their wine run about their cellars, and threw about their corn and spoiled it. And as to those things which they could not destroy in this manner, such as furniture of beds, linen, wearing apparel, plate, and the like, they carried them to the market-place, and sold them to the Jesuits and other Roman Catholics. By these means the Protestants in Montaubon alone were, in four or five days, stripped of above a million of money. But this was not the worst. They turned the dining-rooms of gentlemen into stables for their horses; and treated the owners of the houses where they quartered with the highest indignity and cruelty, lashing them about from one to another, day and night, without intermission, not suffering them either to eat or drink; and when they began to sink under the fatigue and pains they had undergone, they laid them on a bed, and when they thought them somewhat recovered, made them rise, and repeated the same tortures. When they saw the blood and sweat run down their faces and other parts of their bodies, they sluiced them with water, and, putting over their heads kettle-drums turned upside down, they made a continual din upon them till these unhappy creatures lost their senses. When one party of these tormenters were weary, they were relieved by another, who practised the same cruelties with fresh vigour." Such is persecution in its naked form.

DRAGUIGNAN, an arrondissement of the department of the Var, in France, extending over 1078 square miles. It is divided into ten cantons and fifty-eight communes, and contains 75,387 inhabitants. The chief place is a city of the same name, situated on a fine plain, rich in vines and olives. It is a well-built town, and stands on the river Pis, where there is a public library, a museum of natural history, and many oil and silk mills. It contains 8010 inhabitants. Long. 6. 29. E. Lat. 43. 44. N.

DRAIN, a cut or ditch for carrying off water from the soil, to improve it for the purpose of agriculture.

DRAINING.

To drain land means simply to make land dry. This definition is satisfactory in regard to the ancient art of draining, the object of which was to render land which was wetted by springs, or had become marshy by stagnant water, or subjected to the periodical overflowings of rivers, sufficiently dry to permit the exercise of arable culture. It is not so applicable to the modern practice of draining. Draining is now practised on land that is apparently dry, as well as on really wet land. Land that contains a superabundance of water produces plants of a peculiar nature, such as rushes, flags, sprots, and many others; and obstructs the operations of arable culture. The very existence of such plants is sufficiently indicative of the wet state of land. But land that contains no such superabundance of water as to obstruct its arable culture, but which, by its inherent wetness, may nevertheless prevent the luxuriant growth of the cereal grains and the cultivated grasses, requires draining as much as wet land, though wetness is not so *apparent* in it as in the other. The deficiency of the crop on apparently dry lands is naturally attributed to unskilful husbandry, till experience proves that no management, however skilful, can counteract the baneful influence of concealed stagnant water. Observation teaches us that stagnant water, whether on the surface or immediately under the surface of land, injures all the useful classes of plants. How the injury arises is not very clear; perhaps by obstructing perspiration and intro-susception, and thus diseasing their roots; or, what is more probable, it prevents their food from being presented in a nutritious state, by checking the chemical decomposition of the substances which supply the food of plants. Whether the true cause of the bad effects of stagnant water on the vegetation of useful plants will ever be discovered, the future progress of vegeto-physiological science can alone determine. In the mean time, experience assures us that draining will remove these bad effects.

It thus appears there are two species of draining; the one draws off the larger bodies of water which are collected from the discharge of springs in isolated spots, and the other absorbs the superabundance of water from and under the surface of the land. The first is called *under-draining,* because it intercepts the passage of the water from springs at some distance under ground. The second makes channels for conveying away the water which falls on the surface of the ground, and is therefore called *surface-draining.* Surface-draining is again divided into two kinds; the one consists only in making small open channels and furrows immediately on the surface of the ground; the other is effected by means of small drains constructed at a short distance under the surface of the ground, in order to collect the water which would otherwise remain on a retentive subsoil at the bottom of the plough furrow. This latter kind derives its name from the particular construction of the drain.

The theory on which these different kinds of draining are founded is sufficiently explicit. Where the upper surface of land is at all permeable to water, and where it rests on beds of matter of different depths, of various lengths and breadths, each possessing a consistency of retentiveness or permeability, the water produced from rain, snow, or dew, in its progress along the porous bed, will be interrupted and retained by the retentive beds, and will accumulate in them in larger or smaller quantities, according as they present a basin shape, over the edge of which it will burst through the upper surface in the form of springs. Hence the necessity of *under-draining* to draw off the water contained in the basin-shaped curves of the retentive layers. Where the upper surface is permeable, and the subsoil immediately under it retentive, water will accumulate on the subsoil, to the injury of plants growing on the surface soil. Hence the origin of *surface-draining,* by laying land in ridges, and forming small open channels, along which the water percolating through the surface soil may have a free passage. Where the subsoil is so porous as to permit the water to percolate through it beyond the reach of the plough, these open surface gutters will have no effect in removing the superabundant water. Hence the second class of surface drains must then be constructed to absorb it. Where the surface soil and the subsoil are both permeable, they will hold water only by capillary attraction; and what is not so retained will sink down into the inferior permeable beds by its gravity. Hence in such land draining is unnecessary. Of these excessive supplies of water, that from springs is most injurious to the vegetation of useful plants, as being colder, and generally more permanent in their operation. Capillary attraction will retain as much water in the surface soil as vegetation requires, excepting under the extraordinary occurrence of excessive drought. Hence the abstraction of water by draining is quite independent of its supply as a manure, as a meliorator of the soil, as a menstruum for food, or as a regulator of temperature to plants.

These statements prove the necessity of a knowledge of geology for a perfect understanding of the principles of draining; and fortunately practice in this department of rural economy is not at variance with scientific principle. On the contrary, he who is best acquainted with geology and the principles of hydraulics, will constitute the most scientific drainer. But such a character cannot yet be easily acquired by any man; for that department of geology, the knowledge of which is most applicable to the art of draining, is the most difficult to be understood, and has hitherto been the least explored. Most of the arable soil is contained within the tertiary and alluvial formations of rocks. The intricate relations of the newer beds, which compose the alluvial class of rocks, and which are the most intimately connected with arable culture and draining, present almost insurmountable obstacles to the thorough acquirement of the art of draining. They at least throw an uncertainty over its operations; and this uncertainty must continue till the relations of the alluvial rocks are discovered to be as fixed as those of the other classes. Perhaps this certainty is unattainable; because it may be that the newer members of the alluvia strata do not bear a strictly relative position to one another. But till this fact is ascertained one way or the other, draining must be conducted in a great measure in these alluvial deposites by trial. In undertakings on trial, error generally ensues, and unnecessary expense is often incurred. One very unfortunate circumstance, arising from the uncertainty attending draining, is the uselessness of the experience acquired in one set of operations, in guiding to a means of securing a more certain result in another. As uncertainty attends on the number and depth, and even direction, of the drains which are required to dry one field sufficiently, so a similar uncertainty prevails over the similar operations in the adjoining field. Every drainer will concur in the justness of these remarks. A deeper study by geologists in this branch of geology would therefore confer everlasting obligations on the drainer; and would they also direct their particular attention to the connection between the upper surface of the earth's crust, and the one immediately subjacent, that connection would perhaps be found to be intimate; or, at all events, the investigation would supply desirable materials for a correct nomenclature and classification of soils.

It does not appear that the ancients practised draining. The Egyptians, Indians, and Persians, and indeed the inhabitants of the tropical regions, rather practise the opposite though almost sister art in effect, namely, irrigation, on land which is beyond the influence of the great periodical overflowings of rivers. The Greeks had neglected draining; and indeed they did not attend much to agriculture. The Romans, on the other hand, skilful husbandmen in every department of agriculture, drained their lands with the greatest care and assiduity. Cato, their oldest writer on agriculture, enters so minutely into the importance of draining, as even to prescribe the dimensions and shapes of open and covered drains. The Romans had only been acquainted with the draining of springs, and the clearing away of surface water. For the former purpose the drains were left open at both ends, and the water from the springs was conveyed away by them out of the field, as particularly described by Columella. For taking away surface water they used open ditches in stiff soils, as Palladius informs us; and Cato directs that when the rain commences in autumn, all the servants should go out with sarcles, or other iron tools, open drains, turn the water into the channels, and take care of the corn fields, that it flow from them. It thus appears that the Romans were unacquainted with the deeper kind of surface-draining. In our own country draining has been practised for a long period. Ingulphus mentions that a chamberlain of William the Conqueror, Richard de Rulos, lord of Brunne and Deeping, drained a great extent of country, and embanked the river Wielland, which used to overflow the neighbouring county every year. It is more than probable that draining was practised in this country long before that period, as the Romans invariably introduced the arts of life into every country which they conquered. Fitzherbert's *Boke of Husbandrie*, which was published in 1534, during Henry VIII.'s reign, contains minute directions for draining. But the greatest impulse which draining received in Britain was in the latter half of the last century; and that was given by a practical discovery of the seat of springs, by a farmer, Mr Elkington of Princethorp, in Warwickshire. Being an uneducated man, Elkington was not able to communicate his ideas to the public. Mr Johnstone, a drainer residing in Edinburgh, under the authority of the Board of Agriculture, published a full and satisfactory account of Elkington's mode of draining wet land. Elkington was ignorant of geology, and could not therefore have acted on scientific principles. These principles Farey, in his report of the agriculture of Derbyshire, maintains that many contemporaries of Elkington understood better than he did. But whatever might have been Elkington's personal qualifications, it cannot be denied that the mode of draining which he practised himself, and which he showed to many farmers and country gentlemen, produced a complete revolution in that art in this country. His principle was simple and strictly scientific, though he was probably not aware of its scientific character, or of the science which it involved; but it was undoubtedly its scientific nature which caused it to be attended with such success. He applied his principle chiefly to the draining of springs, which was simply to intercept the water by a drain at its source or spring; and the wetness in the land arising from that source will of course be removed. The cutting the drains deep is almost essential to the success of his system. The difficulty in the application of the principle consists in discovering the seat of the spring. A minute knowledge of the alluvial rocks would overcome this difficulty. In the present state of that knowledge, shrewdness must perform the part of science, assisted by trials in digging pits or cutting straight ditches through the beds of earth, in order to ascertain which of them contains the spring.

The drains which our forefathers made rested on the subsoil, immediately under the surface soil; and their depth under the surface depended on the depth of the upper soil. But as the depth of the arable soil, when it is of a different nature from the subsoil, is never very great, these drains were necessarily shallow. As experience, however, would soon teach men the impropriety of placing the stones in a drain within reach of the plough, few stones were placed in them, often not exceeding three, one on each side of the cut, and another above them, forming a sort of conduit. These conduits being near the surface, and of small areas, an additional quantity of water, or moles digging across them, placed such obstructions in them as to prevent entirely the flow of the water. They then became receptacles of water, and produced the mischief they were intended to remedy. Many of these drains are met with in the soil; and they appear to have been formed on the notion that a conduit to convey the stagnant water between the upper and subsoils was quite sufficient to render the soil permanently dry. The discovery of these trifling drains compels us to the belief of the fact, that the mode of draining practised by the Romans, and which without doubt they had introduced into this country, had been neglected or forgotten in the dark ages, previously to the revival of agriculture in Britain in the reign of Henry the Eighth.

Compared with the paltry method just described, the system of Elkington is super-excellent. No wonder that it produced at the time of its introduction a revolution in the art. It was as much more effective than the old system in changing the quality of the land, as blood-letting with a lancet from a vein affects the general constitution in a greater degree than the topical application of leeches. Elkington's discovery also created discussion, which terminated in the permanent establishment of the present method of draining practised in this country. This method is a modification of that of Elkington; and it is an improvement, in as far as it effectually drains a species of wetness in land, for which his method is perhaps not so suitable. It is fully granted, that to drain bursts of water and marshy ground, it is necessary to cut off the springs which supply them with water; and that whatever depth of drain or strength of materials are required to effect these purposes, they ought to be executed. In this manner many extensive properties have been drained, at great expense it is true, but so effectually, that the increased income derived from the improved quality of the soil, and the more rapid growth of the trees, will continue as a permanent fund, from which the expense of the improvements will be amply repaid. Granting these advantages, with which, however, it is not intended to intermeddle, it is nevertheless maintained by many that the portion of land which is wetted by water springing from below, bears a very small proportion to that which is in a wet state from the retention of rain water on an impervious subsoil. A great extent of land may be wetted by the bursting out of a spring of water; and the obvious mode of drying that land is to remove the spring; but will the same mode of draining, dry land which is wetted to a great extent by rain water being retained in the surface soil like water in a sponge, in consequence of a retentive subsoil? Obviously not. A drain in a retentive subsoil cannot draw water from a distance. A number of drains should therefore be made, all to co-operate by their absorbing power, in order to remove the water from the retentive subsoil; and as drains cannot draw water from a distance in a retentive subsoil, so in such a subsoil they need not be made deeper than to contain a sufficient quantity of materials to ensure their durability. This method of draining may be as expensive or more expensive than the system of draining springs; but whatever may be its expense, the increased produce and the improved quality of the subsequent crops will soon repay it. The theory on which this method is founded is also purely scientific. In the natural circumstances of the upper and subsoils, varying from light dry loam resting on beds of sand and gravel, to a thin steril crust, incumbent on impervious clay, the drainage must be various. In the former no water springs from below; and what falls upon the surface is immediately absorbed and carried down beyond the reach of vegetation. In the latter case, water, whether springing from below or falling on the surface in the shape of rain, must, where there is a declivity, run slowly off over the surface, however great the distance; or, in the event of a level surface, must remain stagnant till evaporated by the sun. On such a subsoil, a sufficient depth of *active* soil cannot be long maintained; for even if enriched with lime and manure, it will bear scanty crops; and if laid out for pasture, it will in a few years revert to its natural state, and produce only coarse herbage. Some soils rest on subsoils partially permeable by water. Such, in dry seasons, with judicious management, produce good crops; but in rainy seasons the crops are thin and the grain inferior in quality. When soil is immediately incumbent on open rock, such as the trap rocks, which contain many fissures, the land is uniformly fertile. Thus carefully copying the operations of nature, if drains were made in retentive subsoils, so as to give water frequent opportunities of escape, the soil would then become fertile, like the soil which rests on the open rock. Hence the drains are made straight and parallel to one another, and as near to each other as is necessary for the effectual drying of the land. These parallel drains are placed down the inclination, instead of across the land.

Strong objections are urged against this system of surface-draining by those who are strenuous advocates of Elkington's mode of cutting deep drains across the face of inclined ground. They maintain that fewer of these cross drains will dry the land than those which run straight down the inclined ground, and that these small drains will only serve a temporary purpose, and will have to be renewed at no great distance of time, at a greater cost than the making of cross drains. Such objections to the parallel straight drains are not so strong as they appear. It might be supposed, indeed, at first sight, that a drain passing across a piece of inclined ground will more readily intercept the descent of water than drains passing down in a direction parallel to the course of the water. But the fact is, in all pieces of ground which lie at an inclination, there is a double inclination, the one *down* the face of the inclination, which is always the greatest, and the other *across* its face. Water running down a double inclination will of course take the direction of the diagonal, in the exact proportion the angles of inclination bear to one another, provided the substance of the subsoil were homogeneous. As it is very improbable that the subsoil should be homogeneous, there is a risk of cutting the cross drains parallel to the course of the water, in which case they would not intercept any of it; whereas numerous drains cut parallel to the direction of the ridges on the inclined ground, would certainly intercept the water in its diagonal and devious course. Should the adoption of small drains cause them to be superficially constructed, this defect would be a strong objection against the whole system; but substantial drains are as necessary in this as in the other system. Drains which are to contain broken stones, and no other material will answer the purpose in a retentive but spongy subsoil, should *not be less* than thirty inches in depth; one foot for the passage of the plough over the stones, and eighteen inches of small stones. This is the *least* size the drains should be, and of this size they will endure for generations. In this mode of draining it is proposed to make the drains three feet deep.

Having explained the *rationale* of different modes of draining, it will be necessary to give a minute detail of the mode of forming the different kinds of drains.

It is scarcely necessary to state that all drains must be cut in a direction to permit the water in them to run down hill. No drain should be made more level than an inclination in the bottom of one foot in twenty-five yards. With this fall water will easily gravitate in a drain. Drains formed for the purpose of drying springs which are not in the immediate vicinity of marshy ground, should be four feet in depth at the least. A reservation is made in case of marshy ground, for it is probable that its vicinity will not afford a fall of four feet. All drains of four feet in depth should be filled with small stones gathered from the fields, or stones from the quarry broken small for the purpose; and such drains should always be built with a conduit of dry masonry, of a size in the opening proportionate to the quantity of water which it is supposed will run through them; and the size of this conduit will of course regulate the breadth of the bottom of the drain to be cut out. In all cases of conduits they should be built on a bottom floored on stones; for in many kinds of clay which have a mixture of sand (and in all drainable clays such a mixture does exist), the water, if considerable, will wear away the clay from under the conduit, and cause sinkings in the drain. The small stones should be carefully packed around the conduit with the hand till it be covered, and the remainder thrown in from the side of the drain by the hand, to within eighteen or fifteen inches of the surface of the ground. When the filling is completed, the stones should be neatly levelled; the filling should commence immediately after the cutting is finished, which should be executed in small portions at a time. The stones should be covered over with any material which will prevent the loose earth trickling down through them into the drain, such as straw, which is perhaps too valuable an article for this purpose, turf with the grass side downwards, or quicken well shaken of its earth gathered from the fallow fields. The levelling of the earth which has been cast out should be executed as soon after the filling of the stones as possible, and it should be carefully and not slovenly performed; as a ridge of earth, however small, placed across a piece of inclined ground, and which cannot afterwards be removed till the field is ploughed up again, will intercept the water in its descent down the furrows, and there cause that moisture in the ground which the draining was intended to remove. An easy method of levelling the earth is to put some of it in the first place with the spade over the covering of the stones, and then to pass the plough and turn the earth over into the drain in the same direction, returning the plough empty. This operation may be repeated twice or thrice, according to the quantity of earth to be levelled, and then a space of the adjoining ground may be ploughed with that thrown out, in the manner of a common ridge, till the whole is flat. It is almost always recommended to fill drains from their upper end towards the mouth. This may be a desirable arrangement when the drain is necessarily very level, in order to preserve the fall, but never otherwise; for the risk which is incurred should wet weather set in, by the falling in of the sides, while waiting for perhaps a great length of cutting, would more than counteract any advantage of preserving a minute level. These general observations on the cutting and filling and covering of drains apply to every species of drain. Other general observations are, that main drains, into which the lateral drains empty themselves, should be larger than the lateral ones. Main drains should be cut in the nearest and most convenient hollows for the outlet of water from the fields. All lateral drains should enter the main drain, or other lateral drains, with an acute angle of confluence, to expedite the water in its course. The mouths of main drains should be left open, strongly built, and defended with wooden or iron bars, to prevent the ingress of the larger class of vermin, such as badgers, foxes, and polecats.

Where square stones cannot be easily procured for the building of conduits, and where flat stones are more plentiful, they should be used in *coupling*, that is, one should be laid flat on the bottom of the drain, and other two set up on it, meeting at the top, the three forming an isosceles triangle. Small stones should then be packed carefully with the hand along the side and over the apex of the triangle. This coupled drain is perhaps not so strong as a built conduit, but it may be made very durable if the stones are of compact structure, and it is less expensive, as it requires a narrower cut than the conduit.

Drains from three and a half to two and half feet deep should be wholly filled with small stones. They are termed *rubble* drains. They need not exceed the breadth of a garden spade at the bottom. The small stones with which they are filled should not exceed the size of the fist, and they should be thrown in by the hand from the side of the drain; not carelessly against the sides and on the bottom of the drain, but rolled down, as it were, the inclined face of the stones already filled in. In this manner they will arrive easily at the bottom, and find their own position. When rubble drains are formed in hazel loams, they become the favourite resort of earthworms in search of fresh and unexhausted soil. Moles soon follow them, and these may cause damage to the drains if precautionary measures be not adopted. The pressing of the smallest stones by the foot into the bottom of the drain, to form a sort of causeway upon which the other stones are placed, is an insuperable obstacle to moles running under it, and heaving the earth up into the drain.

It has always been recommended to build conduits in quicksands; but the circumstance most deserving notice in the drainage of these troublesome things is the laying the bottom of the drain with flat stones, and building up its sides with a sort of masonry, in which pieces of turf should act as mortar, to prevent the sand running into the middle of the drain. Instead of leaving the conduit open, it should be filled up with small stones carefully packed in with the hand, because this construction is the strongest for resisting the lateral pressure of the quicksand.

In regard to the comparative advantages of a conduit and rubble drain, where no necessity exists of making the drain so deep as the stones at the bottom would be pressed into the earth by the weight of those above them, and this injurious effect will not be produced at a less depth than three and a half feet, no better materials can be employed to fill drains than hard round stones not exceeding the size of a goose's egg. It will be quite unnecessary to be at the expense of conduits and couples in all those shallow drains formed in retentive subsoils not containing springs. Water in the quantity generally found in drains, percolates through rubble stones with less injury to the drains themselves than in conduits; because, after a tract of wet weather, when the water in all drains is more or less turbid, according to the soil through which it passes, the rubble drain retards its current throughout its whole course, and causes it to deposite what portion of earth may be mechanically suspended in it, in a gradual manner; whereas the rather rapid current in a conduit will deposite its earth in quantities in every eddy which it forms, and in the course of time banks of earth will be formed in the conduit at different places, so as to affect the depth of the drain above those deposites.

Tiles made on purpose for drains are now very frequently used instead of stones. They are sometimes made in the shape of long truncated cones which fit into one another, but more commonly in semicircular pieces placed upon flat tiles. Where stones can be procured for the gathering, or quarried near at hand, and a sufficient quantity can be obtained of them, they are in every case superior to tiles for draining. Tiles may be beneficially used in conjunction with stones when the latter are carefully packed around, and of a sufficient depth above the former. They may also be used in clay soils, if well packed in a mass of peat moss. Clay soils seldom contain stones, but are often associated with peat. Tiles at present (1833) are for the most part used in *furrow-draining*, that is, in drains cut in any furrow between the ridges. These drains are generally made twenty inches in depth, one foot wide at the top, and two or three inches at the bottom. Sometimes small broken stones to the height of ten inches are used in these drains instead of tiles. With whatever materials they are filled, such a size of drains is objectionable. If intended to drain springs, they are incompetent to reach their source; if surface water arising from rain lodging on an impervious subsoil, the paucity of materials in them deprives them of utility and durability. Such a system can only serve a temporary purpose; and in a permanent improvement such a motive should always be proscribed. Draining insufficiently performed is nearly as bad as leaving it undone. Its defects cannot frequently be discovered till a great loss has been sustained.

Another method of draining has lately been introduced, and is termed *plug-draining*. It is exclusively confined to the draining of tenacious clay, and chiefly practised on pasture land. It consists of removing the turf with a common spade twelve inches in width and six inches in depth. The clay under the turf is removed with a narrow-shaped instrument called a grafting iron, on the side of which is raised a cutting bit six inches long, to the depth of eighteen inches. The drain is made two feet deep, one foot in breadth at the top, and one inch and three quarters at the bottom. Plugs of wood to fit the bottom of the drain, one and three quarters of an inch wide at bottom, four inches at the top, and six inches in height, and of any length, perhaps a foot, are then placed in the bottom. The clay last taken out of the drain is returned into it and rammed hard down, until the whole clay thrown out is replaced in a solid mass into the drain. Upon the clay the grass turf is replaced in its original position. The plugs are then withdrawn from below the clay to within eight inches of their length, by means of a lever acting upon it with a chain attached to the end of the plugs. Three or four of these plugs are united together by iron slips, which permit them to have as much play as to accommodate themselves to any curvature or inequality in the cutting of the drain. Expedients for draining the surface of grass lands have frequently been attempted; such as turning over a turf slice with the plough, paring the earth off the bottom of the turf slice with a spade, and replacing it. The drain thus made is like a large mole gallery, and hence it is called *mole-draining*. But this and the plug-draining, and all other expedients of the like kind, are but temporary shifts. They all originate in a false notion of economy. The advantages of draining can only be obtained when it is effectually executed, and it cannot be so executed without a considerable expense. Its operations being beyond the reach of daily observation, is a strong reason for executing it effectually. To be obliged to rectify the errors of draining is a serious evil, and will always cost more than a judicious primary outlay.

The minor adjuncts connected with Elkington's mode of draining springs should not be overlooked. They consist of *boring* with the *auger*, and *sinking pits*. Where tenacious beds of clay of moderate thickness forming retentive subsoils rest on gravel or sand, or open rock, holes bored through them with the auger when their depth is considerable, or pits sunk through them when they are less so, may effect a very considerable saving of expense. There is obviously no use of cutting a great length of a main drain, merely as a conveyance for water, when a hole or a pit opened on the spot would effect a similar purpose. In many cases, rich marshy land, and land-locked lakes, cannot be drained in any other way. A correct knowledge of geology is essentially necessary in this department of draining, in order to arrive at the desirable result with the least trouble.

These various modes of draining, which have been but imperfectly described, are executed in what may be termed different *styles*. Elkington's mode presents a ramified or dendritic appearance. The main drains occupy the lowest parts, or the hollows of fields. From them the lateral drains branch out in various lengths in a sloping direction along the inclined face of the ground. Where springs abound at the foot of mountain ridges, and where the substratum consists of beds of sand, however thin, interlayed with thick beds of impervious clay, and where the water evidently rises from *below*, this is the most beneficial system of draining which can be followed. The upper soil on such a substratum is generally a clay loam, unprofitable when wet, but extremely grateful when dried. With deep ploughing, plentiful liming, and liberal manuring, after drainage, such land will continue for ages to produce wheat, clover, beans, and Swedish turnips, in abundance. The expense of this method of draining is considerable by the rood, though not by the acre. It will be more than a shilling per rood of six yards; but not exceeding L.3 or L.4 per imperial acre. These clay loams almost always rest on inferior kinds of clay, of various qualities and colours. They rest on retentive subsoils, generally occupy large flats, large detached patches, knolls, and often run in bands across part of the country. In hollow portions of ground, mossy soils of little depth rest on these clays. In examining the structure of the subsoil on which these clay loams rest, it is probable they have been deposited when the retiring waters were nearly in a quiescent state. Though the different kinds of clay, often exhibiting different colours, are not arranged in horizontal or parallel beds, they appear in undulating beds of different lengths, and of contemporaneous formation, and these are frequently divided by thin beds of sand. These undulations act as basins to intercept and collect the water which permeates gradually through the detached beds of sand. This permeant properly permits them to contain large quantities of water, and hence this class of soil is very wet, and difficult to manage before they are drained. Very frequently a thicker bed of sand than the rest divides the mixed clayey subsoil from clay of a different and generally more homogeneous structure below it; and in cases where this homogeneous clay is not more than six feet below the surface, and it is often less, it forms an excellent flooring for a main drain.

Another style of draining has lately assumed the appellation of the *frequent-drain*. It consists of cutting parallel rows of drains down the face of inclined ground, which terminate in a main drain in the lowest part of the field. Contrary to the mode of draining just mentioned, this will cost little per rood, and much per acre. The expense in the hardest clay subsoil will not exceed tenpence per rood of six yards; but from the number of drains required, it will cost in such a subsoil nine or ten pounds per imperial acre. The cost of course will be in proportion to the obduracy of the material to be operated upon. In clayey subsoils generally of a reddish hue, containing small round and angular stones, frequently round masses of slaty sandstone, sometimes water-worn boulders of the older formations, and isolated veins of sand, this species of draining is admirably adapted, provided the drains are made of a sufficient depth to contain eighteen inches of small stones. This subsoil often continues of the same structure to a great depth, and it is very retentive of water, which has its origin in it chiefly from *above* in the shape of rain and snow. Deep draining is quite inapplicable to this subsoil. From the very structure of the subsoil, it is clear that digging the drains beyond a certain depth will confer no advantage. Water permeates such a subsoil only through the sand which it contains; and as that exists in an isolated state, it is not in the power of any drain to attract moisture from a distance. Dark hazel-coloured loams and black mould generally rest on these subsoils. These soils, when drained, form good turnip land, are sound for the rearing and feeding of live stock, raise barley of fine quality, and will carry good winter and spring wheat, when clay enters into their composition. In deep loams, where the *influence* of moisture is *remote*, draining, at least deep draining, is unnecessary. It is more necessary in thin loams, as the proximate relation of the subsoil to them in regard to a state of wetness has a direct influence on the productive powers of the soil.

Furrow-draining consists of cutting a drain in every furrow between the ridges, and these drains will be crooked or straight as the furrows are so: the drains terminate in a main drain at the lowest part of the field. The only instance where furrow-draining can be safely recommended is in pure clays, where the soil from time immemorial has been formed into broad, high, crooked ridges, the furrows of which cannot with propriety be changed in ploughing the land, as may be done with most other soils. Many of these furrows contain surface water during a great part of the year, which frequently destroys the crops half way up the sides of the ridges, the general declivity of the surface of the land being unable to convey away the water without the assistance of drains. But instead of making these furrow-drains two or three inches wide at the bottom, as is usually done, they should never be less than the breadth of a common spade, and filled eighteen inches high with small stones or gravel, or tiles with peat moss, and the remainder to the top with porous earth. Pure clays, which extend to some depth, and which have the upper and subsoils composed of homogeneous clay, if judiciously managed, require no draining at all, not because they are not wet soils (on the contrary they are very wet soils), but because water cannot permeate through them, except as far as the plough reaches. Such soils may be effectually dried by deep ploughing, and keeping the furrows always clear with the spade. To keep such a soil dry, a practice might be beneficially taken from Irish agriculture. It is called *double shovelling*. This is done after the land is water-furrowed. A cutting plough drawn by two horses, one before the other, is passed along the furrow. The plough goes and returns close to the sides of the ridges, and at six inches deep, thus furnishing fresh mould, and preserving a narrow furrow, the shovelling with the shovel or spade being completed from its depth instead of its width; and if the mould be thus ploughed in dry weather, it can be shovelled even after receiving rain. In retentive soils these furrows are absolutely necessary; and by the foregoing method, the extra covering for the ridge, by which some harrowing is saved after the sowing of the seed, is produced with nearly as little waste of ground as by the common water-furrow drawn by the plough. All flat clay deposites, or what are called Carses in Scotland, are composed of this kind of soil, and many detached fields on the sides of winding rivers may be found of a similar character. They cover a very inconsiderable portion of the face of the country, though in productive powers they stand in the first rank of soils.

Sandy soils resting on sand require no draining. They are found occupying extensive flats on the estuaries of large rivers. All soils resting on a subsoil of gravel are naturally dry. Drought alone injures them. It is remarkable that all soils which rest on gravel are a light loam, of a light hazel-brown colour, whether they have a siliceous or alluminous basis. These constitute the true turnip soils, and are to be found on the banks and haughs of straight-running rivers, rapid streams, and fresh-water lakes.

A thorough knowledge of the various modes of draining is not alone sufficient to constitute a good drainer; he should know the principles as well as the practice of his art. The difficulty is not so great in constructing a drain, as in knowing *where* it should be made. A true knowledge of whether the wetness in land arises from springs or stagnant water under the surface of the soil, can alone teach a man *where* to open up the ground. Every manager of land unfortunately thinks he possesses that knowledge, and the consequence has frequently happened that small drains have been opened where only deep ones should have been, and much money expended in making deep drains where smaller ones would have answered the purpose. But the former error is greater than the latter. In neither case, however, has the money expended been thrown away. A certain degree of success has attended every attempt at draining; and this favourable result, perhaps, more than any other circumstance, has beguiled many into the belief that they are accomplished drainers; for no one, however incapable he might be of directing the operation aright, would even make the attempt to drain land until he had actually experienced an obvious injury arising from wet land. It must be confessed that many improvements effected by draining have been purchased at a greater cost than was necessary to accomplish the end. Many attempts have been made at draining land by men who did not know how to accomplish it to the best advantage either to themselves or the land. The outlay of their money has therefore been ill directed. Were the evil effects of ignorance confined to the squandering of a little money, they might be counteracted by superior management in the other operations of the farm. But, unfortunately, the sinking of valuable capital in injudicious draining, deprives the farmer of the means of pursuing other improvements, and prevents his reaping all the advantages derivable from draining itself. Thus crippled in his resources, he cannot put and maintain his farm in the highest condition; for such is the generous character of our farmers, as promoters of improvement, that they cannot be accused of the desire of hoarding up riches through the love of gain, so long as they can improve the condition of their farms in any way, even though they themselves may not ultimately reap the advantages arising from those improvements. Were draining an operation which could be executed at little cost and trouble, it would be of little importance to urge its accomplishment in the most effectual way; but as it is an expensive operation, when conducted even in the most economical manner, much thought is requisite before attempting to break up the ground to a great extent. A knowledge of the structure of the upper portion of the earth's crust is absolutely necessary to direct our thoughts aright on this subject. That knowledge may even now be partially acquired by any farmer. Let him therefore, in the first place, contemplate the facts it unfolds to his view, and endeavour through them to acquire that wisdom which will direct him to expend his money in draining with prudence as well as skill. It will assist him much in ascertaining what are the kinds of soil which require deep draining, and what kinds may be treated equally well under a different management. Inattention to this distinction has given rise to the inordinate application of a general principle, which, as a general principle, but subject to great and necessary limitations, must receive the approbation of every man who knows and feels the importance of this improvement in husbandry.

Much has already been effected in Great Britain, but much yet remains to be done, by draining. A vast extent of the arable land of England and Scotland, and we may more especially include Ireland, generally esteemed dry, is yet so far injured by the tardy and imperfect escape of the water, especially in winter, and during long periods of wet weather in summer, that the working of it is often difficult and precarious, and its fertility much below what would uniformly exist under a thorough dryness. A system of drainage, therefore, generally applicable, and effecting complete and uniform dryness, is of the utmost importance to the agricultural interest, and *through* them to every other interest in the country.

The advantages arising from draining land are both numerous and various. Manures and stimulants can never impart their peculiar benefits to any soil which rests continually on a wet bottom;—the operations of husbandry can never be accomplished in due season;—and the produce is never abundant or of good quality in such circumstances. Draining removes all these evils. It is truly an operation, as Pliny terms it, of the highest utility,—"*Humidiorem agrum fossis concidi atque siccari, utilissimum est;*"—it is not only the meliorator, but the maker of soil. Let no one despair of his soil, however forbidding; let him really drain it, and the results will encourage him.

The general improvement of the soil by draining would lower the value of high-rented land; but it would greatly increase the aggregate rental of the kingdom. It would diminish the general cost of produce, thereby affording cheaper provisions to the consumer. Both landlord and tenant would have greater returns from the land; and these returns being permanent, the landlord ought to bear the greatest share of the expense. Increased production would create a demand for labour, and the labourers of all professions would be enabled to live more comfortably. From this only true mode of cheapening labour, the British manufacturer would be aided in his competition with foreign labour;—the general revenue of the country would increase;—the salubrity of the climate, and the general beauty of the country, would be greatly promoted. There is no subject, therefore, more worthy the attention of the landed interest, than the encouragement of thorough drainage, and, as a necessary and beneficial consequence of draining, the deep working of the soil. (K. K. K.)

Drake.

DRAKE, Sir Francis, a celebrated English admiral, was the son of Edmund Drake, a sailor, and was born near Tavistock, in Devonshire, in the year 1545. He was brought up at the expense and under the care of Sir John Hawkins, who was his kinsman, and, at the age of eighteen, was the purser of a ship trading to Biscay. At twenty he made a voyage to Guinea, and at twenty-two he was made captain of the *Judith*. In that capacity he was in the harbour of San Juan de Ulloa, in the Gulf of Mexico, where he behaved most gallantly in the actions under Sir John Hawkins, and returned with him to England, having acquired great reputation, though not worth a groat. Upon this he projected an attack against the Spaniards in the West Indies; a project which he no sooner published than he found volunteers enow ready to accompany him. In 1570 he undertook an expedition with two ships, and the next year with only one, in which he returned safe, if not with such advantages as he had expected. In 1572 he made another expedition, in which he did the Spaniards some mischief, and gained considerable booty. In these expeditions he was much assisted by a nation of Indians, who were then engaged in a sort of chronic warfare with the Spaniards. The prince of these people was named Pedro, to whom Drake presented a fine cutlass from his side, which he saw the Indian greatly admired. Pedro, in return, gave him four large wedges of gold; which Drake threw into the common stock, saying that he thought it but just that such as on his credit bore the charge of so uncertain a voyage, should share the utmost advantage which that voyage produced. Then having embarked his men with all the wealth he had obtained, which was very considerable, he bore away for England, where he arrived in August 1573.

His success in this expedition, joined to his honourable behaviour towards his owners, gained him high reputation, and the use which he made of his riches a still higher. Having fitted out three frigates at his own expense, he sailed with them to Ireland; and there, under Walter earl of Essex, the father of the famous but unfortunate earl, he served as a volunteer, and performed many glorious actions. After the death of his patron, he returned to England, where Sir Christopher Hatton introduced him to her majesty Queen Elizabeth, and procured him countenance and protection at court. By this means he acquired the means of undertaking that grand expedition which has rendered his name immortal. The first proposal he made was to undertake a voyage into the South Seas through the Straits of Magelhaens; an achievement which no Englishman had hitherto ever attempted. This project having been well received at court, the queen furnished him with means; and his own fame quickly drew together a sufficient force. The fleet with which he sailed on this enterprise consisted only of five vessels, small when compared with the size of modern ships, and having on board no more than a hundred and sixty-four able men. Having sailed on the 13th of December 1577, he on the 25th fell in with the coast of Barbary, and on the 29th with Cape Verde. On the 18th of March he passed the equinoctial, made the coast of Brazil on the 5th of April, and entered the river Plata, where he parted company with two of his ships; but having met them again, and taken out their provisions, he turned them adrift. On the 29th of May he entered the port of St Julian's, where he continued two months for the sake of laying in a stock of provisions. On the 20th of August he entered the Straits of Magelhaens, and on the 25th of September passed them, having then only his own ship. On the 25th of November he arrived at Macao, which he had appointed as the place of rendezvous in the event of his ships being separated; but Captain Winter, his vice-admiral, having repassed the straits, had returned to England. He thence continued his voyage along the coast of Chili and Peru, taking all opportunities of seizing Spanish ships, and attacking them on shore, till his men were satiated with plunder; and then, coasting America to the height of forty-eight degrees, he endeavoured to find a passage that way back into the Atlantic, but could not, because none exists. However, he landed, and called the country *New Albion*, taking possession of it in the name and for the use of Queen Elizabeth; and having careened his ship, he set sail from thence on the 29th September 1579, for the Moluccas. He is supposed to have chosen this passage round, partly to avoid being attacked by the Spaniards at a disadvantage, and partly because, from the lateness of the season, dangerous storms and hurricanes were apprehended. On the 13th of October he fell in with certain islands inhabited by the most barbarous people he had met with in all his voyage. On the 4th of November he got sight of the Moluccas; and, arriving at Ternate, was extremely well received by the king of that place, who appears from the most authentic relations of this voyage to have been a wise and politic prince. On the 10th of December he made the Celebes, where his ship unfortunately struck upon a rock on the 9th of January following; but, beyond all expectation, they got her off, and continued their course. On the 16th of March he arrived at Java, whence he intended to have directed his course to Malacca; but he found himself obliged to alter his purpose, and to think of returning home. On the 25th of March 1580, he put this design in execution; and on the 15th of June he doubled the Cape of Good Hope, having then on board only fifty-seven men and three casks of water. On the 12th of July he passed the line, reached the coast of Guinea on the 16th, and there watered. On the 11th of September he made the island of Terceira, and on the 3d of November he entered the harbour of Plymouth. This voyage round the world was performed in two years and about ten months. Shortly after his arrival, the queen having gone to Deptford, went on board his ship, and there, after dinner, conferred upon him the honour of knighthood, at the same time declaring her entire approbation of all that he had done. She likewise gave directions for the preservation of his ship, that it might remain a monument of his own and his country's glory. In the year 1585, he sailed with a fleet to the West Indies, and took the cities of St Jago, St Domingo, Carthagena, and St Augustine. In 1587 he went to Lisbon with a fleet of thirty sail; and having received intelligence of a great fleet being assembled in the bay of Cadiz, and destined to form part of the armada, he with great courage entered the port, and there burnt upwards of 10,000 tons of shipping; a feat which he afterwards merrily called "burning the king of Spain's beard." In 1588, when the Spanish armada was approaching our shores, Sir Francis Drake was appointed vice-admiral under Charles Lord Howard of Effingham, high-admiral of England; and here fortune favoured him as remarkably as ever; for he made prize of a very large galleon, commanded by Don Pedro de Valdez, who was reputed the projector of the invasion. This affair deserves to be particularly stated. On the 22d of July, Sir Francis observing a great Spanish ship floating at a distance from both fleets, sent his pinnace to summon the commander to yield. Valdez replied, with much Spanish solemnity, that they were four hundred and fifty strong, that he himself was Don Pedro, and stood much upon his honour; and thereupon propounded several conditions, upon which he was willing to yield. But the vice-admiral replied, that he had no leisure to parley; that if the Don thought fit instantly to yield, he might; if not, he should soon find that Drake

Drama.

was no coward. Pedro, hearing the name of Drake, immediately yielded, and with forty-six of his attendants came on board the admiral's ship. This Don Pedro remained about two years Sir Francis Drake's prisoner in England; and when he was released, paid for his own and his captain's liberty a ransom of L.3500. Drake's soldiers were well recompensed with the plunder of this ship, for they found in it 55,000 ducats of gold, which were divided amongst them.

A little before this formidable Spanish armament put to sea, the ambassador of his Catholic majesty had the confidence to propose to Queen Elizabeth, in Latin verse, the terms upon which she might hope for peace. The lines embodying this singular diplomatic communication are as follow:

> Te veto ne pergas bello defendere Belgas;
> Quæ Dracus eripuit nunc restituantur oportet:
> Quas pater evertit jubeo te condere cellas:
> Religio Papæ fac restituatur ad unguem.

To these the queen made this extempore response:

> Ad Græcas, bone rex, fiant mandata kalendas.

In the year 1559, Sir Francis Drake commanded the fleet sent to restore Dom Antonio, king of Portugal, the land forces being under the orders of Sir John Norris; but they had hardly put to sea when the commanders differed, and thus the attempt proved abortive. But as the war with Spain continued, a more formidable expedition was fitted out, under Sir John Hawkins and Sir Francis Drake, against their settlements in the West Indies, than had hitherto been undertaken during the whole course of it. Here, however, the commanders again disagreed about the plan; and the result in like manner disappointed public expectation. Before these two last expeditions, all difficulties had given way to the skill and fortune of Sir Francis Drake; and this probably was the reason why he did not bear these disappointments so well as he might otherwise have done. A strong sense of them is supposed to have thrown him into a melancholy, which occasioned a bloody flux, of which he died on board his own ship, near the town of Nombre de Dios, in the West Indies, on the 28th of January 1595-96. His death was lamented by the whole nation, and particularly by his countrymen, who had great reason to love him from the correctness of his private life, as well as to esteem him on account of his public character. He was elected burgess for the town of Bossiny, otherwise called Tintagal, in the county of Cornwall, in the twenty-seventh parliament of Queen Elizabeth; and for Plymouth, in Devonshire, in the thirty-fifth of the same reign. This town was under very particular obligations to him; for, in the year 1587, he undertook to bring into it water, from want of which it had till then been grievously distressed; and he performed this undertaking by conducting thither a stream from springs at eight miles distance, but by a course of upwards of twenty miles.

Drakenborch
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Drama.

DRAKENBORCH, Arnold, a celebrated scholar and editor, was a native of Utrecht, where he was born on the 1st of January 1684; and in that city he was afterwards professor of rhetoric and history, an office which he filled with great reputation. Grævius and Burmann taught him the belles lettres, and Cornelius Van Eck was his preceptor whilst he devoted his attention to the law. He succeeded Professor Burmann in the year 1716, and terminated his mortal career in 1748, in the sixty-fourth year of his age. He was an author of distinguished eminence, as his publications sufficiently evince. His dissertation entitled *Disputatio philologico-historica de Præfecto urbis*, in 4to, proves him to have been an able philologist, and gave flattering indications of future eminence. Its intrinsic merit caused it to be reprinted at Frankfort, in 1752, by Professor Uhl, accompanied with a life of its learned author. His next work, entitled *Disputatio de officio præfectorum prætorio*, was published in the year 1707; and ten years afterwards he gave to the world his edition of *Silius Italicus*, in seventeen books, 4to. In order to render this edition as perfect as possible, nothing was omitted; and many historical subjects were engraved for the purpose of elucidating the text, to which his own copious and learned annotations greatly contributed. But his splendid edition of Livy, with a life of that eminent historian, is that on which his fame as a scholar chiefly rests. It is entitled *T. Livii Patavini historiarum ab urbe condita libri, qui supersunt, omnes.* Lugd. Batav. 1738 and 1746, 7 tom. The preface to this work is very long, and replete with erudition, giving a particular account of all the literary characters who have at different periods commented on the works of Livy. He took the edition of Gronovius as his model, because in his estimation it was the most correct; but he made many important alterations on the authority of manuscripts which it is probable Gronovius had either never seen, or not taken the pains to consult. Upon the whole, this edition of Livy is at once the most elaborate, interesting, and instructive, ever given to the world, since he has introduced into it the criticisms of Duchier, Gronovius, Perizonius, and Sigonius, in addition to his own, which, though somewhat prolix, are certainly fraught with much literature and deep discernment.

DRAMA.

A drama (we adopt Dr Johnson's definition, with some little extension) is a poem or fictitious composition in dialogue, in which the action is not related, but represented.

A disposition to this fascinating amusement, considered in its rudest state, seems to be inherent in human nature. It is the earliest sport of children to take upon themselves some fictitious character, and sustain it to the best of their skill, by such appropriate gesture and language as their youthful fancies suggest, and such dress and decoration as circumstances place within their reach. The infancy of nations is as prone to this pastime as that of individuals. When the horde emerges out of a nearly brutal state, so far as to have holidays, public sports, and general rejoicings, the pageant of their imaginary deities, or of their fabulous ancestors, is usually introduced as the most pleasing and interesting part of the show. But however general the predisposition to the assumption of fictitious character may be, there is an immeasurable distance betwixt the rude games in which it first displays itself, and that polished amusement which is numbered among the fine arts, which poetry, music, and painting have vied to adorn, and to whose service genius has devoted her most sublime efforts; whilst philosophy has stooped from her loftier task, to regulate the progress of the action, and give probability to the representation and personification of the scene.

Outline.

The history of Greece—of that wonderful country, whose days of glory have left such a never-dying blaze of radiance behind them—the history of Greece affords us the means of correctly tracing the polished and regulated drama, the subject of severe rule, and the vehicle for expressing the noblest poetry, from amusements as rude in their outline as the mimic sports of children or of savages. The history of the Grecian stage is that of the dramatic art in general. They transferred the drama, with their other literature, to the victorious Romans, with whom it rather existed as a foreign than flourished as a native art. Like the other fine arts, the stage sunk under the decay of the empire, and its fall was accelerated by the introduction of the Christian religion. In the middle ages dramatic representation revived, in the shape of the homely Mysteries and Moralities of our forefathers. The revival of letters threw light upon the scenic art, by making us acquainted with the pitch of perfection to which it had been carried by the genius of Greece. With this period commences the history of the modern stage, properly so called. Some general observations on the drama, and its present state in Britain, will form a natural conclusion to the article.

Rise of the Grecian drama.

The account which we have of the origin of Grecian theatrical representations, describes them as the fantastic orgies of shepherds and peasants, who solemnized the rites of Bacchus by the sacrifice of a goat, by tumultuous dances, and by a sort of masquerade, in which the actors were disguised like the ancient *Morrice-dancers* of England, or the *Guisards* of Scotland, who have not as yet totally disused similar revels. Instead of masks, their faces were stained with the lees of wine, and the songs and jests corresponded in coarseness to the character of the satyrs and fawns, which they were supposed to assume in honour of their patron Bacchus. Music, however, always formed a part of this rude festivity, and to this was sometimes added the recitations of an individual performer, who, possessed of more voice or talent than his companions, was able to entertain an audience for a few minutes by his own individual exertions.

Out of such rude materials, Thespis is supposed to have been the first who framed something like an approach to a more regular entertainment. The actors under this, the first of theatrical managers, instead of running about wild among the audience, were exalted upon a cart, or upon a scaffold formed of boards laid upon tressels. In these improvements Thespis is supposed to have had the aid of one Susarion, whose efforts were more particularly directed to the comic drama. But their fortunes have been unequal, for whilst the name of Thespis is still united with every thing dramatic, that of Susarion has fallen into oblivion, and is only known to antiquaries.

The drama in Greece, as afterwards in Britain, had scarcely begun to develope itself from barbarism, ere, with the most rapid strides, it advanced towards perfection. Thespis and Susarion flourished about four hundred and forty or fifty years before the Christian era. The battle of Marathon was fought in the year 490 before Christ; and it was upon Æschylus, one of the Athenian generals on that memorable occasion, that Greece conferred the honoured title of the Father of Tragedy. We must necessarily judge of his efforts by that which he did, not by that which he left undone; and if some of his regulations may sound strange in modern ears, it is but just to compare the state in which he found the drama, with that in which he left it.

Æschylus was the first, who, availing himself of the invention of a stage by Thespis, introduced upon the boards a plurality of actors at the same time, and converted into action and dialogue, accompanied or relieved at intervals by the musical performance of the chorus, the dull monologue of the Thespian orator. It was Æschylus, also, who introduced the deceptions of scenery, stationary indeed, and therefore very different from the decorations of our stage, but still giving a reality to the whole performance, which could not fail to afford pleasure to those who beheld for the first time an effort to surround the player, while invested with his theatrical character, with scenery which might add to the illusions of the representations. But this was not all. A theatre, at first of wood, but afterwards of stone, circumscribed, whilst it accommodated, the spectators, and reduced a casual and disorderly mob to the quality and civilization of a regular and attentive audience.

The most remarkable effect of the tragedy of Æschylus was the introduction of the chorus in a new character, which continued long to give a peculiar tone to the Grecian drama, and to make a striking difference betwixt that original theatre and those which have since arisen in modern nations.

The chorus who sung hymns in favour of Bacchus, the musical part, in short, of the entertainment, remained in the days of Thespis, as it had been in the rude village gambols which he had improved, the principal part of the dramatic entertainment. The intervention of monologue, or recitation, was merely a relief to the musicians and a variety to the audience. Æschylus, whilst he assigned a part of superior consequence to the actor in his improved dialogue, new-modelled the chorus, which custom still enjoined as a necessary and indispensable branch of the performance. They were no longer a body of vocal musicians, whose strains were as independent of what was spoken by the personages of the drama, as those of our modern orchestra when performing betwixt the acts. The chorus assumed from this time a different and complicated character, which forms a marked peculiarity in the Grecian drama, distinguishing it from the theatrical compositions of modern Europe.

The chorus, according to this new model, was composed of a certain set of persons, priests, captive virgins, matrons, or others, usually of a solemn and sacred character, the contemporaries of the heroes who appeared on the stage, who remained upon the scene to celebrate in hymns set to music the events which had befallen the active persons of the drama; to afford them alternately their advice or their sympathy; and, at least, to moralize, in lyrical poetry, on the feelings to which their history and adventures, their passions and sufferings, gave rise. The chorus might be considered as, in some degree, the representatives of the audience, or rather of the public, on whose great stage those events happen in reality which are presented in the mimicry of the drama. In the strains of the chorus, the actual audience had those feelings suggested to them as if by reflection in a mirror, which the events of the scene ought to produce in their own bosom; they had at once before them the action of the piece, and the effect of that action upon a chosen band of persons, who, like themselves, were passive spectators, whose dignified strains pointed out the moral reflections to which the subject naturally gave rise. The chorus were led or directed by a single person of their number, termed the coryphæus, who frequently spoke or sung alone. They were occasionally divided into two bands, who addressed and replied to each other. But they always preserved the character proper to them, of spectators, rather than agents in the drama.

The number of the chorus varied at different periods, often extending to fifty persons, and sometimes restricted to *half* that number; but it is evident that the presence of so many persons on the scene, officiating as no part of the *dramatis personæ*, but rather as contemporary spectators, involved many inconveniences and inconsistencies. That which the hero, however agitated by passion, must naturally have suppressed within his own breast, or uttered in soliloquy, was thus necessarily committed to the confidence of fifty people, less or more. And when a deed of violence was to be committed, the helpless chorus, instead of interfering to prevent the atrocity to which the perpetrator had made them privy, could only, by the rules of the theatre, exhaust their sorrow and surprise in dithyrambics. But still the union which Æschylus accomplished betwixt the didactic hymns of the chorus and the events which were passing upon the stage, was a most important improvement upon the earlier drama. By this means the two unconnected branches of the old Bacchanalian revels were combined together; and we ought rather to be surprised that Æschylus ventured, whilst accomplishing such an union, to render the hymns sung by the chorus subordinate to the action or dialogue, than that he did not take the bolder measure of altogether discarding that which, before his time, was reckoned the principal object of a religious entertainment.

Gr ian the re, an node of ing.

The new theatre and stage of Athens were reared, as we have seen, under the inspection of Æschylus. He also introduced dresses in character for his principal actors, to which were added embellishments of a kind which mark the wide distinction betwixt the ancient and modern stage. The personal disguise which had formerly been attained by staining the actor's face, was now, by what doubtless was considered as a high exertion of ingenuity, accomplished by the use of a mask, so painted as to represent the personage whom he performed. To augment the apparent awkwardness of this contrivance, the mouths of these masks were frequently fashioned like the extremity of a trumpet, which, if it aided the actor's voice to reach the extremity of the huge circuit to which he addressed himself, must still have made a ridiculous appearance upon the stage, had not the habits and expectations of the spectators been in a different tone from those of a modern audience. The use of the *cothurnus* or buskin, which was contrived so as to give to the performer additional and unnatural stature, would have fallen under the same censure. But the ancient and modern theatres may be said to resemble each other only in name, as will appear from the following account of the Grecian stage, abridged from the best antiquaries.

The theatres of the Greeks were immensely large in comparison to ours; and the audience sat upon rows of benches, rising above each other in due gradation. In form they resembled a horse-shoe. The stage occupied a platform, which closed in the flat end of the building, and was raised so high as to be on a level with the lowest row of benches. The central part of the theatre, or what we call the pit, instead of being filled with spectators, according to modern custom, was left for the occasional occupation of the chorus, during those parts of their duty which did not require them to be nearer to the stage. This space was called the *orchestra*, and corresponded in some measure with the open space which, in the modern equestrian amphitheatres, is interposed betwixt the audience and the stage, for the display of feats of horsemanship. The delusion of the scene being thus removed to a considerable distance from the eye of the spectator, was heightened; and many of the objections offered to the use of the mask and the buskin were lessened or totally removed. When the chorus did not occupy the orchestra, they ranged themselves beside the *thymele*, a sort of altar, surrounded with steps, placed in front of their stage orchestra. From this, as a post of observation, they watched the progress of the drama, and to this point the actors turned themselves when addressing them. The solemn hymns and mystic dances of the chorus, performed during their retreat into the orchestra, formed a sort of interludes, or interruptions of the action, similar in effect to the modern division into acts. But, properly speaking, there was no interruption of the representation from beginning to end. The piece was not, indeed, constantly progressive; but the illusion of the scene was always before the audience, either by means of the actors themselves or of the chorus. And the musical recitation and character of the dances traced by the chorus in their interludes, were always in correspondence with the character of the piece, grave, majestic, and melancholy; in tragedy, gay and lively; in comedy, and during the representation of satirical pieces, wild, extravagant, and bordering on buffoonery. The number of these interludes, or interruptions of the action, seems to have varied from three to six, or even more, at the pleasure of the author. The music was simple and inartificial, although it seems to have produced powerful effects on the audience. Two flute-players performed a prelude to the choral hymns, or directed the movement of the dances, which in tragedy were a solemn, slow, modulated succession of movements, very little resembling anything termed dancing among the moderns.

The stage itself was well contrived for the purposes of the Greek drama. The front was called the *logeum*, and occupied the full width of the flat termination of the theatre, contracted, however, at each extremity by a wall, which served to conceal the machinery necessary for the piece. The stage narrowed as it retired backwards; and the space so restricted in breadth was called the *proscenium*. It was terminated by a flat decoration, on which was represented the front of a temple, palace, or whatever else the poet had chosen for his scene. Suitable decorations appeared on the wings, as in our theatres. There were several entrances, both by the back scene and in front. These were not used indiscriminately, but so as to indicate the story of the piece, and render it more clear to apprehension. Thus, the persons of the drama who were supposed to belong to the palace or temple in the flat scene, entered from the side or the main door, as befitted their supposed rank; those who were inhabitants of the place represented, entered through a door placed at the side of the logeum; while those supposed to come from a distance were seen to traverse the orchestra, and to ascend the stage by a stair of communication, so that the audience were made spectators, as it were, of their journey. The proscenium was screened by a curtain, which was withdrawn when the piece commenced. The decorations could be in some degree altered, so as to change the scene; though this, we apprehend, was seldom practised. But machinery for the ascent of phantoms, the descent of deities, and similar exhibitions, were as much in fashion among the Greeks as on our own modern stage; with better reason, indeed, for we shall presently see that the themes which they held most proper to the stage called frequently for the assistance of these mechanical contrivances.

In the dress and costume of their personages the Greeks bestowed much trouble and expense. It was their object to disguise as much as possible the mortal actor who was to represent a divinity or an hero; and while they hid his face and augmented his height, they failed not to assign him a mask and dress in exact conformity to the popular idea of the character represented; so that, seen across the orchestra, he might appear the exact resemblance of Hercules or of Agamemnon.

The Grecians, but in particular the Athenians, became most passionately attached to the fascinating and splendid amusement which Æschylus thus regulated, which Sophocles and Euripides improved, and which all three, with other dramatists of inferior talents, animated by the full vigour of their genius. The delightful climate of Greece permitted the spectators to remain in the open air (for there was no roof to their huge theatres) for whole days, during which several plays, high monuments of poetical talent, were successively performed before them. The enthusiasm of their attention may be judged of by what happened during the representation of a piece written by Hegemon. It was while the Athenians were thus engaged that there suddenly arrived the astounding intelligence of the total defeat of their army before Syracuse. The theatre was filled with the relations of those who had fallen; there was scarcely a spectator, who, besides sorrowing as a patriot, was not called to mourn a friend or relative. But, spreading their mantles before their faces, they commanded the representation to proceed; and thus veiled, continued to give it their attention to the conclusion. National pride, doubtless, had its share in this singular conduct, as well as fondness for the dramatic art. Another instance is given of the nature and acuteness of their feelings, when the assembly of the people amerced Phrynicus in a fine of a thousand drachmæ, because, in a comedy founded upon the siege of Miletos, he had agitated their feelings to excess, in painting an incident which Athens lamented as a misfortune dishonourable to her arms and her councils.

The price of admission was at first one *drachma;* but Pericles, desirous of propitiating the ordinary class of citizens, caused the entrance-money to be lowered to two *oboli*, so that the meanest Athenian had the ready means of indulging in this luxurious mental banquet. As it became difficult to support the expense of the stage, for which such cheap terms of admission could form no adequate fund, the same statesman, by an indulgence yet more perilous, caused the deficiency to be supplied from the treasure destined to sustain the expense of the war. It is a sufficient proof of the devotion of the Athenians to the stage, that not even the eloquence of Demosthenes could tempt them to forego this pernicious system. He touched upon the evil in two of his orations; but the Athenians were resolved not to forego the benefits of an abuse which they were aware could not be justified, and they passed a law making it death to touch upon that article of reformation.

It must not be forgotten, that the Grecian audience enjoyed the exercise of critical authority, as well as of classical amusement, at their theatre. They applauded and censured, as at the present day, by clapping hands and hissing. Their suffrage at those tragedies acted upon the solemn feasts of Bacchus, adjudged a laurel crown to the most successful dramatic author. This faculty was frequently abused; but the public, on sober reflection, seldom failed to be ashamed of such acts of injustice, and faithful, upon the whole, to the rules of criticism, evinced a fineness and correctness of judgment, which never descended to the populace of any other nation.

Peculiar character of the Grecian drama.

To this general account of the Grecian stage, it is proper to add some remarks on those peculiar circumstances from which it derives a tone and character so different from that of the modern drama; circumstances affecting at once its style of action, mode of decoration, and general effect on the feelings of the spectators.

The Grecian drama, it must be remembered, derived its origin from a religious ceremony; and, amid all its refinement, never lost its devotional character, unless it shall be judged to have done so in the department of satirical comedy.

When the audience was assembled, they underwent a religious lustration, and the archons or chief magistrates paid their public adoration to Bacchus, still regarded as the patron of the theatrical art, and whose altar was always placed in the theatre.

The subject of the drama was frequently religious. In tragedy especially, Sophocles and Euripides, as well as Æschylus, selected their subjects from the exploits of the deities themselves, or of the demigods and heroes whom Greece accounted to draw an immediate descent from the denizens of Olympus, and to whom she paid nearly equal reverence. The object of the tragic poets was less to amuse and interest their audience by the history of the human heart, or soften them by the details of domestic distress, than to elevate them into a sense of devotion or submission, or to astound and terrify them by the history and actions of a race of beings before whom ordinary mortality dwindled into pigmy size. This they dared to attempt; and, what may appear still more astonishing to the mere English reader, this they appear in a great measure to have performed. Effects were produced upon their audience which we can only attribute to the awful impression communicated by the idea of the immediate presence of the divinity. The emotions excited by the apparition of the Eumenides or furies, in Æschylus's tragedy of that name, so appalled the audience that females are said to have lost the fruit of their womb, and children to have actually expired in convulsions of terror. These effects may have been exaggerated; but that considerable inconveniences occurred from the extreme horror with which this tragedy impressed the spectators, is evident from a decree of the magistrates, limiting the number of the chorus, in order to prevent in future such tragical consequences. It is plain that the feeling by which such impressions arose must have been something very different from what the spectacle of the scene alone could possibly have produced. The mere sight of actors disguised in masks, suited to express the terrific yet sublime features of an antique Medusa, with her hair entwined with serpents,—the wild and dishevelled appearance, the sable and bloody garments, the blazing torches, the whole apparatus, in short, or properties as they are technically called, with which the classic fancy of Æschylus could invest those terrific personages,—nay more, even the appropriate terrors of language and violence of gesture with which they were bodied forth, must still have fallen far short of the point which the poet certainly attained, had it not been for the intimate and solemn conviction of his audience that they were in the performance of an act of devotion, and to a certain degree in the presence of the deities themselves. It was this conviction, and the solemn and susceptible temper to which it exalted the minds of a large assembly, which prepared them to receive the electric shock produced by the visible representation of those terrible beings, to whom, whether as personifying the stings and terrors of an awakened conscience, or as mysterious and infernal divinities, the survivors of an elder race of deities, whose presence was supposed to strike awe even into Jove himself, the ancients ascribed the task of pursuing and punishing atrocious guilt.

It was in consistency with this connection betwixt the drama and religion of Greece, that the principal Grecian tragedians thought themselves entitled to produce upon the stage the most sacred events of their mythological history. It might have been thought that in doing so they injured the effect of their fable and action, since suspense and uncertainty, so essential to the interest of a play, could not be supposed to exist where the immortal gods, beings controlling all others, and themselves uncontrolled, were selected as the agents in the piece. But it must be remembered, that the synod of Olympus, from Jove downwards, were themselves but limitary deities, possessing indeed a certain influence upon human affairs, but unable to stem or divert the tide of fate or destiny, upon whose dark bosom, according to the Grecian creed, gods as well as men were embarked, and both sweeping downwards to some distant yet inevitable termination of the present system of the universe, which should annihilate at once the race of divinity and of mortality. This awful catastrophe is hinted at not very obscurely by Prometheus, who, when chained to his rock, exults, in his prophetic view, in the destruction of his oppressor Jupiter; and so far did Æschylus, in particular, carry the introduction of religious topics into his drama, that he escaped with some difficulty from an accusation of having betrayed the Eleusinian mysteries.

Where the subject of the drama was not actually taken from mythological history, and when the gods themselves did not enter upon the scene, the Grecian stage was, as we have already hinted, usually trod by beings scarcely less awful to the imagination of the audience; the heroes namely of their old traditional history, to whom they attributed an immediate descent from their deities, a frame of body and mind surpassing humanity, and after death an exaltation into the rank of demigods.

It must be added, that, even when the action was laid among a less dignified set of personages, still the altar was present on the stage; incense frequently smoked; and frequent prayers and obtestations of the deity reminded the audience that the sports of the ancient theatre had their origin in religious observances. It is scarcely necessary to state how widely the classical drama, in this respect, differs in principle from that of the modern, which pretends to be nothing more than an elegant branch of the fine arts, whose end is attained when it supplies an evening's amusement, whose lessons are only of a moral description, and which is so far from possessing a religious character, that it has with difficulty escaped condemnation as a profane, dissolute, and antichristian pastime. From this difference of principle there flows a difference of practical results, serving to account for many circumstances which might otherwise seem embarrassing.

The ancients, we have seen, endeavoured by every means in their power, including the use of masks and of buskins, to disguise the person of the actor; and, at the expense of sacrificing the expression of his countenance, and the grace, or at least the ease, of his form, they removed from the observation of the audience every association which could betray the person of an individual player, under the garb of the deity or hero he was designed to represent. To have done otherwise would have been held indecorous, if not profane. It follows, that as the object of the Athenian and of the modern auditor in attending the theatre was perfectly different, the pleasure which each derived from the representation had a distinct source. Thus, for example, the Englishman's desire to see a particular character is intimately connected with the idea of the actor by whom it is performed. He does not wish to see Hamlet in the abstract, so much as to see how Kemble performs that character,[1] and to compare him perhaps with his own recollections of Garrick in the same part. He comes prepared to study each variation of the actor's countenance, each change in his accentuation and deportment; to note with critical accuracy the points which discriminate his mode of acting from that of others; and to compare the whole with his own abstract of the character. The pleasure arising from this species of critical investigation and contrast is so intimately allied with our ideas of theatrical amusement, that we can scarce admit the possibility of deriving much satisfaction from a representation sustained by an actor whose personal appearance and peculiar expression of features should be concealed from us, however splendid his declamation, or however appropriate his gesture and action. But this mode of considering the drama, and the delight which we derive from it, would have appeared to the Greeks a foolish and profane refinement, not very different in point of taste from the expedient of Snug the joiner, who intimated his identity by letting his natural visage be seen under the mask of the lion which he represented. It was with the direct purpose of concealing the features of the individual actor, as tending to destroy the effect of his theatrical disguise, that the mask and buskin were first invented, and afterwards retained in use. The figure was otherwise so dressed as to represent the deity or demigod, according to the statue best known, and adored with most devotion, by the Grecian public. The mask was, by artists who were eminent in the plastic art, so formed as to perfect the resemblance. Theseus or Hercules stood before the audience in the very form with which painters and statuaries had taught them to invest the hero, and there was certainly thus gained a more complete scenic deception than could have been obtained in our present mode. It was aided by the distance interposed betwixt the audience and the stage; but, above all, by the influence of enthusiasm acting upon the congregated thousands, whose imaginations, equally lively and susceptible, were prompt to receive the impressions which the noble verse of their authors conveyed to their ears, and the living personification of their gods and demigods placed before their eyes.

It is scarcely necessary to add, that, while these observations plead their apology for the mask and the buskin of the ancients, they leave, where it stood before, every objection to those awkward and unseemly disguises, considered in themselves, and without reference to the peculiar purpose and tendency of the ancient theatre. In fact, the exquisite pleasure derived from watching the eloquence of feature and eye, which we admire in an accomplished actor, was not, as some have supposed, sacrificed by the ancients for the assumption of these disguises. They never did, and, according to the plan of their theatres, never could, possess that source of enjoyment. The circuit of the theatre was immense, and the eyes of the thousands whom it contained were so far removed from the stage, that, far from being able to enjoy the minute play of the actor's features, the mask and buskin were necessary to give distinction to his figure, and to convey all which the ancients expected to see, his general resemblance, namely, to the character he represented.

The style of acting, so far as it has been described to us, corresponded to the other circumstances of the representation. It affected gravity and sublimity of movement and of declamation. Rapidity of motion and vivacity of action seem to have been reserved for occasions of particular emotion; and that delicacy of bye-play, as well as all the aid which look and slight jesture bring so happily to the aid of an impassioned dialogue, were foreign to their system. The actors, therefore, had an easier task than on the modern stage, since it is much more easy to preserve a tone of high and dignified declamation, than to follow out the whirlwind and tempest of passion, in which it is demanded of the performer to be energetic without bombast, and natural without vulgarity.

The Grecian actors held a high rank in the republic, and those esteemed in the profession were richly recompensed. Their art was the more dignified, because the poets themselves usually represented the principal character in their own pieces; a circumstance which corroborates what we have already stated concerning the comparative inferiority of talents required in a Grecian actor, who was only expected to move with grace and declaim with truth and justice. His disguise hid all personal imperfections; and thus a Grecian poet might aspire to become an actor without that extraordinary and unlikely union of moral and physical powers which would be necessary to qualify a modern dramatist to mount the stage in person, and excel at once as a poet and as an actor.

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[1] It is proper to state here, once for all, that, contrary to our usual practice, this article is reprinted as it originally appeared in the Supplement to the fourth, fifth, and sixth editions of this work, without any of those adaptations which the course of time and change of circumstances render necessary in ordinary cases. We have deemed this homage due to the genius and fame of the illustrious author (Sir Walter Scott), whose splendid view of the origin and progress of the dramatic art we have accordingly presented to the reader exactly as it proceeded from his own hand, leaving every contemporaneous allusion and illustration untouched.

Principal tragic writers in Athens.

It is no part of our present object to enter into any minute examination of the comparative merits of the three great tragedians of Athens, Æschylus, Sophocles, and Euripides. Never, perhaps, did there arise, within so short a space, such a succession of brilliant talents. Sophocles might, indeed, be said to be the contemporary of both his rivals, for his youthful emulation was excited by the success of Æschylus, and the eminence of his latter years was disturbed by the rivalry of Euripides, whom, however, he survived. To Æschylus, who led the van in the dramatic enterprise, as he did in the field of Marathon, the sanction of antiquity has ascribed unrivalled powers over the realms of astonishment and terror. At his summons, the mysterious and tremendous volume of destiny, in which are inscribed the doom of gods and men, seemed to display its leaves of iron before the appalled spectators; the more than mortal voices of Deities, Titans, and departed Heroes, were heard in awful conference; heaven bowed, and its divinities descended; earth yawned, and gave up the pale spectres of the dead, and the yet more undefined and grisly forms of those infernal deities who struck horror into the gods themselves. All this could only be dared and done by a poet of the highest order, confident, during that early age of enthusiasm, that he addressed an audience prompt to kindle at the heroic scene which he placed before them. It followed almost naturally, from his character, that the dramas of Æschylus, though full of terrible interest, should be deficient in grace and softness; that his sublime conciseness should deviate sometimes into harshness and obscurity; that, finding it impossible to sustain himself at the height to which he had ascended, he should sometimes drop, "fluttering his pinions vain," into great inequalities of composition; and, finally, that his plots should appear rude and inartificial, contrasted with those of his successors in the dramatic art. Still, however, Æschylus led not only the way in the noble career of the Grecian drama, but outstripped, in point of sublimity at least, those by whom he was followed.

Sophocles, who obtained from his countrymen the title of the *Bee* of Attica, rivalled Æschylus when in the possession of the stage, and obtained the first prize. His success occasioned the veteran's retreat to Sicily, where he died, commanding that his epitaph should make mention of his share in the victory of Marathon, but should contain no allusion to his dramatic excellencies. His more fortunate rival judiciously avoided the dizzy and terrific path which Æschylus had trode with so firm and daring a step. It was the object of Sophocles to move sorrow and compassion, rather than to excite indignation and terror. He studied the progress of action with more attention than Æschylus, and excelled in that modulation of the story by which interest is excited at the beginning of a drama, maintained in its progress, and gratified at its conclusion. His subjects are also of a nature more melancholy and less sublime than those of his predecessor. He loved to paint heroes rather in their forlorn than in their triumphant fortunes, aware that the contrast offered new sources of the pathetic to the author. Sophocles was the most fortunate of the Greek tragedians. He attained the age of ninety-one years; and, in his eightieth, to vindicate himself from a charge of mental imbecility, he read to the judges his *Œdipus Coloneus*, the most beautiful, at least the most perfect, of his tragedies. He survived Euripides, his most formidable rival, of whom also we must say a few words.

It is observed by Schlegel, that the tone of the tragedies of Euripides approaches more nearly to modern taste than to the stern simplicity of his predecessors. The passion of love predominates in his pieces, and he is the first tragedian who paid tribute to the passion which has been too exclusively made the moving cause of interest on the modern stage,—the first who sacrificed to

Cupid, king of gods and men.

The dramatic use of this passion has been purified in modern times, by the introduction of that tone of sentiment which, since the age of chivalry, has been a principal ingredient in heroic affection. This was unknown to the ancients, in whose society females, generally speaking, held a low and degraded place, from which few individuals emerged, unless those who aspired to the talents and virtues proper to the masculine sex. Women were not forbidden to become competitors for the laurel or oaken crown offered to genius and to patriotism; but antiquity held out no myrtle wreath as a prize for the domestic virtues peculiar to the female character. Love, therefore, in Euripides, does not always breathe purity of sentiment, but is stained with the mixture of violent and degrading passions. This, however, was the fault of the age rather than of the poet, although he is generally represented as an enemy of the female sex; and his death was ascribed to a judgment of Venus.

When blood-hounds met him by the way,
And monsters made the bard their prey.

This great dramatist was less happy than Sophocles in the construction of his plots; and, instead of the happy expedients by which his predecessor introduces us to the business of the drama, he had too often recourse to the mediation of a prologue, which came forth to explain in detail the previous history necessary to understand the piece.

Euripides is also accused of having degraded the character of his personages, by admitting more alloy of human weakness, folly, and vice, than was consistent with the high qualities of the heroic age. Æschylus, it was said, transported his audience into a new and more sublime race of beings; Sophocles painted mankind as they ought to be, and Euripides as they actually are. Yet the variety of character introduced by the latter tragedian, and the interest of his tragedies, must always attract the modern reader, coloured as they are by a tone of sentiment, and by his knowledge of the actual business, rules, and habits of actual life, to which his predecessors, living, as they did, in an imaginary and heroical world of their own, appear to have been strangers. And although the judgment of the ancients assigned the pre-eminence in tragedy to Æschylus or Sophocles, yet Euripides has been found more popular with posterity than either of his two great predecessors.

The division betwixt tragedy and comedy, for both sprung from the same common origin, the feasts, namely, in honour of Bacchus, and the disguises adopted by his worshippers, seems to have taken place gradually, until the jests and frolics, which made a principal part of these revels, were found misplaced when introduced with graver matter, and were made by Susarion, perhaps, the subject of a separate province of the drama. The Grecian comedy was divided into the ancient, the middle, and the modern style of composition.

Ancient comedy.

The ancient and original comedy was of a kind which may, at first sight, appear to derogate from the religious purposes which we have pointed out as the foundation of the drama. They frequently turn upon parodies, in which the persons and adventures of those gods and heroes who were the sublime subjects of the tragic drama, are introduced for the purpose of buffoon-sport and ridicule, as in Carey's modern farces of *Midas* and the *Golden Pippin.* Hercules appears in one of those pieces astonishing his host by an extravagant appetite, which the cook in vain attempts to satiate, by placing before him, in succession, all the various dishes which the ancient kitchen afforded. In another comedy, Bacchus, in whose honour the solemnity was instituted, is brought in only in order to ridicule his extreme cowardice.

At other times, allowing a grotesque fancy its wildest range, the early comic authors introduced upon the stage animals, and even inanimate things, as part of their *dramatis personæ*, and embodied forth on the stage the fantastic imaginations of Lucian in his *True History.* The golden age was represented in the same ridiculous and bizarre mode of description as the *Pays de la Cocagne* of the French minstrels, or the popular ideas of *Lubber-land* in England; and the poets furnished kingdoms of birds, and worlds, in the moon.

Had the only charm of these entertainments consisted in the fantastic display with which the eyes of the spectators were regaled at the expense of the over-excited imagination of the poet, they would soon have fallen into disuse; for the Athenians were too acute and judicious critics to have been long gratified with mere extravagance. But these grotesque scenes were made the medium for throwing the most bold and daring ridicule upon the measures of the state, upon the opinions of individuals, and upon the religion of the country.

This propensity to turn into ridicule that which is most serious and sacred, had probably its origin in the rude gambols of the sylvan deities who accompanied Bacchus, and to whose petulant and lively demeanour rude jest was a natural accompaniment. The audience, at least the more ignorant part of them, saw these parodies with pleasure, which equalled the awe they felt at the performance of the tragedies, whose most solemn subjects were thus burlesqued; nor do they appear to have been checked by any sense that their mirth was profane. In fact, when the religion of a nation comes to consist chiefly in the practice of a few unmeaning ceremonies, it is often found that the populace, with whatever inconsistence, assume the liberty of profaning them by grotesque parodies, without losing their reverence for the superstitions which they thus vilify. Customs of a like tendency were common in the middle ages. The festival of the Ass in France, of the Boy-Bishop in England, of the Abbot of Unreason in Scotland, and many other popular practices of the same kind, exhibited, in countries yet Catholic, daring parodies of the most sacred services and ceremonies of the Roman church. And as these were practised openly, and under authority, without being supposed to shake the people's attachment to the rites which they thus ridiculed, we cannot wonder that similar profanities were well received among the Pagans, whose religion sat very loosely upon them, and who professed no fixed or necessary articles of faith.

It is probable that, had the old Grecian comedy continued to direct its shafts of ridicule only against the inhabitants of Olympus, it would not have attracted the coercion of the magistracy. But its province was far more extensive, the poets claiming the privilege of laying their opinions on public affairs before the people in this shape. Cratinus, Eupolis, and particularly Aristophanes, a daring, powerful, and apparently unprincipled writer, converted comedy into an engine for assailing the credit and character of private individuals, as well as the persons and political measures of those who administered the state. The doctrines of philosophy, the power of the magistrate, the genius of the poet, the rites proper to the deity, were alternately made the subject of the most uncompromising and severe satire. It was soon discovered that the more directly personal the assault could be made, and the more revered or exalted the personage, the greater was the malignant satisfaction of the audience, who loved to see wisdom, authority, and religious reverence brought down to their own level, and made subjects of ridicule by the powers of the merciless satirist. The use of the mask enabled Aristophanes to render his satire yet more pointedly personal; for, by forming it so as to imitate, probably with some absurd exaggeration, the features of the object of his ridicule, and by imitating the dress and manner of the original, the player stepped upon the stage a walking and speaking caricature of the hero of the night, and was usually placed in some ludicrous position, amidst the fanciful and whimsical chimeras with which the scene was peopled.

In this manner Aristophanes ridiculed with equal freedom Socrates, the wisest of the Athenians, and Cleon, the demagogue, when at the height of his power. As no one durst perform the latter part, for fear of giving offence to one so powerful, the author acted Cleon himself, with his face smeared with the lees of wine. Like the satire of Rabelais, the political and personal invective of Aristophanes was mingled with a plentiful allowance of scurril and indecent jests, which were calculated to insure a favourable reception from the bulk of the people. He resembles Rabelais also in the wild and fanciful fictions which he assumes as the vehicle of his satire; and his comedy of the Birds may even have given hints to Swift, when, in order to contrast the order of existing institutions with those of an Utopian and fantastic fairy land, he carries Gulliver among giants and pigmies. Yet though his indecency, and the offensive and indiscriminate scurrility of his satire, deserve censure;—though he merits the blame of the wise for his attack upon Socrates, and of the learned for his repeated and envenomed assaults on Euripides,—Aristophanes has nevertheless added one deathless name to the deathless period in which he flourished; and, from the richness of his fancy, and gaiety of his tone, has deserved the title of the Father of Comedy. When the style of his sarcasm possessed the rareness of novelty, it was considered of so much importance to the state, that a crown of olive was voted to the poet, as one who had taught Athens the defects of her public men. But unless angels were to write satires, ridicule cannot be considered as the test of truth. The temptation to be witty is just so much the more resistless, that the author knows he will get no thanks for suppressing the jest which rises to his pen. As the public becomes used to this new and piquant fare, fresh characters must be sacrificed for its gratification. Recrimination adds commonly to the contest, and those who were at first ridiculed out of mere wantonness of wit, are soon persecuted for resenting the ill usage; until literature resembles an actual personal conflict, where the victory is borne away by the strongest and most savage, who deals the most desperate wounds with the least sympathy for the feeling of his adversary.

The ancient comedy was of a character too licentious to be long tolerated. Two or three decrees having been in vain passed, in order to protect the citizens against libels of this poignant description, the ancient comedy was finally proscribed by that oligarchy which assumed the government of Athens upon the downfall of the popular government towards the end of the Peloponnesian war. By order of these rulers, Anaxander, an actor, was punished capitally for parodying a line of Euripides, so as to infer a slight of the government. He was starved to death, to which, as an appropriate punishment, the public has since his time often indirectly condemned both actors and dramatists. Aristophanes, who was still alive, bowed to the storm, and relinquished the critical and satirical scourge which he had hitherto exercised in the combined capacity of satirist, reformer, and reviewer; and the use of the chorus was prohibited to comic actors, as it seems to have been in their stanzas chiefly that the offensive satire was invested. To this edict Horace alludes in the well known lines:

> Successit vetus his comœdia, non sine multa
> Laude: sed in vitium libertas excidit, et vim
> Dignam lege regi. lex est accepta, chorusque
> Turpiter obticuit, sublato jure nocendi.[1]

Middle comedy.

In the middle comedy, Thalia and her votaries seemed to have retraced their steps, and, avoiding personal satire, resorted once more to general subjects of burlesque raillery. We learn from history, real or fabulous, or from the works of the elder poets, that these plays had the fanciful wildness without the personal satire of the ancient comedy; for the authors were obliged to take care that there was no "offence" in their pleasantry. At most, they only ventured to touch on matters of instant interest in the way of inuendo, under feigned titles and oblique hints, and had no longer the audacity to join men's vices or follies to their names. Aristophanes re-cast several of his pieces in this manner. But the same food, without the poignant seasoning to which the audience had been accustomed, palled on their taste, and this cast of pieces soon gave place to that which the ancients called the New Comedy, so successfully cultivated by Menander and others.

New comedy.

Notwithstanding what modern critics have said to the contrary, and particularly the ingenious Schlegel, the new tone which comedy thus assumed seems more congenial to true taste as well as to public decorum, and even to the peace and security of the community, than that of Aristophanes, whose satiric wit, like a furious bull, charged upon his countrymen without respect or distinction, and tossed and gored whatever he met with in his way.

The new comedy had for its object the ludicrous incidents of private life (*celebrare domestica facta*, says Horace); to detail those foibles, follies, and whimsical accidents, which are circumstances material and serious to the agents themselves, but, as very usually happens on the stage of the world, matters only of ludicrous interest to the on-lookers. The new comedy admitted also many incidents of a character not purely ludicrous, and some which, calling forth pathetic emotion, approached more nearly to the character of tragedy than had been admitted in the ancient comedies of Aristophanes, and in this rather resembled what the French have called *Tragédie Bourgeoise.* It is scarce necessary to remark, that the line cannot be always distinctly drawn betwixt the subjects which excite mirth and those which call forth sympathy. It often happens that the same incident is at once affecting and ludicrous, or admits of being presented alternately in either point of view. In a drama, also, which treats of the faults and lighter vices, as well as of the follies of mankind, it is natural that the author should sometimes assume the high tone of the moralist. In these cases, to use the language of Horace, comedy exalts her voice, and the offended father, the pantaloon of the piece, swells into sublimity of language. A pleasant species of composition was thus attained, in which wit and humour were relieved by touches both of sentiment and moral instruction. The new comedy, taken in this enlarged point of view, formed the introduction to the modern drama; but it was neither so comprehensive in its plan, nor so various in character and interest.

The form which the Greeks, and in imitation of them the Romans, adopted, for embodying their comic effusions, was neither extended nor artificial. To avoid the charge of assaulting, or perhaps the temptation to attack private persons, the actors in their drama were rather painted as personifications of particular classes of society, than living individual characters. The list of these personages was sufficiently meagre. The principal character, upon whose devices and ingenuity the whole plot usually turns, is the *Geta* of the piece, a witty, roguish, insinuating, and malignant slave, the confident of a wild and extravagant son, whom he aids in his pious endeavours to cheat a suspicious, severe, and griping father. When to these three are added a wily courtezan, a procuress, a stolen virgin, who is generally a mute or nearly such, we have all the stock-characters which are proper to the classic comedy. Upon this limited scale of notes the ancients rung their changes, relieving them occasionally, however, by the introduction of a boastful soldier, a boorish clown, or a mild and good-natured old man, to contrast with the irascible Chremes of the piece, the more ordinary representative of old age.

The plot is in general as simple as the cast of the characters. A father loses his child, who falls into the hands of a procuress or slave merchant. The efforts of the youth, who falls in love with this captive, to ransom her from her captivity, are seconded by the slave, who aids him in the various devices necessary to extort from his father the funds necessary for the purchase, and their tricks form the principal part of the intrigue. When it is necessary that the play shall close, the discovery of the girl's birth takes place, and the young couple are married. The plots are indeed sometimes extended or enlarged by additional circumstances, but very seldom by any novelty of character or variety of general form.

It is a necessary consequence, that the ancient comic authors were confined within a very narrow compass. The vast and inexhaustible variety of knavery, folly, affectation, humour, &c. as mingled with each other, or as modified by difference of age, sex, temper, education, profession, and habit of body, are all within the royalty of the modern comic dramatist, and he may summon them up, under what limitations and in what circumstances he pleases, to play their parts in his piece. The ancients were much more limited in their circle of materials, and, perhaps, we must look for the ruling cause once more in the great size of their theatres, and to the use of the mask, which, though it easily presented the general or generic character of the personage introduced, was incapable of the endless variety which can be given to ridicule of a more minute, refined, and personal kind, by the flexible organs of a modern actor.

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[1] The ancient comedy next play'd its part,
Well-famed, at first, for spirit and for art:
But Liberty o'erleaping decent awe,
Satiric rage required restraint from law;
The edict spoke, dishonour'd silence bound
The chorus, and forbade their ancient right to wound.

But besides this powerful reason for refraining from any attempt to draw characters distinguished by peculiar habits, there is much reason to think that the mode of life pursued by the ancient Athenians was unfavourable to the formation of whimsical, original, or eccentric characters. Citizens of the same state, they lived much together, and the differences of ranks did not make the same distinction in taste and manners as in modern Europe. Their occupation, also, was the same. They were all public men, and had a common interest in the management of the state; and it probably followed that, in men whose pursuits were all bent the same way, the same general similarity of manners might be found to exist, which is remarked in those who follow the same profession. The differences of youth and age, of riches and poverty, of good or bad temper, &c. must have been much modified in Attica, where all free citizens were, to a certain degree, on a level—discussed the same topics of state, and gave the same vote to forward them—enjoyed, without restriction, the same public amusements; and where the same general cast of manners might descend to the lowest of the citizens, for the very reason that even a poor herbwoman understood the delicacy of the Attic dialect so perfectly, as to distinguish a stranger by the first words he addressed to her.

The chorus, silenced, as we have seen, owing to the license of the old comedy, made no appendage to that which was substituted in its place. The exhibition of the Grecian comedy did not, in other respects, in so far as we know, materially differ from that of the tragedy. Instead of the choral interludes, the representation was now divided, by intervals of cessation, into acts, as upon the modern stage. And the number five seems to have been fixed upon as the most convenient and best adapted for the purposes of representation. The plot, as we have seen, and the distinct and discriminated specification of character, were, in either case, subordinate considerations to the force of style and composition. It follows, of consequence, that we can better understand and enjoy the tragedies than the comedies of the ancients. The circumstances which excite sublime or terrific sensations are the same, notwithstanding the difference of age, country, and language. But comic humour is of a character much more evanescent. The force of wit depends almost entirely upon time, circumstance, and manners, insomuch that a jest which raises inextinguishable laughter in a particular class of society, appears flat or disgusting if uttered in another. It is, therefore, no wonder that the ancient comedy, turning upon manners so far removed from our own time, should appear to us rather dull and inartificial. The nature of the intercourse between the sexes in classic times was also unfavourable for comedy. The coquette, the fine lady, the romp, all those various shades of the female character which occupy so many pleasant scenes on the modern stage, were totally unknown to ancient manners. The wife of the ancient comedy was a mere household drudge, the vassal, not the companion, of an imperious husband. The young woman whose beauty is the acting motive of the intrigue, never evinces the slightest intellectual property of any kind. And the only female character admitting of some vivacity is that of the courtezan, whose wit as well as her charms appeared to have been professional.

After subtracting the large field afforded by female art or caprice, female wit, or folly, or affection, the realm of the ancient comedy will appear much circumscribed; and we have yet to estimate a large deduction to be made on account of the rust of antiquity, and the total change of religion and manners. It is no wonder, therefore, that the wit of Plautus and Terence should come forth diminished in weight and substance, after having been subjected to the alembic of modern criticism. That which survives the investigation, however, is of a solid and valuable character. If these dramas do not entertain us with a display of the specific varieties of character, they often convey maxims evincing a deep knowledge of human passion and feeling; and are so admirably adapted to express, in few and pithy words, truths which it is important to remember, that even the Apostle Paul himself has not disdained to quote a passage from a Grecian dramatist. The situation, also, of their personages is often truly comic; and the modern writers who have borrowed their ideas, and arranged them according to the taste of their own age, have often been indebted to the ancients for the principal cause of their success.

Roman drama.

Having dwelt thus long upon the Grecian drama, we are entitled to treat with conciseness that of Rome, which, like the other fine arts, that people, rather martial than literary, copied from their more ingenious neighbours.

The Romans were not, indeed, without a sort of rude dramatic representation of their own, of the same nature with that which, as we have already noticed, usually arises in an early period of society. These were called *Fabulæ Atellanæ;* farces, for such they were, which took their name from *Atella*, a town belonging to the *Osci*, in Italy. They were performed by the Roman youth, who used to attack each other with satirical couplets during the intervals of some rude game, in which they seem to have represented the characters of fabulous antiquity. But, 361 years before the Christian era, the Romans, in the time of a great pestilence, as we learn from Livy, introduced a more regular species of theatrical entertainment, in order to propitiate the deities by a solemn exhibition of public games; after which, what had hitherto been matter of mere frolic and amusement, assumed, according to the historian, the appearance of a professional art; and the Roman youth, who had hitherto appeared as amateur performers, gave up the stage to regular performers.

These plays continued, however, to be of a very rude structure, until the Grecian stage was transplanted to Rome. Livius Andronicus, by birth a Grecian, led the way in this improvement, and is accounted her first dramatist.

Seneca the philosopher is the only Roman tragedian whose works have reached our time. But his tragedies afford no very favourable specimen of Roman art. They are in the false taste which succeeded the age of Augustus, and debased the style of composition in that of Nero; bombastic, tedious, and pedantic; treating, indeed, of Grecian subjects, but not with Grecian art.

By a singular contrast, although we have lost the more valuable tragedies of Rome, we have been compelled to judge of the new Greek comedy through the medium of the Latin translations. Of Menander we have but a few fragments, and our examples of his drama are derived exclusively from Plautus and Terence. Of these, the former appears the more original, the latter the more elegant author. The comedies of Plautus are much more connected with manners, much more full of what may be termed drollery and comic situation, and are believed to possess a greater portion of Roman character. The Romans, indeed, had two species of comedy, the *Palliata*, where the scene and dress were Grecian; the *Togata*, where both were Roman. But besides this distinction, even the *Mantled*, or Grecian comedy, might be more or less of a Roman cast; and Plautus is supposed to have infused a much stronger national tone into his plays than can be traced in those of Terence. They are also of a ruder cast, and more extravagant, retaining, perhaps, a larger portion of the rough horse-play peculiar to the *Fabulæ Atellanæ*. Terence, on the contrary, is elegant, refined, and sententious; decorous and regular in the construction of his plots; exhibiting more of wit in his dialogue, than of comic force in his situations; grave often and moral, sometimes even pathetic; and furnishing, upon the whole, the most perfect specimens of the Grecian comedy, both in action and character.

The alterations which the Romans made in the practice of the theatrical art do not seem to have been of great consequence. One circumstance, however, deserves notice. The orchestra, or, as we should say, the pit of the theatre, was no longer left vacant for the occasional occupation of the chorus, but was filled with the senators, knights, and other more respectable citizens. The stage was thus brought more near to the eye of the higher class of the audience. It would also seem that the theatres were smaller; for we read of two so constructed that each turned upon a pivot, so that, when placed back to back, they were separate theatres, yet were capable of being wheeled round, with all the audience, so as to bring their oblong ends together, then forming a single amphitheatre, in which the games of the circus succeeded to dramatic representation. It is not easy to conceive the existence of such machinery; but the story, at any rate, seems to show that their theatres must have been greatly smaller than those of Greece, to admit the supposition of such an evolution as being in any degree practicable. This diminution in the size of the house, and the occupation of the orchestra by the most dignified part of the audience, may have afforded a reason why masks were, at least occasionally, disused on the Roman stage. That they were sometimes disused is certain; for Cicero mentions Roscius Gallus as using a mask to conceal a deformity arising from the inequality of his eyes, which implies plainly that other comedians played with their faces disclosed. It is therefore probable that the imperfections of the mask were felt so soon as the distance was diminished between the performer and the spectators; and we may hazard a conjecture that this disguise was first laid aside in the smaller theatres.

Degradation of the theatrical profession.

But the principal change introduced by the Romans into the drama, and which continues to affect it in every country of Europe, respected the *status* or rank of the actors in society. We have seen that Athens, enthusiastic in her attachment to the fine arts, held no circumstances degrading which were connected with them. Æschylus and Sophocles were soldiers and statesmen, yet lost nothing in the opinion of their countrymen by appearing on the public stage. Euripides, who was also a person of consequence, proved that "love esteems no office mean;" for he danced in a female disguise in his own drama, and that not as the Princess Nauticlea, but as one of her handmaidens, or, in modern phrase, as a *figurante*. The Grecians, therefore, attached no dishonour to the person of the actor, nor esteemed that he who contributed to giving the amusement of the theatre was at all degraded beneath those who received it. It was otherwise in Rome. The contempt which the Romans entertained for players might be founded partly upon their confounding this elegant amusement with the games of the circus and amphitheatre, performed by gladiators and slaves, the meanest, in short, of mankind. Hence, to use the words of St Augustine, "the ancient Romans, accounting the art of stage-playing and the whole scene infamous, ordained that this sort of men should not only want the honour of other citizens, but also be disfranchised and thrust out of their tribe, by a legal and disgraceful censure, which the censors were to execute; because they would not suffer their vulgar sort of people, much less their senators, to be defamed, disgraced, or defiled with stage-players;" which act of theirs he styles "an excellent true Roman prudence, to be enumerated among the Romans' praises."

Accordingly, an edict of the prætor stigmatized as infamous all who appeared on the stage, either to speak or act; but it is remarkable that from this general proscription the Roman youth were excepted; and they continued to enact the *Fabulæ Atellanæ*, namely, the farces or drolleries of ancient Italian origin, without incurring any stigma. This exception seems to indicate that the edict originated in the national pride of the Romans, and their contempt for Grecian literature, and for foreigners of every description. Under any other view it is impossible they should have preferred the actors in these coarse farces, who, by the bye, are supposed to have been the originals of no less persons that Harlequin and Punchinello, to those who possessed taste and talents sufficient to execute the masterly scenes borrowed from the Grecian drama.

Injustice, however, and we call that law unjust which devotes to general infamy any profession of which it nevertheless tolerates the practice, is usually inconsistent. Several individual play-actors in Rome rose to high public esteem, and to the enjoyment of great wealth. Roscius was the friend and companion of Piso and of Sylla, and, what was still more to his credit, of Cicero himself, who thus eulogises the scenic art, while commemorating the merit of his deceased friend: *Quis nostrûm tam animo agresti ac duro fuit, ut Roscii morte nuper non commoveretur? qui quum esset senex mortuus, tamen, propter excellentem artem ac venustatem, videbatur omnino mori non debuisse.*

Paris, another Roman actor, reached a height of celebrity as distinguished as Roscius, and exercised, as many of his profession have since done, an arbitrary authority over the unfortunate dramatic authors. It is recorded by the satirist that Statius the epic poet might have starved had he not given up to this favourite of the public, upon his own terms doubtless, the manuscript of an unacted performance. Paris was put to death by Domitian out of jealousy.

If the actors rose to be persons of importance in Rome, the dramatic critics were no less so. They had formed a code of laws for the regulation of dramatic authors, to which the great names of Aristotle and Horace both contributed their authority. But these will be more properly treated of when we come to mention their adoption by the French stage.

Having thus hastily given some account of the ancient stage, from its rise in Greece to its transportation to Rome, we have only to notice the circumstances under which it expired.

Christianity from its first origin was inimical to the institution of the theatre. The fathers of the church inveigh against the profaneness and immodesty of the theatre. In the treatise of Tertullian, *De Spectaculis*, he has written expressly upon the subject. The various authorities on this head have been collected and quoted by the enemies of the stage, from Prynne down to Collier. It ought, however, to be noticed, that their exprobation of the theatre is founded, first, upon its origin, as connected with heathen superstition; and secondly, on the beastly and abominable license practised in the pantomimes, which, although they made no part of the regular drama, were presented nevertheless in the same place, and before the same audience. "We avoid your shows and games," says Tertullian, "because we doubt the warrant of their origin. They savour of superstition and idolatry, and we dislike the entertainment, as abhorring the heathen religion on which it is founded." In another place he observes, the temples were united to theatres, in order that superstition might patronize debauchery; and that they were dedicated to Bacchus and to Venus, the confederate deities of lust and intemperance.

It was not only the connection of the theatre with heathen superstition that offended the primitive church, but also the profligacy of some of the entertainments which were exhibited. There cannot be much objected to the regular Roman dramas in this particular, since even Mr Collier allows them to be more decorous than the British stage of his own time; but, as we have already hinted, in the *Ludi Scenici*, the intrigues of the gods and the heroes were represented upon the stage with the utmost grossness. These obscene and scandalous performances thus far coincided with the drama, that they were acted in the same theatres, and in honour of the same deities, and both were subjected to the same sweeping condemnation. They were not, however, absolutely or formally abolished, even when Christianity became the religion of the state. Tertullian and St Augustin both speak of the scenic representations of their own day, under the distinct characters of tragedy and comedy; and although condemned by the church, and abhorred by the more strict Christians, there is little doubt that the ancient theatre continued to exist until it was buried under the ruins of the Roman empire.

MODERN DRAMA.

Dr atic rep en- tati s of the id- dle es.

The same proneness to fictitious personification, which we have remarked as a propensity common to all countries, introduced, during the dark ages, a rude species of drama into most of the nations of Europe. Like the first efforts of the ancients in that art, it had its foundation in religion; with this great difference, that as the rites of Bacchus before, and even after the improvements introduced by Thespis, were well enough suited to the worship of such a deity, the religious dramas, mysteries, or whatever other name they assumed, were often so unworthy of the Christian religion, on which they were founded, that their being tolerated can be attributed only to the gross ignorance of the laity, and the cunning of the Catholic priesthood, who used them, with other idle and sometimes indecorous solemnities, as one means of amusing the people's minds, and detaining them in contented bondage to their spiritual superiors.

In the empire of the East, religious exhibitions of a theatrical character appear to have been instituted about the year 990, by Theophylact, patriarch of Constantinople, with the intention, as Warton surmises, of weaning the minds of the people from the Pagan revels, by substituting Christian spectacles, partaking of the same spirit of license. His contemporaries give him little credit for his good intentions. "Theophylact," says Cedrenus, as translated by Warton, "introduced the practice, which prevails to this day, of scandalizing God and the memory of his saints, on the most splendid and popular festivals, by indecent and ridiculous songs, and enormous shoutings, even in the midst of those sacred hymns which we ought to offer to divine grace for the salvation of our souls. But he having collected a company of base fellows, and placing over them one Euthynicus, surnamed Casnes, whom he also appointed the superintendent of his church, admitted into the sacred service diabolical dances, exclamations of ribaldry, and ballads borrowed from the streets and brothels." The irregularities of the Greek clergy, who, on certain holidays, personated feigned characters, and entered even the choir in masquerade, are elsewhere mentioned. (Warton's *History of English Poetry*, vol. ii. p. 370.) These passages do not prove that actual mysteries or sacred dramas were enacted on such occasions; but probably the indecent revels alluded to bore the same relation to such representations, as the original rites of Bacchus to the more refined exhibitions of Thespis and Susarion.

There has been some dispute among theatrical antiquaries, in which country of Europe dramatic representations of a religious kind first appeared. The liberal and ingenious editor of the *Chester Mysteries* has well remarked, in his introduction to that curious and beautiful volume, that a difficulty must always attend the inquiry, from the doubts that exist, whether the earliest recorded performances of each country were merely pantomimes, or were accompanied with dialogue.

The practice of processions and pageants with music, in which characters, chiefly of sacred writ, were presented before the public, is so immediately connected with that of speaking exhibitions, that it is difficult to discriminate the one from the other.

We are tempted to look first to Italy; as it is natural that the tragic art should have revived in that country in which it was last exercised, and where traditions, and perhaps some faint traces, of its existence were still preserved.

"The first speaking sacred drama," says Mr Walker, "was *Della Passione di nostro Signor Giesù Christo*, by Giuliano Dati, bishop of San Leo, who flourished about the year 1445." (Walker's *Essay on the Revival of the Drama in Italy*, p. 6.) This elegant author does, indeed, show that Italian scholars, and particularly Mussato, the Paduan historian, had composed two Latin dramas upon something like the classical model about the year 1300. Yet, although his play upon the tyranny and death of Ezzlino obtained him both reputation and honour, it does not appear to have been composed for the stage, but rather to have been a dramatic poem, since the progress of the piece is often interrupted by the poet speaking in his own person.

The French drama is traced by M. Legrand as high as the thirteenth century; and he has produced one curious example of a pastoral entitled *Un Jeu*. He mentions also a farce, two devotional pieces, and two moralities, to each of which he ascribes the same title. It may be suspected that these are only dialogues recited by the travelling minstrels and troubadours, such as Petrarch acknowledges having sometimes composed for the benefit of the strolling musicians. Such were probably the spectacles exhibited by Philip the Fair in 1313, on account of the honour of knighthood conferred on his children. Riccoboni, anxious for the honour of Italy, denies to these amusements the character of a legitimate drama; with what justice we have no information that can enable us to decide.

Amidst this uncertainty, it is not unpleasant to record the fair claim which Britain possesses to be one of the earliest, if not the very first nation in which dramatic representation seems to have been revived. The *Chester Mysteries*, called the *Whitsun Plays*, appear to have been performed during the mayoralty of John Arneway, who filled that office in Chester from 1268 to 1276. The very curious specimen of these mysteries, which has been of late printed for private distribution by Mr Markland of the Temple, furnishes us with the banes or proclamation, containing the history and character of the pageants which it announces.

Reverende lordes and ladyes all,
That at this tyme here assembled bee,
By this messauge understande you shall,
That sometymes there was mayor of this citie,

Sir John Arnway, Knyghte, who most worthilye
Contented hymselfe to sett out an playe
The devise of one Done Rondali, moonke of Chester Abbey.

This moonke, moonke-like in scriptures well seene,
In storyes travelled with the best sorte;
In pagentes set fourth, apparently to all eyne,
The Olde and Newe Testament with livelye comforte;
Intermynglinge therewith, onely to make sporte,
Some things not warranted by any writt,
Which to gladd the hearers he woulde men to take yt.

This matter he abrevited into playes twenty-foure,
And every playe of the matter gave but a taste,
Leavinge for better learninge scircumstances to accomplishe,
For his proceedinges maye appeare to be in haste:
Yet all together unprofitable his labour he did not waste,
For at this daye, and ever, he deserveth the fame
Which all monkes deserves professinge that name.

* * *

This worthy Knihte Arnway, then mayor of this citie,
This order toke, as declare to you I shall,
That by twentye-fower occupations, artes, craftes, or misteries,
These pagentes shoulde be played after breeffe rehearsall;
For every pagente a cariage to be provyded withall,
In which sorte we purpose this Whitsontyde,
Our pageants into three partes to devyde.

I. Now you worshippfull Tanners that of custome olde
The fall of Lucifer did set out,
Some writers awarraute your matter, therefore be boulde
Lustelye to playe the same to all the rowtte:
And yf any thereof stand in any doubte.
Your author his author hath, your shewe let bee,
Good speech, fyne players, with apparill comelye.

Chester Mysteries.

Such were the celebrated Mysteries of Chester. To Mr Markland's extracts from them is prefixed a curious dissertation upon their age and author. They were so highly popular, as to be ranked, in the estimation of the vulgar, with the ballads of Robin Hood; for a character in one of the old moralities is introduced as boasting,

I can rhimes of Robin Hood, and Randal of Chester,
But of our Lord and our Lady I can nought at all.

The poetical value of these mysteries is never considerable, though they are to be found among the dramatic antiquities of all parts of Europe. It was, however, soon discovered that the purity of the Christian religion was inconsistent with these rude games, in which passages from scripture were profanely and indecently mingled with human inventions of a very rude, and sometimes an indecorous character. To the Mysteries, therefore, succeeded the Moralities, a species of dramatic exercise, which involved more art and ingenuity, and was besides much more proper for a public amusement, than the imitations or rather parodies of sacred history, which had hitherto entertained the public.

Moralities. These Moralities bear some analogy to the old or original comedy of the ancients. They were often founded upon allegorical subjects, and almost always bore a close and poignant allusion to the incidents of the day. Public reformation was their avowed object, and, of course, satire was frequently the implement which they employed. Dr Percy, however, remarks that they were of two characters, serious and ludicrous; the one approaching to the tragedy, the other to the comedy of classical times; so that they brought taste as it were to the threshold of the real drama. The difference between the Catholic and reformed religion was fiercely disputed in some of these dramas; and in Scotland, in particular, a mortal blow was aimed at the superstitions of the Roman church, by the celebrated Sir David Lindsay, in a play or morality acted in 1539, and entitled *The Satire of the Three Estates.* The objects of this drama were entirely political, although it is mixed with some comic scenes, and introduced by an interlude, in coarseness altogether unmatched. The spirit of Aristophanes, in all its good and evil, seems to have actuated the Scottish king-at-arms. It is a singular proof of the liberty allowed to such representations at the period, that James V. and his queen repeatedly witnessed a piece, in which the corruptions of the existing government and religion were treated with such satirical severity. The play, as acted, seems to have differed in some respects from the state in which it exists in manuscript.

In a letter to the Lord Privy Seal of England, dated 26th January 1540, Sir William Eure (envoy from Henry VIII.) gives the following account of the play, as it had then been performed "in the feast of Ephipanie at Lightgowe, before the king, queene, and the whole counsaile, spirituall and temporall. In the firste entres come in Solace (whose parte was but to make mery, sing ballets with his fellowes, and drinke at the interluydes of the play), whoe showed firste to all the audience the play to be played. Next come in a king, who passed to his throne, having nae speche to thende of the play, and then to ratify and approve, as in parliament, all things done by the rest of the players, which represented The Three Estates. With hym came his cortiers, Placebo, Picthank, and Flatterye, and sic alike gard; one swering he was the lustiest, starkeste, best proportionit, and most valycant man that ever was; ane other swere he was the beste with long-bowe, crosse-bowe, and culverin, and so fourth. Thairafter there come a man armed in harness, with a swerde drawn in his hande, a Bushop, a Burgesman, and Experience, clede like a Doctor; who set them all down on the deis under the King. After them come a poor man, who did go up and down the scaffolde, making a hevie complainte that he was hereyet, throw the courtiers taking his fewe in one place, and his tackes in another; wherthrough he had sceyled his house, his wyfe and childrene beggyng thair brede, and so of many thousands in Scotland; saying thair was no remedy to be gotten, as he was neither acquainted with controller nor treasurer. And then he looked to the king, and said he was not king in Scotland, for there was ane other king in Scotland that hanged Johne Armstrang, with his fellowes, Sym the Laird, and mony other mae; but he had lefte ane thing undone. Then he made a long narracione of the oppression of the poor, by the taking of the corsepresaunte beists, and of the herrying of poor men by the consistorye lawe, and of many other abusions of the Spiritualitie and Church. Then the Bushop raise and rebuked him. Then the Man of Armes alledged the contraire, and commanded the poor man to go on. The poor man proceeds with a long list of the bishop's evil practices, the vices of cloisters, &c. This is proved by Experience, who, from a New Testament, shows the office of a bushop. The Man of Armes and the Burges approve of all that was said against the clergy, and alledge the expediency of a reform, with the consent of parliament. The Bushop dissents. The Man of Armes and the Burges said they were two, and he but one, wherefore their voice should have most effect. Thereafter the king, in the play, ratified, approved, and confirmed all that was rehersed."

The other nations of Europe, as well as England, had their mysteries and moralities. In France, Boileau, following Menestrier, imputes the introduction of these spectacles to travelling bands of pilgrims.

Chez nos dévots ayeux, le théâtre abhorré
Fut long-temps dans la France un plaisir ignoré;
Des pélerins dit-on, une troupe grossière
En public à Paris y monta la première;
Et sottement zélée en sa simplicité
Joüa les saints, la Vierge, et Dieu par piété.

L'Art Poetique, chant. iii.

In Spain the *Autos Sacramentales*, which are analogous to the mysteries of the middle ages, are still presented without shocking a nation whose zeal is stronger than their taste; and, it is believed, such rude and wild plays, founded on scripture, are also occasionally acted in Flanders. In the *History of the Council of Constance*, we find that mysteries were introduced into Germany by the English, about 1417, and were first performed to welcome the Emperor Sigismund, on his return from England; and, from the choice of the subjects, we should almost suppose that they had transferred to that country the *Chester Mysteries* themselves. "Les Anglois," says the historian, "se signalè ent entre les autres par un spectacle nouveau, ou au moins inusité jusques alors en Allemagne. Ce fut une comédie sacrée, que les evêques Anglois firent représenter devant l'empéreur, le Dimanche 31 de Janvier, sur la Naissance du Sauveur, sur l'Arrivée des Mages, et sur la Massacre des Innocens." (*Hist. du Concile de Constance*, par L'Enfant, lib. v.) The character of these rude dramatic essays renders them rather subjects for the antiquary than a part of a history of the regular dramatic art.

Latin plays.

We may also pass over, with brief notice, the Latin plays which, upon the revival of letters, many of the learned composed in express imitation of the ancient Grecian and Latin productions. We have mentioned those of Mussato, who was followed by the more celebrated Cararo, in the path which he had opened to fame. In other countries the same example was followed. These learned prolusions, however, were only addressed to persons of letters, then a very circumscribed circle, and, when acted at all, were presented at universities or courts on solemn public occasions. They form no step in the history of the drama, unless that, by familiarizing the learned with the form and rules of the ancient classical drama, they gradually paved the way for the adoption of the same regulations into the revived vernacular drama, and formed a division amongst the theatres of modern Europe, which has never yet been reconciled.

Historical plays.

While the learned laboured to revive the classical drama in all its purity, the public at large, to which the treasures of the learned languages were as a fountain sealed, became addicted to a species of representation which properly neither fell under the denomination of comedy or tragedy, but was named History or Historical Drama. Charles Verardo, who, about 1492, composed a drama of this sort, in Latin, upon the expulsion of the Moors from Granada, claims, for this production, a total emancipation from the rules of dramatic criticism.

> Requirat autem nullus hic comœdiæ,
> Leges ut observantur, aut tragediæ;
> Agenda nempe est *historia* non fabula.

"Let none expect that in this piece the rules of comedy or of tragedy should be observed; we mean to act a history, not a fable." From this expression it would seem that, in a historical drama, the author did not think himself entitled to compress or alter the incidents as when the plot was fabulous, but was bound, to a certain extent, to conform to the actual course of events. In these histories, the poet embraced often the life and death of a monarch, or some other period of history, containing several years of actual time, which, nevertheless, were made to pass before the eyes of the audience during the two or three hours usually allotted for the action of a play. It is not to be supposed that, with so fair a field open before them, and the applause of the audience for their reward, the authors of these histories should long have confined themselves to the matter of fact contained in records. They speedily innovated or added to their dramatic chronicles without regard to the real history. To those who plead for stage plays, that they elucidate and explain many dark and obscure histories, and fix the facts firmly in the minds of the audience, of which they had otherwise but an imperfect apprehension, the stern Prynne replies with great scorn, "that play-poets do not explain, but sophisticate and deform, good histories, with many false varnishes and playhouse fooleries;" and that "the histories are more accurately to be learned in the original authors who record them, than in derivative playhouse pamphlets, which corrupt them." (Prynne's *Histrio-Mastix*, p. 940.)

The dramatic chronicles, therefore, were a field in which the genius of the poet laboured to supply, by character, sentiment, and incident, the meagre detail of the historian. They became so popular in England, that, during the short interval betwixt the revival of the stage and the appearance of Shakspeare, the most part of the English monarchs had lived and died upon the stage; and it is well known that almost all his historical plays were new written by him, upon the plan of old dramatic chronicles which already existed.

But the miscellaneous audience which crowded to the vernacular theatre at its revival in Europe, were of that rank and intellect which is apt to become tired of a serious subject, and to demand that a lamentable tragedy should be intermingled with very pleasant mirth. The poets, obliged to cater for all tastes, seldom failed to insert the humours of some comic character, that the low or grotesque scenes in which he was engaged might serve as a relief to the graver passages of the drama, and gratify the taste of those spectators who, like Christofero Sly, tired until the fool came on the stage again. Hence Sir Philip Sidney's censure on these dramatists, "how all their plays be neither right tragedies nor right comedies, mingling kings with clowns; not because the matter so carrieth it, but to thrust in the clown, by head and shoulders, to play a part in magestical matters, with neither decency nor discretion, so that neither the admiration and commiseration, nor the right sportfulness, is by their mongrel tragi-comedy attained." (*Defence of Poesie*. Sidney's *Arcadia*, edit. 1627, p. 563.) "If we mark them well," he concludes, "funerals and hornpipes seldom match daintily together."

Romantic drama.

The historical plays led naturally into another class, which may be called Romantic Dramas, founded upon popular poems or fictitious narratives, as the former were on real history. Some of these were borrowed from foreign nations, ready dramatized to the hand of the borrower; others were founded on the plots which occurred in the almost innumerable novels and romances which we had made our own by translation. "I may boldly say it," says Gosson, a recreant play-wright, who attacked his former profession, "because I have seen it, that the *Palace of Pleasure*, the *Golden Asse*, the *Ethiopian History*, *Amadis of Fraunce*, the *Round Table*, *Bawdie Comedies in Latin, French, Italian, and Spanish*, have been thoroughly ransacked to furnish the playhouse in London." But it was not to be supposed that the authors would confine themselves to stricter rules in pieces founded upon Italian and Spanish novels, or upon romances of chivalry, than they had acted upon in the histories. Every circumstance which tended to loosen the reins of theatrical discipline in the one case, existed in the other; and, accordingly, comedies of intrigue, and tragedies of action and show, everywhere superseded, at least in popular estimation, the severe and simple model of the classical drama.

It happened that in England and Spain, in particular, the species of composition which was most independent of critical regulation was supported by the most brilliant display of genius. Lopez de Vega and Calderon rushed on the stage with their hasty and high-coloured, but glowing productions, fresh from the mint of imagination, and scorning that the cold art of criticism should weigh them in her balance. The taste of the Spaniards has been proverbially inclined to the wild, the romantic, and the chivalrous; and the audience of their bards would not have parted with one striking scene, however inartificially introduced, to have gained for their favourites the praise of Aristotle and all his commentators. Lopez de Vega himself was not ignorant of critical rules; but he pleads the taste of his countrymen as an apology for neglecting those restrictions which he had observed in his earlier studies.

> Yet true it is I too have written plays,
> The wiser few, who judge with skill, might praise;
> But when I see how show and nonsense draws
> The crowds, and, more than all, the fair's applause;
> Who still are forward with indulgent rage
> To sanction every monster of the stage;
> I, doom'd to write the public taste to hit,
> Resume the barbarous dress 'twas vain to quit;
> I lock up every rule before I write,
> Plautus and Terence banish from my sight,
> Lest rage should teach these injured wits to join,
> And their dumb books cry shame on works like mine.
> To vulgar standards, then, I frame my play,
> Writing at ease, for, since the public pay,
> 'Tis just, methinks, we by their compass steer,
> And write the nonsense that they love to hear.
> Lord Holland's *Life of Lope de Vega*, p. 103.

The Spanish comedies of intrigue also went astray, as far as their romantic tragedies, from the classical path. In fact, these new representations were infinitely more captivating from their vivacity, novelty, and, above all, from their reflecting the actual spirit of the time, and holding the mirror up to nature, than the cold imitations which the learned wrote in emulation of the classic drama. The one class are existing and living pictures of the times in which the authors lived; the others, the cold resurrection of the lifeless corpses which had long slumbered in the tomb of antiquity. The spirit of chivalry, which so long lingered in Spain, breathes through the wild and often extravagant genius of her poets. The hero is brave and loyal, and true to his mistress:

> A knight of love who never broke a vow.

Lovers of this description, in whose minds the sexual passion is sublimated into high and romantic feeling, make a noble contrast with the coarse and licentious Greek or Roman, whose passion turns only on the difficulty of purchasing his mistress's person, but who never conceives the slightest apprehension concerning the state of her affections.

That the crowd might have their loud laugh, a *grazioso* or clown, usually a servant of the hero, is in the Spanish drama uniformly introduced to make sport. Like Kemp or Tarletun, famous in the clown's part before the time of Shakspeare, this personage was permitted to fill up his part with extemporary jesting, not only on the performers, but with the audience. This irregularity, with others, seems to have been borrowed by the English stage from that of Spain, and is the license which Hamlet condemns in his instructions to the players: "And let those that be your clowns speak no more than is set down for them; for there be of them that will themselves laugh, to set on some quantity of barren spectators to laugh too, though, in the mean time, some necessary question of the play be then to be considered; that's villainous, and shows a most pitiful ambition in the fool that uses it."

The bald simplicity of the ancient plots was, in like manner, contrasted to disadvantage with the intricacies, involutions, suspense, and bustle of Spanish intrigue upon the stage. Hence the boast of one of their poets, thus translated by Lord Holland:

> Invention, interest, sprightly turns in plays,
> Say what they will, are Spain's peculiar praise;
> Her's are the plots which strict attention seize,
> Full of intrigue, and yet disclosed with ease.
> Hence acts and scenes her fertile stage affords,
> Unknown, unrivall'd, on the foreign boards.
> *Life of Lope de Vega*, p. 106.

While we admire the richness of fancy displayed in the Spanish pieces, it is impossible, in an age of refinement, to avoid being shocked by their wilful and extravagant neglect of every thing which can add probability to the action of their drama. But the apology for this license is well pleaded by Lord Holland.

"Without dwelling on the expulsion of the chorus (a most unnatural and inconvenient machine), the moderns, by admitting a complication of plot, have introduced a greater variety of incidents and character. The province of invention is enlarged; new passions, or at least new forms of the same passions, are brought within the scope of dramatic poetry. Fresh sources of interest are opened, and additional powers of imagination called into activity. Can we then deny what extends its jurisdiction, and enhances its interest, to be an improvement in an art whose professed object is to stir the passions by the imitation of human actions? In saying this I do not mean to justify the breach of decorum, the neglect of probability, the anachronisms, and other extravagancies of the founders of the modern theatre. Because the first disciples of the school were not models of perfection, it does not follow that the fundamental maxims were defective. The rudeness of their workmanship is no proof of the inferiority of the material; nor does the want of skill deprive them of the merit of having discovered the mine. The faults objected to them form no necessary part of the system they introduced. Their followers in every country have either completely corrected or gradually reformed such abuses. Those who bow not implicitly to the authority of Aristotle, yet avoid such violent outrages as are common in our early plays. And those who pique themselves on the strict observance of his laws, betray, in the conduct, the sentiments, the characters, and the dialogue of their pieces (especially of their comedies), more resemblance to the modern than the ancient theatre; their code may be Grecian, but their manners, in spite of themselves, are Spanish, English, or French. They may renounce their pedigree, and even change their dress, but they cannot divest their features of a certain family-likeness to their poetical progenitors."

In France the irregularities of the revived drama were of a lower complexion; for, until her stage was refined by Corneille, and brought under its present strict *regime*, it was adorned by but little talent; a circumstance which, amongst others, may account for the ease with which she subjected herself to critical rules, and assumed the yoke of Aristotle. Until she assumed the Grecian forms and restrictions, there is but little interesting in the history of her stage.

England adopted the historical and romantic drama with ardour, and in a state scarce more limited by rules than that of Spain herself. Her writers seem early to have ransacked Spanish literature; for the union of the countries during the short reign of Mary, nay even their wars under Elizabeth and Philip, made them acquainted with each other. The Spaniards had the start in the revival of the drama. *Ferrex and Perrex*, our earliest tragedy, was first presented in 1561; and *Gammer Gurton's*

Needle, our first comedy, in 1575; whereas Lopez de Vega, who was not by any means the earliest Spanish dramatist, died in 1562, leaving the stage stocked with his innumerable productions, to which his contemporaries had not failed to add their share. Thus, as soon as the stage of Britain was so far advanced as to be in a capacity of borrowing, that of Spain offered a fund to which her authors could have recourse; and, in fact, the Spanish drama continued to be a mine in which the British poets collected materials, often without acknowledgment, during all the earlier part of her dramatic history. From this source, as well as from the partialities of the audience, arose that early attempt at show and spectacle, at combats and marvellous incidents, which, though with very poor means of representation, our early dramatic poets loved to produce at the Bull or the Fortune playhouses. The extravagance of their plots, and the poor efforts by which our early dramatists endeavoured to represent show and procession, did not escape the censure of Sir Philip Sidney, who, leaning to the critical reformation which was already taking place in Italy, would gladly have seen our stage reduced to a more classical model.

"It is faultie," says that gallant knight, "both in place and time, the two necessarie companions of all corporall actions. For the stage should alway present but one place; and the uttermost time presupposed in it should bee, both by *Aristotle's* precept and common reason, but one day; there are both many dayes and many places inartificially imagined. But if it be so in *Gorboduke*, how much more in all the rest? where you shall have *Asia* of the one side, and *Affricke* of the other, and so many other under kingdomes, that the plair, when he comes in, must ever begin with telling where hee is, or else the tale will not be conceived. Now shall you have three ladies walke to gather flowers, and then wee must beleeve the stage to be a garden. By and by wee heare newes of shipwracke in the same place, then wee are to blame if we accept it not for a rocke. Upon the backe of that comes out a hideous monster with fire and smoke, and then the miserable beholders are bound to take it for a cave; while, in the mean time, two armies flie in, represented with some swordes and bucklers, and then what hard heart will not receive it for a pitched field? Now of time they are much more liberall; for ordinarie it is, that two young princes fall in love. After many traverses shee is got with childe, delivered of a faire boy; he is lost, groweth a man, falleth in love, and is readie to get another childe, and all this in two houres space; which how absurd it is in sense, even sense may imagine, and art hath taught, and all ancient examples justified, and at this day the ordinary players in *Italy* will not err in."

It n tr dy.

Italy, referred to by Sir Philip Sidney as the cradle of the reformed drama, had had her own age of liberty and confusion; her mysteries, her moralities, her historical and her romantic dramas. But the taste for the ancient and classical stage was still rooted in the country where it had flourished, and Trissino is acknowledged as the father of the regular drama. The *Sophonisba* of this learned prelate is praised by Voltaire as the first regular tragedy which Europe had seen after so many ages of barbarism. Pope has added his tribute.

When learning, after the long Gothic night,
Fair o'er the western world renewed its light,
With arts arising, Sophonisba rose,
The tragic muse returning wept her woes;
With her the Italian scene first learned to glow,
And the first tears for her were taught to flow.

This tragedy was represented at Rome in the year 1515. The Greek model is severely observed, and the author has encumbered his scene with a chorus. It has some poetic beauties, and is well calculated to recommend the new or rather revived system on which it was written. *La Rosmonda* of Rucelleri was written about the same time with *Sophonisba*; and, after these pieces, tragi-comedies, histories, and romantic dramas, were discarded, and succeeded by tragedies upon a regular classical model; written in verse, having five acts, and generally a chorus.

Notwithstanding their rigorous attention to the ancient model, the modern tragic poets of Italy have not been very successful in arresting the attention of their countrymen. They are praised rather than followed; and the stern, unbending composition of Alfieri, while it has given a tone of rude and stoical dignity to his dramas, has failed in rendering them attractive. They frequently please in the closet; but the audience of modern days requires to be kept awake by something more active, more bustling, more deeply interesting, than the lessons of the schools; and a poet of high fancy has written in some measure in vain, because he has mistaken the spirit of his age. The tragic actors, also, whatever excellence they may attain to in their art, do not attract the same consideration, attention, and respect, as in France or England; and they who are the direct authors of a pleasure so nearly connected with our noblest and best feelings, occupy a rank subordinate to the performers at the opera.

Opera.

It is only as a modification of the drama that we here propose to touch upon that entertainment of Italian growth, but known by importation in every civilized kingdom of Europe. These kingdoms have often rivalled each other in the rewards held forth to musical performers, and encouraged their merit by a degree of profusion, which has had the effect of rendering the professors petulant, capricious, and unmanageable. Their high emoluments are not granted, or their caprices submitted to, without a degree of pleasure in some degree corresponding to the expense and the sufferance; and it is in vain for the admirers of the legitimate drama to pretend that such is not obtained. Voltaire has with more justice confessed, that probably the best imitation of the ancient stage was to be found in the Italian tragic opera. The recitative resembled the musical declamation of the Athenians, and the choruses, which are frequently introduced, when properly combined with the subject, approach to those of the Greeks, as forming a contrast, by the airs which they execute, to the recitative, or modulated dialogue of the scene. Voltaire instances the tragic operas of Metastasio in particular, as approaching in beauty of diction, and truth of sentiment, near to the ancient simplicity; and finds an apology even for the detached airs, so fatal to probability, in the beauty of the poetry and the perfection of the music. And although, as a critic and man of cultivated taste, this author prefers the regular, noble, and severe beauties of the classic stage, to the effeminate and meretricious charms of the opera, still he concludes that, with all its defects, the sort of enchantment which results from the brilliant intermixture of scenery, chorus, dancing, music, dress, and decoration, subjects even the genius of criticism; and that the most sublime tragedy, and most artful comedy, will not be so frequently revisited by the same individual as an indifferent opera. We may add the experience of London to the testimony of this great critic; and, indeed, were it possible that actors could frequently be procured, possessed of the powers of action and of voice which were united in Grassini, it would be impossible to deny to the opera the praise of being an amusement as exquisite in point of taste as fascinating from show and music. But as the musical parts of the entertainment are predominant, every thing else has been too often sacrificed to the caprice of a composer, wholly ignorant in every art save his own; and the mean and paltry dialogue, which is used as a vehicle for the music, is become proverbial to express nonsense and inanity.

Italian comedy.

The Italian comedy, as well as their tragedy, boasts its regular descent from classical times. Like the comedy of Menander, it introduces *dramatis personæ* whose characters are never varied, and some of whom are supposed to be directly descended from the ancient *Mimi* of the Atellan Fables. Such an origin is claimed for the celebrated Harlequin, and for the no less renowned Punchinello, our English Punch, both of whom retain the character of jesters, cowards, wags, and buffoons, proper to the *Sannio* of the Romans. It is believed of these worthies that they existed before the time of Plautus, and continued to play their frolics during the middle ages, when the legitimate drama was unknown. For the former fact, sculpture, as well as tradition, is appealed to by Italian antiquaries, who have discovered the representation of these grotesque characters upon the Etruscan vases. In support of the latter averment, the grave authority of Saint Thomas Aquinas is appealed to, who, we rejoice to find, thought Harlequin and Punch no unlawful company in fitting time and place. "*Ludus*," says that eminent person, with more consideration for human infirmity than some saints of our own day, "*est necessarius ad conversationem vitæ humanæ: ad omnia autem quæ sunt utilia conversationi humanæ, deputari possunt aliqua officia licita: et ideo etiam officium histrionum quod ordinatur ad solatium hominibus exhibendum, non est secundum se illicitum, nec sunt histriones in statu peccati, dummodo moderate ludo utantur; id est, non utendo aliquibus illicitis verbis vel factis, ad ludum, et non adhibendo ludum negotiis et temporibus indebitis, unde illi qui moderate eis subveniunt, non peccant, sed juste faciunt mercedem ministerii eorum eis tribuendo. Et licet D. August.* super Joan. *dicit quod donare res suas histrionibus, vitium est immane, hoc intelligi debet de illis qui dant histrionibus qui in ludo utuntur illicitis, vel de illis qui superflue sua in tales consumunt, non de illis histrionibus qui moderate ludo utuntur.*"

Saint Anthony gives his sanction to Saint Thomas on this point: "*Histrionatus ars quia deservit humanæ recreationi quæ necessaria est vitæ hominis secundum D. Thomam, de se non est illicita et de illa arte vivere non est prohibitum.*" (S. Antonius in 3 part. *Suæ Summæ*, tit. iii. cap. 4.) Saint Anthony, indeed, adds the reasonable restriction, that no clergyman should play Harlequin, and that Punch should not exhibit in the church.

Under this venerable authority these *Mimi* went on and flourished. Other characters enlarged their little drama. The personages appeared in masks. "Each of these," says Mr Walker, "was originally intended as a kind of characteristic representation of some particular Italian district or town. Thus *Pantalone* was a Venetian merchant; *Dottore*, a Bolognese physician; *Spaviento*, a Neapolitan braggadocio; *Pullicinella*, a wag of Apulia; *Giangurgolo* and *Coviello*, two clowns of Calabria; *Gelsomino*, a Roman beau; *Beltrame*, a Milanese simpleton; *Brighella*, a Ferarese pimp; and *Arlecchino*, a blundering servant of Bergamo. Each of these personages was clad in a peculiar dress, each had his peculiar mask, and each spoke the dialect of the place he represented. Besides these, and a few other such personages, of which at least four were introduced in each play, there were the *Amorosos* or *Innamoratos;* that is, some men and women who acted serious parts, with Smeraldina, Colombina, Spilletta, and other females, who played the parts of servettas or waiting-maids. All these spoke Tuscan or Roman, and wore no masks." (*Essay on the Revival of the Drama in Italy*, p. 249.)

The pieces acted by this class of actors were called *Commedia dell' arte*, and were congenial to the taste of the Italians, with whom gesticulation and buffoonery are natural attributes. Their drama was of the most simple kind. Each of the actors was already possessed of his dramatic character, which was as inalienable as his dress, and was master of the dialect he was to use, and had his imagination and memory stored with all the characteristic jests, or *lazzi* as they were termed, peculiar to the personage he represented. All that the author had to do was to invent the skeleton of a plot which should bring his characters into dramatic situation with respect to each other. The dialogue suited to the occasion was invented by the players, just as ours invest their parts with the proper gestures and actions. This skeleton had the name of *scenario;* and was filled up by the performers, either impromptu or in consequence of previous arrangement and premeditation. This species of comedy was extremely popular, especially among the lower class of spectators. It was often adopted as an amusement in good society, and by men of genius; and Flamineo de la Scala has left about fifty such *scenarios* adapted for representation. The fashion even found its way into England, and probably the part of Master Punch, who first appeared in the character of the *Vice* of the English morality, was trusted to the improvisatory talents of the actor. Mr d'Israeli, a curious as well as elegant investigator of ancient literature, has shown that at least one scheme of a *Commedia dell' arte* has been preserved to us. It is published in the *Variorum* edition of Shakspeare, but remains unexplained by the commentators. Such comedies, it is evident, could require no higher merit in the composer than the imagining and sketching a few comic situations; the dialogue and diction was all entrusted to the players.

The Italians, however, became early possessed of a regular comedy, which engrossed the admiration of the more cultivated classes of society. Bibbiena's comedy, entitled *La Calandra*, is composed in imitation of Terence and Plautus. It was first acted in 1490. *La Calandra* is remarkable, not only for being the first Italian comedy, but also for the perfection of scenic decoration with which it was accompanied in the representation. It was followed by the productions of Ariosto and Trissino, and other authors in the same line. But it appears, from the efforts used to support this style of drama, that it did not take kindly root in the soil, and lacked that popularity which alone can nurse it freely. Various societies were formed under the whimsical titles of *Gli Intronati*, *Gli Insensati*, and so forth, for the express purpose of bringing forward the regular drama; exertions which would certainly have been unnecessary had it received that support and encouragement which arises from general popularity.

Goldoni, in a later age, at once indulged his own fanciful genius and his natural indolence, by renouncing the classical rules, and endeavouring to throw into the old and native Italian *Mascherata* the variety and attributes of the proper comedy. He adopted Harlequin and the rest of his merry troop in the characters which they held, and endeavoured to enlist them in the more regular service of the drama, just as free corps and partizans are sometimes new-modelled into battalions of the line. This ingenious and lively writer retained all the license of the *Commedia dell' arte*, and all the immunities which it claimed from regular and classical rules; but instead of trusting to the extempore jests and grotesque wit of the persons whom he introduced, he engaged them in dialogues, as well as plots, of his own invention, which often display much humour and even pathos. It required, however, the richness of a fancy like Goldoni's to extract novelty and interest from a dramatic system in which so many of the actors held a fixed and prescriptive character, hardly admitting of being varied. Accordingly, we do not find that the Italian stage is at present in a more flourishing condition than that of other modern nations.

French drama.

The revival of the regular drama in France was attended with important consequences, owing to the nature of her government, the general use of her language throughout Europe, and the influence which, from her situation, she must necessarily hold over other nations. It is the boast of Paris that the regular classical drama, banished from every other stage, found a safe and honourable refuge on her own. Yet France has reluctantly confessed that she also had her hour of barbarism. Her earlier drama was borrowed, like that of other countries, from Spain, who, during the whole of the sixteenth and great part of the seventeenth century, held such a formidable predominance in the European republic. While the classical stage was reviving in Italy, and the historical and romantic drama was flourishing in Spain, France was torn to pieces by civil discord. The first French tragedy composed upon a regular plan was that of *Mairet*, imitated from the *Sophonisba* of Trissino; and Riccoboni boasts with justice, that whoever shall compare the Italian tragedy of the sixteenth century with that of the French of the same period, will find the latter extravagant and irregular, and the former already possessed of gravity, dignity, and regularity. The French, like the English, date the excellence of their stage from one great author; and the illustrious name of Pierre Corneille affords to their dramatic history the mighty landmark which Shakspeare gives to our own.

Cardinal Richelieu, who had succeeded in establishing upon a broad basis the absolute power of the French monarch, was not insensible to the graces and ornaments which the throne derived from being surrounded by the muses. He was himself fond of poetry, and even a competitor for the honours of the buskin. He placed himself at the head of five dramatic writers, to whom on that account the public gave the title of *Les Cinq Auteurs*. All these are deservedly forgotten excepting Corneille, of whose successful talent the cardinal had the meanness to evince no ordinary degree of jealousy. The malevolence of that minister was carried so far that he employed the French Academy, whose complaisance must be recorded to their shame, to criticise severely the *Cid*, the first, and perhaps the finest, of Corneille's tragedies. Scudery, a favourite of the cardinal, buoyed by Richelieu's favour, was able for some time to balance Corneille in the opinion of the public; but his name is now scarcely known by any other circumstance than his imprudent and audacious rivalry. This great man was not only surrounded by the worst possible models, but unfortunately the authors of these models were also favourites of the public and of the all-powerful cardinal; yet Corneille vanquished the taste of his age, the competition of his rivals, and the envy of Richelieu.

Corneille, like his predecessors, and like Routrou in particular, borrowed liberally from the Spanish theatre; but his own taste, regulated probably upon his situation, dictated an adherence to the classical model. The French stage arose, it must be remembered, under the protection of an absolute monarch, for whose amusement the poet laboured, and in whose presence the drama was performed. It followed, as a natural consequence, that a more strict etiquette was exacted upon the scene than had hitherto been supposed applicable to a merely popular amusement. A departure from regularity in tragedy was no longer a bold flight. A violation of decorum in comedy was no longer a broad jest. When the audience was dignified by the presence of the monarch, the former became an impertinence, and the latter a gross and indecent insult. The muse of comedy was therefore bound over for her good behaviour; and even her grave sister was laid under such rules and restrictions as should insure the decorum and dignity of her scene.

French writers enforce the unities.

It was at this period that those classical fetters which are framed on the three unities were fashioned into form, and imposed on the French drama. These are acknowledged by Corneille, in his *Essay upon Dramatic Poetry*, in the following short but emphatic sentence: "*Il faut observer les unités d'action, de lieu, et de jour; personne n'en doute.*" The rule, as thus emphatically admitted by the fiery Corneille, was equally binding upon the elegant Racine, and has fettered the French stage until the present day. "La Motte," says Voltaire, "a man of wit and talent, but attached to paradoxes, has written in our time against the doctrine of the unities; but that literary heresy had no success."

Upon these rules, adopted by the very first writer of eminence for the French stage, and subscribed to by all succeeding dramatists, depends the principal and long-disputed difference betwixt the drama of France and those countries in which her laws of taste have been received, and the stages of Spain, England, and modern Germany, where those critical maxims have been controverted. In other words, the unities proper to the classical drama have been found inapplicable to plays of a historical or romantic plan. It is therefore necessary to examine with accuracy the essence and effect of those laws so often disputed with more obstinacy than liberality.

Examination of this doctrine.

The arbitrary forms to which the French thus subjected their theatre are, in their general purport, founded on good and sound rules of the critical art. But, considered judaically and literally, the interpretation put upon those unities by the French critics must necessarily lay the dramatic author under restraints equally severe and unnecessary, without affording any corresponding addition to the value of his work. The pedantry by which they are enforced reminds one of the extreme, minute, rigorous, and punctilious discipline to which some regiments have been subjected by a pedantic commanding officer, which seldom fails to lower the spirit and destroy the temper of the soldier, without being of the slightest service to him in the moment of danger or the day of battle.

The first dramatic unity is that of action, and, rightly understood, it is by far the most important. A whole, says Aristotle, is that which has a beginning, middle, and end. In short, one strong concentrated interest, upon which all subordinate incidents depend, and to which they contribute, must pervade the piece. It must open with the commencement of the play, evolve itself, and be progressive with its progress—must be perpetually in sight, and never stationary, until at length it arrives at a catastrophe, by which it is ended and extinguished. In this rule, abstractedly considered, there is nothing but what is consistent with good sense and sound criticism. The period allowed for dramatic representation is not long, and will not admit of the episodical ornaments which may be happily introduced into epic poetry. And as the restlessness or impatience of a theatrical audience is always one of its marked characteristics, it has been observed, that neither the most animated description, nor the most beautiful poetry, can ever reconcile the spectators to those inartificial scenes in which the plot or action of the piece stands still that the performers may say fine things. The introduction of an interest, separate and distinct from the main action of the play, has a still worse effect; it diminishes the effect of the whole, and divides the attention of the audience; as a pack of hounds, when in full pursuit, are impeded and puzzled by starting a fresh object of chase.

Yet even this rule must be liberally considered if we would allow dramatic authors that fair room and exercise for their genius, which gives rise to the noblest displays of genius in the art. Modern dramatists are no longer, it must be remembered, limited to the simple and surer uniformity of the ancient drama, which fixed on one single event as its object, made it the subject of the moral reflections of the chorus, managed it by the intervention of three or at most five persons, and consequently presented a picture so limited in size and subject that there was no difficulty in avoiding the intermixture of a foreign interest. The modern taste has opened the stage to a wider range of topics, which are at the same time more complicated in detail, depending on the agency of a variety of performers, and on the result of a succession of events. Such dramas have indeed an unity of action peculiar to themselves, which should predominate over and absorb every other. But although, like the oak, it should predominate over all the neighbouring underwood, its dignity is not injured by the presence and vicinity of that which it overshadows. On the contrary, a succession of events tending to the same end, if they do not divert the attention from the principal interest, cannot fail, by their variety and succession, to keep it fixed upon the business of the scene.

To take an example. In the tragedy of Macbeth a chain of varied and important events are introduced, any one link of which might be hammered out into a drama on the severe and simple model of the drama of ancient Greece. There is the murder of Duncan, that of Banquo, and the dethronement and death of the tyrant; all which are events complete of themselves, independent of each other, and yet included within one tragedy of five acts. But, nevertheless, this is never felt as a deficiency in the performance. It is to the character of Macbeth, to his ambition, guilt, remorse, and final punishment, that the mind attaches itself during the whole play; and thus the succession of various incidents, unconnected excepting by the relation they bear to the principal personage, far from distracting the attention of the audience, continues to sharpen and irritate curiosity till the curtain drops over the fallen tyrant. This is not, indeed, an unity of action according to the rule of Aristotle, or the observance of the French theatre. But, in a lighter point of view, it has all the advantage which could possibly be derived from the severest adherence to the precept of Aristotle, with this additional merit, that the interest never stagnates in declamation, or is suspended by unnecessary dialogue.

It would in fact be easy to show that the unity of action, in its strict sense, may frequently be an unnatural as well as a cumbrous restraint on the genius of the poet. In the course of nature, an insulated action seldom exists of a nature proper to transfer to the stage. If, indeed, the play is founded on some single mythological fable, or if the scene is laid in some early stage of society, when man as yet remained separated from his kind, and connected only with his petty tribe or family, the subject of a plot may be chosen where the agency of a very few persons, and these naturally connected together, may, without foreign or extraneous assistance, afford matter for a tragedy. But in the actual course of the peopled world, men are so crowded together, and their movements depend so much upon impulses foreign to themselves, that the action must often appear multiplied and complicated, and all that the author can do is to preserve the interest uniform and undivided. Its progress may be likened to that of a brook through beautiful scenery. A judicious improver of the landscape would be certainly desirous to make its course visible, but not to cut off its beautiful undulations, or to compel it into a straight channel. He would follow the course of nature, and neither affect to conceal the smaller rills by which the stream was fed, nor bring them so much in view as to deprive the principal object of its consequence. We admit the difficulty inseparable from the dramatic art, and must grant that the author runs some risk of losing sight of the main interest of the piece, by dwelling upon the subordinate accessories; but we contend that the attention of the audience is still more likely to be fatigued by a bald and simple plot, to which, during the course of five acts, there must belong much speaking and little progress. And, in point of common sense and common feeling, that piece must always present unity of action which has unity of interest and feeling; which fixes the mind of the audience upon one train of thought and passion, to which every occurrence in the drama verges; and which is consummated and wound up by the final catastrophe.

The second dramatic unity is that of time, about which the critics of various nations have disagreed. If taken in its strict and proper sense, it means that the time supposed to be consumed in the action represented, should not exceed that which is occupied by the actual representation. But even Aristotle extends the duration of the action to one revolution of the sun, and Corneille extends it to thirty hours, which is to the actual period of representation as ten to one. Boileau, a supereminent authority, thus lays down the rule for the unities of time and place:

> Que le lieu de la scène y soit fixé & marqué.
> Un Rimeur, sans péril, delà les Pirenées,
> Sur la scène en un jour renferme des années.
> Là souvent le Héros d'un spectacle grossier,
> Enfant au premier acte, est Barbon au dernier,
> Mais nous, que la Raison à se règles engage,
> Nous voulons qu'avec art l'action se ménage :
> Qu'en un lieu, qu'en un jour, un seul fait accompli
> Tienne jusqu'à la fin le Théâtre rempli.

It has been triumphantly remarked, that in thus yielding up the strict letter of the precept, in allowing the three hours employed in acting a play to be multiplied into twenty-four or thirty, the critics have retained nearly all the inconvenience of this famous rule, while they sacrificed its principle, and any advantage attached to its observance. The only benefit supposed to be attached to this unity is that of probability. We shall not at present inquire whether this is worth preserving at the cost of imposing heavy restrictions on dramatic genius. But granting the affirmative, probability is as much violated by squeezing the events of twenty-four hours into a period of only three, as if the author had exercised the still greater license of the English and Spanish theatres. There is no charm in the revolution of the sun, which circumscribes within that particular period the events of a drama. When the magic circle drawn around the author by the actual date of representation is once obliterated, the argument grounded upon probability falls; and he may extend his narrative unconfined by any rule, except what may be considered as resolving itself into the unity of action. A week, a month, a year, years may be included in the course of the drama, provided always the poet has power so to rivet the attention of the audience on the passing scene, that the lapse of time shall pass unregarded. There must be none of those marked pauses which force upon the spectators' attention the breach of this unity. Still less ought the judicious dramatist to permit his piece to embrace such a space of time as shall necessarily produce the change on the persons of the characters ridiculed by Boileau. The extravagant conduct of the plot in the *Winter's Tale* has gone far to depreciate that drama, which, in passages of detached beauty, is inferior to none of Shakspeare's, in the opinion of the best judges. It might perhaps be improved in acting, by performing the three first acts as a play, and the fourth and fifth as an afterpiece. Yet, even as it is now acted, who is it that, notwithstanding the cold objection arising out of the breach of unity, witnesses without delight the exquisite contrast betwixt the court and the hamlet, the fascinating and simple elegance of Perdita, or the witty rogueries of Autolycus? The poet is too powerful for the critic, and we lose the exercise of our judgment in the warmth of our admiration.

The faults of Shakspeare or of his age we do not, however, recommend to the modern dramatist, whose modesty will certainly place him in his own estimation far beneath that powerful magician whose art could fascinate us even by means of deformity itself. But if for his own sake the author ought to avoid such gross violations of dramatic rule, the public, for theirs, ought not to tie him down to such severe limitations as must cramp, at least, if they do not destroy, his power of affording them pleasure. If the whole five acts are to be compressed within the space of twenty-four hours, the events must, in the general case, be either so much crowded upon each other as to destroy the very probability which it is the purpose of this law to preserve; or many of them being supposed to have happened before the commencement of the piece, must be detailed in narrative, which never fails to have a bad effect on the stage.

The same objections apply to the rigid enforcement of the third unity, that of place; and indeed the French authors have used respecting it the license of relaxing, in practice, the severity of their theory. They have frequently infringed the rule which they affirm to be inviolable; and their flexible creed permits the place to be changed, provided the audience are not transported out of the city where the scene is laid. This mitigation of doctrine, like that granted in the unity of time, is a virtual resignation of the principle contended for. Let us examine, however, upon what that principle is founded.

The rule which prohibits the shifting the scene during the period of performance, was borrowed by the French from the ancients, without considering the peculiar circumstances in which it arose. First, we have seen already, that during the ancient drama, there was no division into acts, and that the action was only suspended during the songs of the chorus, who themselves represented a certain class of personages connected with the scene. The stage, therefore, was always filled; and a supposed change of place would have implied the violent improbability that the whole chorus were transported, while in the sight of the spectators, and employed in the discharge of their parts, to the new scene of action. Secondly, there is evidence that in the *Eumenides* of Æschylus, and the *Ajax* of Sophocles, the scene is actually changed, in defiance of the presence of the chorus; and a much greater violation of probability is incurred than could have taken place in a modern theatre, where, before every change of scene, the stage is emptied of the performers. Thirdly, the ancients were less hardly pressed by this rule than the modern writers. From the extent of their theatres and the size of their stages, the place of action was considerably larger, and might be held to include a wider extent, than ours. The climate of Greece admitted of many things being transacted with propriety in the open air; and, finally, they had a contrivance for displaying the interior of a house or temple to the audience, which, if not an actual change of scene, was adapted to the same purpose.

If this long litigated question, therefore, is to be disposed of by precedent, we have shown that the rule of the ancients was neither absolute, nor did the circumstances of their stage correspond with those of ours; to which it may be added, that the simple and inartificial structure of their plots seldom required a change of scene. But surely it is of less consequence to examine the practice of the ancients, than to consider how far it is founded upon truth, good taste, and general effect. Granting, therefore, that the supposed illusion, which transports the spectator to the actual scene of action, really exists, let us inquire whether, in sacrificing the privilege of an occasional change of scene, we do not run the risk of shocking the spectator, and disturbing his delightful dreams, by other absurdities and improbabilities, attendant necessarily on a scrupulous adherence to this restriction.

If the action is always to pass in the scene, some place of general resort must be adopted, a hall, anti-room, or the like. It can seldom be so fortunately selected but that much must be necessarily discussed there, which, in order to preserve any appearance of probability, should be transacted elsewhere; that many persons must be introduced whose presence must appear unnatural; and that much must be done there which the very circumstances of the piece render totally absurd. Dennis has applied these observations with great force, and at the same time with great bitterness, in his critique upon *Cato*, which Johnson has quoted at length in his *Life of Addison*. The scene, it must be remembered, is laid, during the whole drama, with scrupulous attention to the classical rule, in the great hall of Cato's palace at Utica. Here the conspirators lay their plots, the lovers carry on their intrigues; and yet Sempronius, with great inconsistency, disguises himself as Juba to obtain entrance into this vestibule, which was common to all. Here Cato retires to moralize, and chides his son for interrupting him; and although he retires to stab himself, it is to this place that he is brought back to die. All this affords a striking proof how genius and taste can be fettered and embarrassed by a too pedantic observance of rules. Let no one suppose that the inconveniences arising from the rigid observance of the unity of place, occur in the tragedy of *Cato* alone; they might in that case be attributed to the inexperience or want of skill in the author. The tragedies of Corneille and Racine afford examples enough that the authors found themselves compelled to violate the rules of probability and common sense, in order to adhere to those of Aristotle. In the tragedy of *Cinna*, for example, the scene is laid in the emperor's cabinet; and in that very cabinet, compelled, doubtless, by the laws of unity, Amelia shouts forth aloud her resolution to assassinate the emperor. It is there too that Maximus and Cinna confide to each other all the secrets of their conspiracy; and it is there where, to render the impropriety more glaring, Cinna suddenly reflects upon the rashness of his own conduct:

> Amis, dans ce palais on peut nous écouter;
> Et nous parlons peut-être avec trop d'imprudence,
> Dans un lieu si mal propre à notre confidence.

It would be an invidious, but no difficult task, to show that several of the *chefs d'œuvres* of the French drama are liable to similar objections; and that the awkward dilemmas in which the unity of place involves them, is far more likely to destroy the illusion of the performance, than the mere change of scene would have done. But we refer the reader to the *Dramaturgie* of Lessing upon this curious topic.

The main question yet remains behind, namely, whether such an illusion is actually produced in the minds of the audience by the best-acted play, as induces them to suppose themselves witnessing a reality;—an illusion, in short, so complete, as to suffer from the occasional extension of time or change of place in the course of the piece? We do not hesitate to say that no such impression was ever produced on a sane understanding; and that the Parisian critic, in whose presence the unities are never violated, no more mistakes Talma for Nero, than a London citizen identifies Kemble with Coriolanus, or Kean with Richard III.[1] The ancients, from the distance of the stage, and their mode of dressing and disguising their characters, might certainly approach a step nearer to reality; and producing on their stage the very images of the deities they worshipped, speaking the language which they accounted proper to them, it is highly probable that, to minds capable of high excitation, there might be a shade of this illusion in their representations. The solemn distance of the stage, the continuous and uninterrupted action, kept the attention of the Greeks at once more closely riveted, and more abstracted from surrounding circumstances. But in the modern theatre, the rapid succession of intervals for reflection, the well-known features of the actors, the language which they speak differing frequently from that which belongs to the age and country where the scene is laid, interrupt at every turn every approximation to the fantastic vision of reality into which those writers who insist upon the strict observance of the unities suppose the audience to be lulled. To use the nervous words of Johnson, "It is false that any representation is mistaken for reality; that any dramatic fable in its materiality was ever credible, or for a single moment was ever credited." There is a conventional treaty between the author and the audience, that upon certain suppositions being granted by the latter, his powers of imagination shall be exerted for the amusement of the spectators. The postulates which are demanded, even upon the French theatre, and under the strictest model, are of no ordinary magnitude. Although the stage is lighted with lamps, the spectator must say with the subjugated Catherine,

> I grant it is the sun that shines so bright.

The painted canvass must pass for a landscape; the well-known faces of the performers for those of ancient Greeks, or Romans, or Saracens; and the present time for many ages distant. He that submits to such a convention ought not scrupulously to limit his own enjoyment; that which is supposed Rome in one act, may in the next be fancied Paris; and as for time, it is, to use the words of Dr Johnson, "of all modes of existence, most obsequious to imagination; a lapse of years is as easily conceived as a passage of hours. In contemplation we easily contract the time of real actions, and therefore willingly permit it to be contracted when we only see their imitation."

If dramatic representation does not produce the impression of reality, in what, it may be asked, consists its power? We reply, that its effects are produced by the powerful emotions which it excites in the minds of the spectators. The professors of every fine art operate their impressions in the same manner, though they address themselves to different organs. The painter exhibits his scene to the eye, the orator pours his thunder upon the ear, the poet awakens the imagination of his reader by written description; but each has the same motive, the hope, namely, of exciting in the reader, hearer, or spectator, a tone of feeling similar to that which existed in his own bosom, ere it was bodied forth by his pencil, tongue, or pen. It is the artist's object, in short, to tune the reader's imagination to the same pitch with his own; and to communicate, as well as colours and words can do, the same sublime sensations which had dictated his own compositions. The tragedian attempts to attain this object still more forcibly, because his art combines those of the poet, orator, and artist, by storming as it were the imagination at once through the eye and the ear. Undoubtedly a drama with such advantages, and with those of dresses and costume, approaches more nearly to actual reality, and therefore has a better chance of attaining its object, especially when addressing the sluggish and inert fancies of the multitude; although it may remain a doubtful question whether, with all these means and appliances, minds of a high poetic temperature may not receive a more lively impression from the solitary perusal than from the representation of one of Shakspeare's plays. But, to the most ignorant spectator, however unaccustomed to the trick of the scene, the excitement which his fancy receives falls materially short of actual mental delusion. Even the sapient Partridge himself never thought of being startled at the apparition of the king of Denmark, which he knew to be only a man in a strange dress; it was the terror so admirably expressed by Garrick, which communicated itself to his feelings, and made him reverse the case of the fiends, and tremble without believing. In truth, the effects produced upon this imaginary character, as described by an excellent judge of human nature, exhibit, probably, the highest point of illusion to which theatrical exhibition can conduct a rational being. In an agony of terror which made his knees knock against each other, he never forgets that he is only witnessing a play. The presence of Mrs Millar and his master assures him against the reality of the apparition; yet he is no more able to subdue his terrors by this comfortable reflection, than we have been to check our tears, although well aware that the Belvidera with whose sorrows we sympathized was no other than our own inimitable Mrs Siddons. With all our passions and all our sympathies, we are still conscious of the ideal character of that which excites them; and it is probably this very consciousness of the unreality of scene that refines our sorrows into a melancholy yet delicious emotion, and extracts from it that bitterness necessarily connected with a display of similar misery in actual life.

If, therefore, no illusion subsists of a character to be affected by a change of scene, or by the prolongation of the time beyond the rules of Aristotle, the very foundation of these unities is undermined; but, at the same time, every judicious author will use liberty with prudence.

If we are inclined to ascend to the origin of these celebrated rules, we ought not to be satisfied with the *ipse dixit* of a Grecian critic, who wrote so many centuries ago, and whose works have reference to a state of dramatic composition which has now no existence. Upon the revival of letters, indeed, the authority of Aristotle was considered as omnipotent; but even Boileau remonstrated against his authority, when weighed with that of reason and common sense.

> Un pedant envieux de sa vaine science,
> Tout herissé de Grec, tout bouffi d'arrogance,
> Et qui de mille auteurs retenus mot pour mot,
> Dans la teste entasséz, n'a souvent fait qu'un sot,
> Croit qu'un livre fait tout, et que sans Aristote
> La raison ne voit goutte, et le bon sens radote.

The opinions of Aristotle must be judged of according to the opportunities and authorities which lay open before him; and from the high critical judgment he has displayed, we can scarce err in supposing he would have drawn different results in different circumstances. Dr Drake, whose industry and taste have concentrated so much curious information respecting Shakspeare and his age, has quoted upon this topic a striking passage from Mr Morgan's *Essay on the Character of Falstaff.*

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[1] See note to page 147.

Speaking, says Dr Drake, of the magic influence which our poet almost invariably exerts over his auditors, Mr Morgan remarks, that "on such an occasion, a fellow like *Rymer,*[1] waking from his trance, shall lift up his constable's staff, and charge this great magician, this daring *practiser of arts inhibited,* in the name of Aristotle to surrender; whilst Aristotle himself, disowning his wretched officer, would fall prostrate at his feet and acknowledge his supremacy.—O supreme of dramatic excellence! might he say, not to me be imputed the insolence of fools. The bards of *Greece* were confined within the narrow circle of the chorus, and hence they found themselves constrained to practise, for the most part, the precision, and copy the details, of nature. I followed them, and knew not that a larger circle might be drawn, and the drama extended to the whole reach of human genius. Convinced, I see that a more compendious *nature* may be obtained; a nature of *effects* only, to which neither the relation of places, or continuity of time, are always essential. Nature, condescending to the faculties and apprehensions of man, has drawn through human life a regular chain of visible causes and effects. But poetry delights in surprise, conceals her steps, seizes at once upon the heart, and obtains the sublime of things without betraying the rounds of her ascent. True poetry is *magic,* not *nature;* an effect from causes hidden or unknown. To the magician I prescribed no laws; his law and his power are one; his power is his law. If his end is obtained, who shall question his course? Means, whether apparent or hidden, are justified in poesy by success; but then most perfect and most admirable when most concealed.

"Yes, continues Mr Morgan, whatever may be the neglect of some, or the censure of others, there are those who firmly believe that this wild, this uncultivated *barbarian,* as he has been called, has not yet obtained one half of his fame; and who trust that some new Stagyrite will arise, who, instead of pecking at the surface of things, will enter into the inward soul of his compositions, and expel, by the force of congenial feelings, those foreign impurities which have stained and disgraced his page. And as to those *spots* which still remain, they may perhaps become invisible to those who shall seek them through the medium of his beauties, instead of looking for those beauties, as is too frequently done, through the smoke of some real or imputed obscurity. When the hand of time shall have brushed off his present editors and commentators, and when the very name of Voltaire, and even the memory of the language in which he has written, shall be no more, the Appalachian Mountains, the banks of the Ohio, and the plains of Sciola, shall resound with the accents of this *barbarian.* In his native tongue he shall roll the genuine passions of nature; nor shall the griefs of *Lear* be alleviated, or the charms and wit of *Rosalind* be abated, by *time.*"[2]

In adopting the views of those authors who have pleaded for the liberty of the poet, it is not our intention to deny that great advantages may be obtained by the observance of the unities; not considering them as in themselves essential to the play, but only as points upon which the credibility and intelligibility of the action in some sort depends. We acknowledge, for example, that the author would be deficient in dramatic art, who should divide the interest of his piece into two or more separate plots, instead of combining it in one progressive action. We confess, moreover, that the author, who more violently extends the time, or more frequently changes the place of representation, than can be justified by the necessity of the story, and vindicated by his exertion of dramatic force, acts unwisely, in so far as he is likely to embarrass a great part of the audience, who, from imperfect hearing or slowness of comprehension, may find it difficult to apprehend the plot of his play. The latitude which we are disposed to grant is regulated by the circumstances of the case, the interest of the plot, and, above all, the talents of the author. He that despises the praise of regularity which is attainable by study, cannot reckon on the indulgence of the audience, unless on the condition of indemnifying them by force of genius. If a definitive rule were to be adopted, we should say that it would certainly be judicious to place any change of place or extension of time at the beginning of a new act; as the falling of the curtain and cessation of the action has prepared the audience to set off, as it were, upon a new score. But we consider the whole of these points of propriety as secondary to the real purposes of the drama, and not as limitary of that gifted genius who can, in the whirlwind of his scene, bear the imagination of his audience along with him over the boundaries of place;

> While panting time toils after them in vain.

French notions of tragi-comedy.

It is not upon the observance of the unities alone that the French found their pretensions to a classical theatre. They boast also to have discarded that intermixture of tragic and comic scenes, which was anciently universal upon the Spanish and English stages.

If it had been only understood by this reformation, that the French condemned and renounced that species of tragi-comedy which comprehended two distinct plots, the one of a serious, the other of a humorous character, and these two totally unconnected, we give them full credit for their restriction. Dryden, in the *Spanish Friar,* and other pieces; and Southern, both in *Oronoko* and *Isabella,* as well as many other authors of their age, have in this particular transgressed unpardonably the unity of action. For, in the cases we have quoted, the combination of the two plots is so slight, that the serious and comic scenes separated, might each furnish forth a separate drama; so that the audience appear to be listening, not to one play only, but to two dramatic actions independent of each other, although contained in the same piece. So far, therefore, we heartily agree in the rule which excludes such an unhappy interchange of inconsistent scenes, moving upon opposite principles and interests.

When, however, the French critics carry this rule farther, and proscribe the appearance of comic or inferior characters, however intimately connected with the tragic plot, we would observe, in the first place, that they run the risk of diminishing the reality of the scene; and secondly, that they exclude a class of circumstances essential to its beauty.

On the first point it must be observed, that the rule which imposes upon valets and subordinate personages the necessity of talking as harmonious verse and as elegant poetry as their masters, entirely ruins the probability of the action. Where all is elegant, nothing can be sublime; where all is ornamented, nothing can be impressive; where all is tuned to the same smooth *falsetto* of sentiment, nothing can be natural or real. By such an assimilation of manners and language, we stamp fiction on the very front of our dramatic representation. The touches of nature which Shakspeare has exhibited in his lower and gayer characters, like the chastened back-ground of a landscape, increase the effect of the principal group. The light and fanciful humour of Mercutio serves, for example, to enhance and illustrate the romantic and passionate character of Romeo. Even the doating fondness and silly peevishness of the nurse tends to relieve the soft and affectionate character of Juliet, and to place her before the audience in a point of view which those who have seen Miss O'Neil perform Juliet know how to appreciate. A contrast is effected which a French author dared not attempt, but of which every bosom at once acknowledges the power and the truth. Let us suppose that the gay and gallant Mercutio had as little character as the walking confident of a French hero, who echoes the hexameters of his friend in hexameters of a lower level; or let us suppose the nurse of Juliet to be a gentle Nora, as sublime in white linen as her principal in white satin; and let the reader judge whether the piece would gain in dignity any thing proportioned to what it must lose in truth and interest. The audience at once sympathizes with the friendship of Romeo and Mercutio, rendered more natural and more interesting by the very contrast of their characters; and each spectator feels as a passion, not as a matter of reflection, that desire of vengeance which impels Romeo against Tibalt; for we acknowledge as an amiable and interesting individual the friend whom he has lost by the sword of Capulet. Even the anilities of the nurse give a reality to the piece, which, whatever French critics may pretend, is much more seriously disturbed by inconsistency of manners, than by breach of their dramatic unities. "God forbid," says Mr Puff, in the *Critic*, "that, in a free country, all the fine words in the language should be engrossed by the higher characters of the piece." The French critics did not carry their ideas of equality quite so far, but they tuned the notes of their subalterns just one pitch lower than those of their principal characters, so that their language, similar in style, but lower in sentiment and diction, presents still that subordinate resemblance and correspondence to that of their superiors, which the worsted lace upon the livery of a servant bears to the embroidery upon the coat of his master.

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[1] Rymer was a calumniator of Shakspeare.

[2] *Shakspeare and his Times,* by Nathan Drake, M.D. p. 553, 554, vol. ii.

It is not to mere expression that these remarks are confined; for if we consult the course of human life, we shall find that mirth and sorrow, and events which cause both, are more nearly allied than perhaps it is altogether pleasing to allow. Considered relatively to a spectator, an incident may often excite a mingled emotion, partaking at once of that which is moving and that which is ludicrous; and there is no reader who has not, at some period of his life, met with events at which he hesitated whether to laugh or to cry. It remains to be proved why scenes of this dubious yet interesting description should be excluded from the legitimate drama, while their force is acknowledged in that of human life. We acknowledge the difficulty of bringing them upon the scene with their full and corresponding effect. It was perhaps under this persuasion that the fool, whose wild jests were too much the result of habit and practice to be subdued even by the terrors of the storm, has been banished from the terrific scene of King Lear. But, in yielding to this difficulty, the terrible contrast has been thus destroyed, in which Shakspeare exhibited the half perceptions of the natural fool, as contrasted with the assumed insanity of Edgar, and the real madness of the old king. They who prefer to this living variety of emotion the cold uniformity of a French scene of passion, must be numbered among those who read for the pleasure of criticism, and without hope of partaking the enthusiasm of the poet.

While we differ from French criticism respecting the right to demand an accurate compliance with the unities, and decline to censure that casual intermixture of comic character which gives at once reality and variety to the drama, we are no less disposed to condemn the impertinent love scenes which these authors have, as a matter of etiquette, introduced into all their tragedies, however alien from the passion on which they are grounded. The French drama assumed its present form under the auspices of Louis XIV. who aimed at combining all the characters of a hero of romance. The same spirit which inspired the dull monotony of the endless *folios* of Scudery and Calprenede, seemed to dictate to Corneille, and even to Racine, those scenes of frigid metaphysical passion which encumber their best plays. We do not dispute the deep interest which attaches to the passion of love, so congenial to the human breast, when it forms the groundwork of the play; but it is intolerably nauseous to find a dull love tale mingled as a indispensable ingredient in every dramatic plot, however inconsistent with the rest of the piece. The *Amoureux* and *Amoureuse* of the piece come regularly forth to recite their common-places of gallantry, in language as cold as it is exaggerated, and as inconsistent with passion and feeling as with propriety and common sense. Even the horrid tale of Œdipus has the misplaced garnishment of a love intrigue between Theseus, brought there for no other purpose, and a certain Dirce, whom, in the midst of the pestilence, he thus gallantly compliments:

> Quelque ravage affreux qu'étale ici la peste,
> L'absence aux vrais amans est encore plus funeste.

The predominance of a passion which expresses itself so absurdly is all that the French have condescended to adopt from the age of chivalry, so rich in more dramatic stores; and they have borrowed it in all its pedantry, and without its tenderness and fire. Riccoboni has probably alleged the true reason for the introduction of these heavy scenes of love intrigue, which is, that at little expense of labour to the author, they fill up three quarters of the action of his play. We quote from the French version, as that immediately before us, and most generally intelligible: "*Par exemple, ôtons de Nicomede les dix scènes de Laodice, de l'Œdipe les dix scènes de Dirce, de Polieucte les scènes d'amour de Severe, de la Phedre de Monsieur Racine les six scènes d'Aricie, et nous verrons que non seulement l'action ne sera point interrompuë, mais qu'elle en sera plus vive; en sorte que l'on verra manifestement, que ces scènes de tendresses n'ont servi qu'à ralentir l'action de la pièce, à la refroidir, et à rendre le héros moins grand. Si après ces deux meilleurs tragédies de la France, on examine tous les autres, on connoîtra bien mieux cette vérité. Lorsque l'amour fait le sujet de la tragédie, ce sentiment, si intéressant par lui-même, occupe le scène avec raison; j'aime l'amour de Phedre, mais de Phedre seule.*" Under this thraldom the fetters of the French stage long laboured, notwithstanding the noble example of *Athalie*, the chef d'œuvre of Racine. By the example of Voltaire, in one or two of his best pieces, they have of late ventured occasionally to discard their uninteresting Cupid, whose appearance on the stage as a matter of course and of ceremony, produced as little effect as when his altar and godhead are depicted on the semicircle of a fan.

We have already observed, that the refined, artificial, and affected character of the French tragedy, arose from its immediate connection with the pleasures and with the presence of an absolute sovereign. From the same circumstance, however, the French stage derived several advantages. A degree of discipline, unknown in other theatres, was early introduced among the French actors; and those of a subordinate rank, who, on the English stage, sometimes exhibit intolerable, contemptuous, and wilful negligence, become compelled, on that of France, to pay the same attention to their parts as their superiors, and to exert what limited talents they possess in the subordinate parts to which they are adapted. The effect of this common diligence upon the scene, is a general harmony and correspondence in its parts, which never fails to strike a stranger with admiration.

The royal protection, also, early produced on the Parisian stage an improved and splendid style of scenery, decoration, and accompaniments. The scenes and machinery which they borrowed from Italy, they improved with their usual alert ingenuity. They were still further improved under the auspices of Voltaire, who had the sole merit of introducing natural and correct costume. Before his time the actors, whether Romans or Scythians, appeared in the full dress of the French court; and Augustus himself was represented in a huge full-bottomed wig, surmounted by a crown of laurel. The strict national costume introduced by Voltaire is now observed. That author has also the merit of excluding the idle crowd of courtiers and men of fashion who thronged the stage during the time of representation, and formed a sort of semicircle round the actors, leaving them thus but a few yards of an area free for performance, and disconcerting at once the performers and the audience, by the whimsical intermixture of players and spectators. The nerves of those pedants who contended most strenuously for the illusion of the scene, and who objected against its being interrupted by an occasional breach of the dramatic unities, do not appear to have suffered from the presence of this singular chorus.

rneille. It was not decoration and splendour alone which the French stage owed to Louis XIV. Its principal obligation was for that patronage which called forth in its service the talents of Corneille and Racine, the Homer and the Virgil of the French drama. However constrained by pedantic rules; however held back from using that infinite variety of materials which national and individual character presented to them; however frequently compelled by system to adopt a pompous, solemn, and declamatory style of dialogue; these distinguished authors still remain the proudest boast of the classical age of France, and a high honour to the European republic of letters. It seems probable that Corneille, if left to the exercise of his own judgment, would have approximated more to the romantic drama. The *Cid* possesses many of the charms of that species of composition. In the character of Don Gourmaz, he has drawn a national portrait of the Spanish nobility, for which very excellence he was subjected to the censure of the academy, his national court of criticism. In a general point of view, he seems to have been ambitious of overawing his audience by a display of the proud, the severe, the ambitious, and the terrible. Tyrants and conquerors have never sat to a painter of greater skill; and the romantic tone of feeling which he adopts in his more perfect characters is allied to that of chivalry. But Corneille was deficient in tenderness, in dramatic art, and in the power of moving the passions. His fame, too, was injured by the multiplicity of his efforts to extend it. Critics of his own nation have numbered about twenty of his dramas which have little to recommend them; and no foreign reader is very likely to verify or refute the censure, since he must previously read them to an end.

cine. Racine, who began to write when the classical fetters were clenched and riveted upon the French drama, did not make that effort of struggling with his chains which we observe in the elder dramatist; he was strong where Corneille evinced weakness, and weak in the points where his predecessor showed vigour. Racine delineated the passion of love with truth, softness, and fidelity; and his scenes of this sort form the strongest possible contrast with those in which he, as well as Corneille, sacrificed to the dull Cupid of metaphysical romance. In refinement and harmony of versification, Racine has hitherto been unequalled; and his *Athalie* is, perhaps, likely to be generally acknowledged as the most finished production of the French drama.

Voltaire. Subsequent dramatists, down to the time of Voltaire, were contented with imitating the works of these two great models, until the active and ingenious spirit of that celebrated author seems tacitly to have meditated further experimental alterations than he thought it prudent to defend or to avow. His extreme vivacity and acute intellect were mingled, as is not unfrequent in such temperaments, with a certain nervous timidity, which prevented him from attempting open and bold innovation, even where he felt compliance with existing rules most inconvenient and dispiriting. He borrowed, therefore, liberally from Shakspeare, whose irregularities were the frequent object of his ridicule; and he did not hesitate tacitly to infringe the dramatic unities in his plays, while in his criticism he holds them up as altogether inviolable. While he altered the costume of the stage, and brought it nearer to that of national truth, he made one or two irresolute steps towards the introduction of national character. If we were, indeed, to believe the admirers of Corneille, little remained to be done in this department; he had already, it is said, taught his Romans to speak as Romans, and his Greeks as Greeks; but of such national discrimination foreigners are unable to perceive a trace. His heroes, one and all, talk like men of no peculiar character or distinct age and nation, but, like the other heroes of the French dramatic school, are " all honourable men," who speak in high, grave, buskined rhimes, where an artificial brilliancy of language, richness of metaphor, and grandeur of sentiment, are substituted for that concise and energetic tone of dialogue, which shows at once the national and individual character of the personage who uses it. In *Mahomet*, *Alzire*, and one or two other pieces, Voltaire has attempted some discrimination of national character; the groundwork, however, is still French; and, under every disguise, whether of the turban of the Ottoman, the feathery crown of the savage, or the silk tunic of the Chinese, the character of that singular people can be easily recognized. Voltaire probably saw the deficiency of the national drama with his usual acuteness; but, like the ancient philosophers, he contentedly joined in the idolatry which he despised.

It seems, indeed, extremely doubtful whether the French tragedy can ever be brought many steps nearer to nature. That nation is so unfortunate as to have no poetical language; so that some degree of unnatural exaltation of sentiment is almost necessary to sustain the tone of tragedy at a pitch higher than that of ordinary life. The people are passionately fond of ridicule; their authors are equally afraid of incurring it: they are aware, like their late ruler, that there is but one step betwixt the sublime and the ridiculous; and they are afraid to aim at the former, lest their attempt, falling short, should expose them to derision. They cannot reckon on the mercy or enthusiasm of their audience; and while they banish combats and deaths, and even violent action of any kind, from the stage, this seems chiefly on account of the manifest risk that a people, more alive to the ludicrous than the lofty, might laugh when they should applaud. The drunken and dizzy fury with which Richard, as personated by Kean, continues to make the motion of striking after he has lost his weapon, would be caviare to the Parisian parterre. Men must compound with their poets and actors, and pardon something like extravagance, on the score of enthusiasm. But if they are nationally dead to that enthusiasm, they resemble a deaf man listening to eloquence, who is more likely to be moved to laughter by the gestures of the orator, than to catch fire at his passionate declamation.

Above all, the French people are wedded to their own opinions. Each Parisian is, or supposes himself, master of the rules of the critical art; and whatever limitations it imposes on the author, the spectators receive some indemnification from the pleasure of sitting in judgment upon him. To require from a dancer to exhibit his agility without touching any of the lines of a diagram chalked on the floor, would deprive the performance of much ease, strength, and grace; but still the spectator would feel a certain interest in watching the dexterity with which the artist avoided treading on the interdicted limits, and a certain pride in detecting occasional infringements. In the same manner, the French critic obtains a triumph from watching the transgressions of the dramatic poet against the laws of Aristotle; equal, perhaps, to the more legitimate pleasure he might have derived from the unfettered exercise of his talents. Upon the whole, the French tragedy, though its regulations seem to us founded in pedantry, and its sentiments to belong to a state of false and artificial refinement, contains, nevertheless, passages of such perfect poetry and exquisite moral beauty, that to hear them declaimed with the art of Talma, cannot but afford a very high pitch of intellectual gratification.

French comedy.

The French comedy assumed a regular shape about the same period with the tragedy; and Molière was in his department what Corneille and Racine were in theirs; an original author, approached in excellence by none of those that succeeded him. The form which he assumed for a model was that of the comedy of Menander, and he has copied pretty closely some pieces from the Latin stage. Molière was endowed by nature with a rich fund of comic humour, which is nowhere more apparent than in those light pieces which are written upon the plan of the Italian masked comedy. In these he has introduced the jealous old pantaloon, the knavish and mischievous servant, and some of its other characters. In his regular comedy he soared to a higher pitch. Before his time the art had sought its resources in the multiplicity and bustle of intrigue, escape, and disguise,—of, at best, in a comic dialogue, approaching to mere buffoonery. Molière's satire aimed at a nobler prey; he studied mankind for the purpose of attacking those follies of social life which are best exposed by ridicule. The aim of few satirists has been so legitimate, or pursued with such success. Female vanity, learned pedantry, unreasonable jealousy, the doating and disgraceful passions of old men, avarice, coquetry, slander, the quacks who disgrace medicine, and the knaves who prostitute the profession of the law, were the marks at which his shafts were directed.

Molière's more regular comedies are limited by the law of unities, and finished with great diligence. It is true, the author found it sometimes necessary tacitly to elude the unity of place, which he durst not openly violate; but, in general, he sacrifices probability to system. In the *Ecole des Femmes*, Arnolph brings his wife into the street, out of the room in which his jealousy has imprisoned her, in order to lecture her upon the circumspection due to her character; which absurdity he is guilty of, that the scene may not be shifted from the open space before his door to her apartment. In general, however, it may be noticed, that the critical unities impose much less hardship upon the comic than upon the tragic poet. It is much more easy to reconcile the incidents of private life to the unities of time and place, than to compress within their limits the extensive and prolonged transactions which comprehend the revolution of kingdoms and fate of monarchs. What influence, however, these rules do possess, must operate to cramp and embarrass the comic as well as the tragic writer; to violate and disunite those very probabilities which they affect to maintain; and to occasion a thousand real absurdities rather than grant a conventional license, which seems essential to the freedom of the drama.

The later comic authors of France seem to have abandoned the track pointed out by Molière, as if in despair of approaching his excellence. Their comedy, compared with that of other nations, and of their great predecessor, is cramped, and tame, and limited. In this department, as in tragedy, the stage experienced the inconvenience arising from the influence of the court. The varied and unbounded field of comic humour which the passions and peculiarities of the lower orders present, was prohibited, as containing subjects of exhibition too low and vulgar for a monarch and his courtiers; and thus the natural, fresh, and varied character of comedy was flung aside, while the heartless vices and polished follies of the great world were substituted in its place. Schlegel has well observed, that the object of French comedy "is no longer life, but society; that perpetual negotiation between conflicting vanities which never ends in a sincere treaty of peace; the embroidered dress, the hat under the arm, and the sword by the side, essentially belong to them; and the whole of the characterization is limited to the folly of the men and the coquetry of the women."

It is scarcely in nature that a laughter-loving people should have remained satisfied with an amusement so dull and insipid as their regular comedy. A few years preceding the revolution, and while the causes of that event were in full fermentation, the *Marriage of Figaro* appeared on the stage. It is a comedy of intrigue; and the dialogue is blended with traits of general and political satire, as well as with a tone of licentiousness, which was till then a stranger to the French stage. It was received with a degree of enthusiastic and frantic popularity which nothing but its novelty could have occasioned, for there is little real merit in the composition. Frederick of Prussia, and other admirers of the old theatrical school, were greatly scandalized at so daring an innovation on the regular French comedy. The circumstances which followed have prevented Beaumarchais' example from being imitated; and the laughers have consoled themselves with inferior departments of the drama. Accordingly, we find the blank supplied by farces, comic operas, and dramatic varieties, in which plots of a light, flimsy, and grotesque character are borne out by the comic humour of the author and comic skill of the actor. Brunet, a comedian of extraordinary powers in this cast of interludes, has at times presumed so far upon his popularity as to season his farce with political allusions. It will scarce be believed that he aimed several shafts at Napoleon when in the height of his power. The boldness as well as the wit of the actor secured him the applause of the audience; and such a hold had Brunet of their affections, that an imprisonment of a few hours was the greatest punishment which Bonaparte ventured to inflict upon him. But whatever be the attachment shown to the art in general, the French, like ourselves, rest the character of their theatre chiefly upon the ancient specimens of art; and the regular tragedy, as well as comedy, seems declining in that kingdom.

Engli dram

As the drama of France was formed under the patronage of the monarch, and bears the strongest proofs of its courtly origin, that of England, which was encouraged by the people at large, retains equally unequivocal marks of its popular descent. Its history must naturally draw to some length, as being that part of our article likely to be most interesting to the reader. In part, however, we have paved the way for it by the details common to the rise of dramatic art in the other nations of Europe. We shall distinguish the English drama as divided into four periods, premising that this is merely a general, and not a precise division. The taste which governed each period, and the examples on which it is grounded, will usually be found to have dawned in the period preceding that in which it was received and established.

I. From the revival of the theatre until the great civil war.

II. From the Restoration to the reign of Queen Anne.

III. From the earlier part of the last century down to the present reign.

IV. The present state of the British drama.

F st pe-ri of the E glish d ma.

I. The drama of England commenced, as we have already observed, upon the Spanish model. *Ferrex and Perrex* was the first composition approaching to a regular tragedy, and it was acted before Queen Elizabeth, upon the 18th day of January 1561, by the gentlemen of the Inner Temple. It partakes rather of the character of a historical than of a classical drama, although more nearly allied to the latter class than the chronicle plays which afterwards took possession of the stage. We have already recorded Sir Philip Sidney's commendation of this play, which he calls by the name of *Gorboduc*, from one of the principal characters. Acted by a learned body, and written in great part by Lord Sackville, the principal author of the *Mirror for Magistrates*, the first of English tragedies assumed in some degree the honours of the learned buskin; but although a chorus was presented according to the classical model, the play was free from the observance of the unities, and contains many irregularities severely condemned by the regular critics.

English comedy, considered as a regular composition, is said to have commenced with *Gammer Gurton's Needle*. This "right pithy, pleasant, and merry comedy," was the supposed composition of John Still, Master of Arts, and afterwards Bishop of Bath and Wells. It was acted in Christ-Church College, Cambridge, in 1575. It is a piece of low humour, the whole jest turning upon the loss and recovery of the needle with which Gammer Gurton was to repair the breeches of her man Hodge; but, in point of manners, it is a great curiosity, as the *curta suppellex* of our ancestors is scarcely anywhere so well described. The popular characters also, the Sturdy Beggar, the Clown, the Country Vicar, and the Shrew of the sixteenth century, are drawn in colours taken from the life. The unity of time, place, and action, are observed through the play with an accuracy of which France might be jealous. The time is a few hours; the place, the open square of the village before Gammer Gurton's door; the action, the loss of the needle; and this, followed by the search for and final recovery of that necessary implement, is intermixed with no other thwarting or subordinate interest, but is progressive from the commencement to the conclusion.

It is remarkable that the earliest English tragedy and comedy are both works of considerable merit; that each partakes of the distinctive character of its class; that the tragedy is without intermixture of comedy, the comedy without any intermixture of tragedy.

These models were followed by a variety of others, in which no such distinctions were observed. Numerous theatres sprung up in different parts of the metropolis, opened upon speculation by distinct troops of performers. Their number shows how much they interested public curiosity; for men never struggle for a share in a losing profession. They acted under licenses, which appear to have been granted for the purpose of police alone, not of exclusive privilege or monopoly; since London contained, in the latter part of the sixteenth century, no fewer than fourteen distinct companies of players, with very considerable privileges and remunerations. (See Drake's *Shakspeare and his Times*, vol. ii. p. 205.)

The public, therefore, in the widest sense of the word, was at once arbiter and patron of the drama. The companies of players who traversed the country might indeed assume the name of some peer or baron, for the sake of introduction or protection; but those of the metropolis do not, at this early period of our dramatic history, appear to have rested in any considerable degree upon learned or aristocratic privilege. Their license was obtained from the crown, but their success depended upon the voice of the people; and the pieces which they brought forward were, of course, adapted to popular taste. It followed necessarily that histories and romantic dramas were the favourites of the age. A general audience in an unlearned age requires rather amusement than conformity to rules, and is more displeased with a tiresome uniformity than shocked with the breach of all the unities. The players and dramatists, before the rise of Shakspeare, followed, of consequence, the taste of the public, and dealt in the surprising, elevating, and often bombastic incidents of tragedy, as well as in the low humour and grotesque incident of the comic scene. Where these singly were found to lack attraction, they mingled them together, and dashed their tragic plot with an under-intrigue of the lowest buffoonery, without any respect to taste or congruity.

The clown was no stranger to the stage; he interfered, without ceremony, in the most heart-rending scenes, to the scandal of the more learned spectators.

> Now lest such frightful shows of fortune's fall,
> And bloody tyrant's rage, should chance appall
> The death-struck audience, 'midst the silent rout
> Comes leaping in a self-misformed lout,
> And laughs and grins, and frames his mimic face,
> And jostles straight into the prince's place;
> Then doth the theatre echo all aloud
> With gladsome noise of that applauding crowd,
> A goodly hotchpotch, where vile russettings
> Are matched with monarchs and with mighty kings.

An ancient stage-trick, illustrative of the mixture of tragic and comic action in Shakspeare's time, was long preserved in the theatre. Henry IV. holding council before the battle of Shrewsbury, was always represented as seated on a drum; and when he rose and came forward, the place was occupied by Falstaff, which seldom failed to produce a laugh from the galleries. The taste and judgment of the author himself was very different. During the whole scene Falstaff gives only once, and under irresistible temptation, the rein to his petulant wit, and it is instantly checked by the prince, to whom, by the way, and not to the king, his words ought to be addressed.

Shakspeare.

The English stage might be considered as equally without rule and without model when Shakspeare arose. The effect of the genius of an individual upon the taste of a nation is mighty; but that genius, in its turn, is formed according to the opinions prevalent at the period when it comes into existence. Such was the case with Shakspeare. With an education more extensive, and a taste refined by the classical models, it is probable that he also, in admiration of the ancient drama, might have mistaken the form for the essence, and subscribed to those rules which had produced such masterpieces of art. Fortunately for the full exertion of a genius as comprehensive and versatile as intense and powerful, Shakspeare had no access to any models of which the commanding merit might have controlled and limited his own exertions. He followed the path which a nameless crowd of obscure writers had trodden before him; but he moved in it with the grace and majestic step of a being of a superior order, and vindicated for ever the British theatre from a pedantic restriction to classical rule. Nothing went before Shakspeare which in any respect was fit to fix and stamp the character of a national drama; and certainly no one will succeed him capable of establishing by mere authority a form more restricted than that which Shakspeare used.

Such is the action of existing circumstances upon genius, and the re-action of genius upon future circumstances. Shakspeare and Corneille were each the leading spirit of his age; and the difference between them is well marked by the editor of the latter. "*Corneille est inégal comme Shakspeare, et plein de génie comme lui; mais le génie de Corneille étoit à celui de Shakspeare ce qu'un seigneur est à l'égard d'un* homme de peuple *né avec le même esprit que lui.*" This distinction is strictly accurate, and contains a compliment to the English author which, assuredly, the critic did not intend to make. Corneille wrote as a courtier, circumscribed within the imaginary rules and ceremonies of a court, as a chicken is by a circle of chalk drawn round it. Shakspeare, composing for the amusement of the public alone, had within his province, not only the inexhaustible field of actual life, but the whole ideal world of fancy and superstition; more favourable to the display of poetical genius than even existing realities. Under the circumstances of Corneille, Shakspeare must have been restricted to the same dull, regular, and unvaried system. He must have written, not according to the dictates of his own genius, but in conformity to the mandate of some *intendant des menus plaisirs;* or of some minister of state, who, like Cardinal Richelieu, thought he could write a tragedy because he could govern a kingdom. It is not equally clear to what height Corneille might have ascended had he enjoyed the national immunities of Shakspeare. Each pitched down a land-mark in his art. The circle of Shakspeare was so extended, that it is with advantage liable to many restrictions; that of Corneille included a narrow limit, which his successors have deemed it unlawful to extend.

It is not our intention, within the narrow space to which our essay is necessarily limited, to enlarge upon the character and writings of Shakspeare. We can only notice his performances as events in the history of the theatre—of a gigantic character indeed, so far as its dignity, elevation, and importance are considered; but, in respect of the mere practice of the drama, rather fixing and sanctioning, than altering or reforming those rules and forms which he found already established. This we know for certain, that those historical plays or chronicles, in which Shakspeare's muse has thrown a never-fading light upon the history of his country, did, almost every one of them, exist before him in the rude shape of dry dialogue and pitiful buffoonery, stitched into scenes by the elder playwrights of the stage. His romantic dramas exhibit the same contempt of regularity which was manifested by Marlow and other writers; for where there was abuse or extreme license upon the stage, the example of Shakspeare may be often quoted as its sanction, never as tending to reform it. In these particulars the practice of our immortal bard was contrasted with that of Ben Jonson, a severe and somewhat pedantic scholar; a man whose mind was coarse, though capable both of strength and elevation, and whose strong perception of comic humour was tinctured with vulgarity.

Jonson.

Jonson's tragic strength consists in a sublime, and sometimes harsh, expression of moral sentiment; but displays little of tumultuous and ardent passion, still less of tenderness or delicacy; although there are passages in which he seems adequate to expressing them. He laboured in the mine of the classics, but overloaded himself with the ore, which he could not or would not refine. His *Cataline* and *Sejanus* are laboured translations from Cicero, Sallust, and Tacitus, which his own age did not endure, and which no succeeding generation will probably be much tempted to revive. With the stern superiority of learning over ignorance, he asserted himself a better judge of his own productions than the public which condemned him, and haughtily claimed the laurel which the public suffrage often withheld; but the world has as yet shown no disposition to reverse the opinion of their predecessors.

In comedy Jonson made some efforts partaking of the character of the older comedy of the Grecians. In his *Tale of a Tub* he follows the path of Aristophanes, and lets his wit run into low buffoonery, that he might bring upon the stage Inigo Jones, his personal enemy. In *Cynthia's Revels* and the *Staple of News*, we find him introducing the dull personification of abstract passions and qualities, and turning legitimate comedy into an allegorical mask. What interest can the reader have in such characters as the three Penny boys, and their transactions with the Lady Pecunia? Some of Jonson's more legitimate comedies may be also taxed here with filthiness of language, of which disgusting attribute his works exhibit more instances than any English writer of eminence excepting Swift. Let us, however, be just to a master-spirit of his age. The comic force of Jonson was strong, marked, and peculiar; and he excelled even Shakspeare himself in drawing that class of truly English characters, remarkable for peculiarity of *humour;* that is, for some mode of thought, speech, and behaviour, superinduced upon the natural disposition by profession, education, or fantastical affectation of singularity. In blazoning these forth with their natural attributes and appropriate language, Ben Jonson has never been excelled, and his works everywhere exhibit a consistent and manly moral, resulting naturally from the events of the scene.

It must also be remembered, that although it was Jonson's fate to be eclipsed by the superior genius, energy, and taste of Shakspeare, yet those advantages which enabled him to maintain an honourable though an unsuccessful struggle, were of high advantage to the drama. Jonson was the first who showed by example the infinite superiority of a well-conceived plot, all the parts of which bore upon each other, and forwarded an interesting conclusion over a tissue of detached scenes, following without necessary connection or increase of interest. The plot of the *Fox* is admirably conceived; and that of the *Alchymist*, though faulty in the conclusion, is nearly equal to it. In the two comedies of *Every Man in his Humour* and *Every Man out of his Humour*, the plot deserves much less praise, and is deficient at once in interest and unity of action; but in that of the *Silent Woman* nothing can exceed the art with which the circumstance upon which the conclusion turns is, until the very last scene, concealed from the knowledge of the reader, while he is tempted to suppose it constantly within his reach. In a word, Jonson is distinguished by his strength and stature, even in those days when there were giants in the land, and affords a model of a close, animated, and characteristic style of comedy, abounding in moral satire, and distinguished at once by force and art, which was afterwards more cultivated by English dramatists, than the lighter, more wild, and more fanciful department in which Shakspeare moved, beyond the reach of emulation.

The general opinion of critics has assigned genius as the characteristic of Shakspeare, and art as the appropriate excellence of Jonson; not surely that Jonson was deficient in genius, but that art was the principal characteristic of his laborious scenes. We learn from his own confession, and from the panegyrics of his friends, as well as the taunts of his enemies, that he was a slow composer. The natural result of laborious care is jealousy of fame; for that which we do with labour, we value highly when achieved. Shakspeare, on the other hand, appears to have composed rapidly and carelessly, and sometimes even without considering, while writing the earlier acts, how the catastrophe was to be huddled up, in that which was to conclude the piece. We may fairly conclude him to have been indifferent about fame, who would take so little pains to win it. Much perhaps might have been achieved by the union of these opposed qualities, and by blending the art of Jonson with the fiery invention and fluent expression of his great contemporary. But such an union of opposite excellencies in the same author was hardly to be expected; nor perhaps would the result have proved altogether so favourable as might at first view be conceived. We should have had more perfect specimens of the art, but they must have been much fewer in number; and posterity would certainly have been deprived of that wild luxuriance of dramatic excellencies and poetic beauties, which, like wild flowers upon a common field, lie scattered profusely among the unacted plays of Shakspeare.

Massinger.

Although incalculably superior to his contemporaries, Shakspeare had successful imitators, and the art of Jonson was not unrivalled. Massinger appears to have studied the works of both with the intention of uniting their excellencies. He knew the strength of plot; and although his plays are altogether irregular, yet he well understood the advantage of a strong and defined interest; and in unravelling the intricacy of his intrigues, he often displays the management of a master. Art, therefore, not perhaps in its technical, but in its most valuable sense, was Massinger's as well as Jonson's; and, in point of composition, many passages of his plays are not unworthy of Shakspeare. Were we to distinguish Massinger's peculiar excellence, we should name that first of dramatic attributes, a full conception of character, a strength in bringing out, and consistency in adhering to it. He does not, indeed, always introduce his personages to the audience in their own proper character; it dawns forth gradually in the progress of the piece, as in the hypocritical Luke, or in the heroic Marullo. But, upon looking back, we are always surprised and delighted to trace from the very beginning, intimations of what the personage is to prove as the play advances. There is often a harshness of outline, however, in the character of this dramatist, which prevents their approaching to the natural and easy portraits bequeathed us by Shakspeare.

Beaumont and Fletcher.

Beaumont and Fletcher, men of remarkable talent, seemed to have followed Shakspeare's mode of composition rather than Jonson's, and thus to have altogether neglected that art which Jonson taught, and which Massinger in some sort practised. They may, indeed, be rather said to have taken for their model the boundless license of the Spanish stage, from which many of their pieces are expressly and avowedly derived. The acts of their plays are so detached from each other, in substance and consistence, that the plot scarce can be said to hang together at all, or to have, in any sense of the word, a beginning, progress, and conclusion. It seems as if the play began because the curtain rose, and ended because it fell, the author, in the mean time, exerting his genius for the amusement of the spectators, pretty much in the same manner as in the *Scenario* of the Italians, by the actors filling up, with their extempore wit, the scenes chalked out for them. To compensate for this excess of irregularity, the plays of Beaumont and Fletcher have still a high poetical value. If character be sometimes violated, probability discarded, and the interest of the plot neglected, the reader is, on the other hand, often gratified by the most beautiful description, the most tender and passionate dialogue, a display of brilliant wit and gaiety, or a feast of comic humour. These attributes had so much effect on the public, that, during the end of the seventeenth and the beginning of the eighteenth centuries, many of Beaumont and Fletcher's plays had possession of the stage, while those of Shakspeare were laid upon the shelf.

Shirley and others.

Shirley, Ford, Webster, Decker, and others, added performances to the early treasures of the English drama, which abound with valuable passages. There never, probably, rushed into the lists of literary competition together a band more distinguished for talent. If the early drama be inartificial and unequal, no nation at least can show so many detached scenes, and even acts, of distinguished poetical merit. One powerful cause seems to have produced an effect so marked and distinguished, to wit, the universal favour of a theatrical public, which daily and nightly thronged the numerous theatres then open in the city of London.

Cause of the abundance of dramatic talent in this period.

In considering this circumstance, it must above all be remembered that these numerous audiences crowded, not to feast their eyes upon show and scenery, but to see and hear the literary production of the evening. The scenes which the stage exhibited were probably of the most paltry description. Some rude helps to the imagination of the audience might be used by introducing the gate of a castle or town; the monument of the Capulets, by sinking a trap-door, or by thrusting in a bed. The good-natured audience readily received these hints, with that conventional allowance which Sir Philip Sidney had ridiculed, and which Shakspeare himself has alluded to when he appeals from the poverty of theatrical representation to the excited imagination of his audience.

> ....Can this cockpit hold
> The vasty fields of France? Or may we cram
> Within this wooden O, the very casques
> That did affright the air at Agincourt?
> O, pardon! since a crooked figure may
> Attest, in little space, a million;
> And let us, ciphers to this great account,
> On your imaginary forces work;
> Suppose, within the girdle of these walls,
> Are now confined two mighty monarchies,
> Whose high upreared and abutting fronts
> The perilous narrow ocean parts asunder;
> Printing their proud hoofs i' the receiving earth.
> For 'tis your thoughts that now must deck our kings,
> Carry them here and there; jumping o'er times;
> Turning the accomplishment of many years
> Into an hour-glass.........

Such were the allowances demanded by Shakspeare and his contemporaries from the public of their day, in consideration of the imperfect means and appliances of their theatrical machinery. Yet the deficiency of scenery and show, which, when existing in its utmost splendour, divides the interest of the piece in the mind of the ignorant, and rarely affords much pleasure to a spectator of taste, may have been rather an advantage to the infant drama. The spectators having nothing to withdraw their attention from the immediate business of the piece, gave it their full and uninterrupted attention. And here it may not be premature to inquire into the characteristical difference between the audiences of the present day, and those earlier theatrical ages, when the drama boasted not only the names of Shakspeare, of Massinger, of Jonson, of Beaumont and Fletcher, of Shirley, of Ford, and others of subordinate degree; the meanest of whom shows occasionally more fire than warms whole reams of modern plays. This will probably be found to rest on the varied and contrasted feelings with which the audience of ancient and that of modern days attend the progress of the scene.

Nothing, indeed, is more certain than that the general cast of theatrical composition must receive its principal bent and colouring from the taste of the audience:

> The drama's laws, the drama's patrons give;
> For those who live to please, must please to live.

But though this be an undeniable, and in some respects a melancholy truth, it is not less certain that genius, labouring in behalf of the public, possesses the power of re-action, and of influencing in its turn that taste to which it is in some respects obliged to conform; while, on the other hand, the playwright, who aims only to catch the passing plaudit and the profit of a season, by addressing himself exclusively to the ruling predilections of the audience, degrades the public taste still farther by the gross food which he ministers to it, unless it shall be supposed that he may contribute involuntarily to rouse it from its degeneracy, by cramming it even to satiety and loathing. This action, therefore, and re-action of the taste of the age on dramatic writing, and *vice versa*, must be both kept in view when treating of the difference betwixt the days of Shakspeare and our own.

Perhaps it is the leading distinction betwixt the ancient and modern audiences, that the former came to listen and to admire; to fling the reins of their imaginations into the hands of the authors and actors, and to be pleased, like the reader to whom Sterne longed to do homage, "they knew not why, and cared not wherefore." The novelty of dramatic entertainments (for there elapsed only about twenty years betwixt the date of *Gammer Gurton's Needle*, accounted the earliest English play, and the rise of Shakspeare) must have had its natural effect upon the audience. The sun of Shakspeare arose almost without a single gleam of intervening dawn; and it was no wonder that the audience, introduced to this enchanting and seductive art at once, under such an effulgence of excellence, should have been more disposed to wonder than to criticise; to admire, or rather to adore, than to measure the height or ascertain the course of the luminary which diffused such glory around him. The great number of theatres in London, and the profusion of varied talent which was dedicated to this service, attest the eagerness of the public to enjoy the entertainments of the scene. The ruder amusements of the age lost their attractions; and the royal bear-ward of Queen Elizabeth lodged a formal complaint at the feet of her majesty, that the play-houses had seduced the audience from his periodical bear-baitings. This fact is worth a thousand conjectures; and we can hardly doubt that the converts, transported by their improving taste from the bear-garden to the theatre, must, generally speaking, have felt their rude minds subdued and led captive by the superior intelligence, which not only placed on the stage at pleasure all ranks, all ages, all tempers, all passions of mere humanity, but extended its powers beyond the bounds of time and space, and seemed to render visible to mortal eyes the secrets of the invisible world. We may, perhaps, form the best guess of the feelings of Shakspeare's contemporary audience, by recollecting the emotions of any rural friend, of rough but sound sense and ardent feelings, whom we have had the good fortune to conduct to a theatre for the first time in his life. It may be well imagined that such a spectator thinks little of the three dramatic unities, of which Aristotle says so little, and his commentators and followers talk so much; and that the poet and the performers have that enviable influence over his imagination, which transports him from place to place at pleasure, crowds years into the course of hours, and interests him in the business of each scene, however disconnected from the others. His eyes are riveted to the stage, his ears drink in the accents of the speakers, and he experiences in his mature age, what we have all felt in childhood, a sort of doubt whether the beings and business of the scene be real or fictitious. In this state of delightful fascination, Shakspeare and the gigantic dramatic champions of his age found the British public at large; and how they availed themselves of the advantages which so favourable a temper afforded them, their works will show so long as the language of Britain continues to be read. It is true that the enthusiastic glow of the public admiration, like the rays of a tropical sun darted upon a rich soil, called up in profusion weeds as well as flowers; and that, spoiled in some degree by the indulgent acceptation which attended their efforts, even our most admired writers of Elizabeth's age not unfrequently exceeded the bounds of critical nicety, and even of common taste and decorum. But these eccentricities were atoned for by a thousand beauties, to which, fettered by the laws of the classic drama, the authors would hardly have aspired, or, aspiring, would hardly have attained. All of us know and feel how much the exercise of our powers, especially those which rest on keen feeling and self-confidence, is dependent upon a favourable reception from those for whom they are put in action. Every one has observed how a cold brow can damp the brilliancy of wit and fetter the flow of eloquence; and how both are induced to send forth sallies corresponding in strength and fire, upon being received by the kindred enthusiasm of those whom they have addressed. And thus, if we owe to the indiscriminate admiration with which the drama was at first received, the irregularities of the authors by whom it was practised, we also stand indebted to it, in all probability, for many of its beauties, which became of rare occurrence, when, by a natural, and indeed a necessary change, satiated admiration began to give way to other feelings.

When a child is tired of playing with a new toy, its next delight is to examine how it is constructed; and, in like manner, so soon as the first burst of public admiration is over with respect to any new mode of composition, the next impulse prompts us to analyse and to criticise what was at first the subject of vague and indiscriminate wonder. In the first instance, the toy is generally broken to pieces; in the other, while the imagination of the authors is subjected to the rigid laws of criticism, the public generally lose in genius what they may gain in point of taste. The author who must calculate upon severe criticism turns his thoughts more to avoid faults than to attain excellence, as he who is afraid to stumble must avoid rapid motion. The same process takes place in all the fine arts; their first productions are distinguished by boldness and irregularity; those which succeed, by a better and more correct taste, but also by inferior and less original genius.

The original school founded by Shakspeare and Ben Jonson, continued by Massinger, Beaumont and Fletcher, Shirley, Ford, and others, whose compositions are distinguished by irregularity as well as genius, was closed by the breaking out of the great civil war in 1642. The stage had been the constant object of reprobation and abhorrence on the part of the puritans, and its professors had no favour to expect at their hands if victorious. We read, therefore, with interest, but without surprise, that almost all the actors took up arms in behalf of their old master King Charles, in whose service most of them perished. Robinson, a principal actor at the Blackfriars, was killed by Harrison in cold blood, and under the application of a text of scripture,—"Cursed is he that doeth the work of the Lord negligently." A few survivors endeavoured occasionally to practise their art in secrecy and obscurity, but were so frequently discovered, plundered and stripped by the soldiers, that "*Enter the red-coat, Exit hat and cloak,*" was too frequent a stage direction. Sir William Davenant endeavoured to evade the severe zealots of the time, by representing a sort of opera, said to have been the first drama in which moveable scenery was introduced upon the stage. Even the cavaliers of the more grave sort disapproved of the revival of these festive entertainments during the unstable and melancholy period of the interregnum. "I went," says the excellent Evelyn, in his *Diary*, 5th May 1658, "to see a new opera after the Italian way; in recitation, music, and scenes, much inferior to the Italian composure and magnificence; but it was prodigious that in such a time of public consternation, such a variety should be kept up or permitted, and being engaged with company, could not decently resist the going to see it, though my heart smote me for it." Davenant's theatrical enterprise, abhorred by the fanaticism of the one party, and ill adapted to the dejected circumstances of the other, was not probably very successful.

S ond pe- r l of the I glish d ma.

II. With royalty the stage revived in England. But the theatres in the capital were limited to two, a restriction which has never since been extended. This was probably by the advice of Clarendon, who endeavoured, though vainly, to stem at all points the flood of idle gaiety and dissipation which broke in after the Restoration. The example of France might reconcile Charles to this exertion of royal authority. With this restoration of the drama, as well as of the crown, commences the second part of English dramatic history.

I roduc- t n of the I oic p ys.

Charles II. had been accustomed to enjoy the foreign stage during his exile, and had taste enough to relish its beauties. It is probable, however, that his judgment was formed upon the French model, for few of the historical or romantic dramas were revived at the restoration. So early as 26th of November 1662, the *Diary* of Evelyn contains this entry: "I saw Hamlet, Prince of Denmark, played; but now the old plays began to disgust this refined age, since his majesty has been so long abroad." Dryden, Howard, and others, who obtained possession of the stage, introduced what was for some time called Heroic Plays, written in couplets, and turning upon the passions of love and honour. In the dialogue, these pieces resembled that of the French stage, where the actors declaim alternately in the best language and in the finest thoughts which the poet can supply, but without much trace of natural passion or propriety of character. But though French in dialogue and sentiment, the heroic plays were English in noise and bustle, and the lack of truth and nature was supplied by trumpets and tempests, victories and processions. An entertainment of a character so forced and unnatural was obviously of foreign growth, and flowed from the court. Dryden himself has assured us "that the favour which heroic plays had acquired upon the stage was entirely owing to the countenance which they had received at court; and that the most eminent persons for wit and humour in the royal circle had so far honoured them, that they judged no way so fit as verse to entertain a noble audience, or express a noble passion." In these pieces the unities were not observed; but in place of the classical restrictions, there were introduced certain romantic whimsical limitations of the dramatic art, which, had they been adopted, must soon have destroyed all its powers of pleasing. The characters were avowedly formed upon the model of the French romance, where honour was a sort of insane gasconading extravagance, and who seem to have made a vow never to speak or think of any thing but love, and that in language sometimes ingeniously metaphysical, sometimes puerile to silliness, sometimes mad even to raving, but always absurd, unnatural, and extravagant. In point of system it was stated, that a heroic play should be an imitation of a heroic poem. The laws of such compositions did not, it was said, dispense with those of the elder drama, but exalted them, and obliged the poet to draw all things as far above the ordinary proportion of the stage, as the stage itself is beyond the common words and actions of human life. The effects which a heroic play, constructed upon such an overstrained model, produced, is well described by Mrs Evelyn, wife of the author of that name already quoted, in a letter to Mr Bohun, written in 1671. "Since my last to you I have seen the *Siege of Grenada*, a play so full of ideas, that the most refined romance I ever read is not to compare with it. Love is made so pure, and valour so nice, that one would imagine it designed for an Utopia rather than our stage. I do not quarrel with the poet, but admire one born in the decline of morality should be able to feign such exact virtue; and as poetic fiction has been instructive in former ages, I wish this the same event in ours. As to the strict law of comedy, I dare not pretend to judge. Some think the division of the story not so well as if it could all have been comprehended in the day of action. Truth of history, exactness of time, possibilities of adventures, are niceties which the ancient critics might require; but those who have outdone them in fine notions may be allowed the liberty to express them their own way, and the present world is so enlightened that the old dramatique must bear no sway. This account perhaps is not enough to do *Mr Driden* right, yet is as much as you can expect from the leisure of one who has the care of a nursery." (See Evelyn's *Works.*) This ingenious lady felt what, overawed by the fashion of the moment, she has intimated rather than expressed; namely, that the heroic drama, notwithstanding the fine poetry of which it may be made the vehicle, was overstrained, fantastical, and unnatural.

In comedy, also, there was evinced, subsequent to the Restoration, a kindred desire of shining in dialogue rather than attempting the humorous delineation of character of which Shakspeare, Jonson, and the earlier schools, had set the example. The comic author no longer wrote to move the hearty laugh of a popular assembly, but to please a fashionable circle, "the men of wit and pleasure about town," with whom wit and raillery is always more prevailing than humour. As in tragedy, therefore, the authors exhausted trope and figure, and reduced to logic the language of heroic passion; so in comedy, a succession of smart jests, which neither serve to advance the action of the piece, nor display the character of the speaker, was bandied to and fro upon the stage.

Heroic plays superseded by dramas of a more natural structure.

Satire is the appropriate corrective of extravagance in composition; and the *Rehearsal* of the Duke of Buckingham, though it can scarcely be termed a work of uncommon power, had yet the effect of holding up to public ridicule the marked and obvious absurdities of the revived drama in both its branches. After the appearance of this satire, a taste too extravagant for long endurance was banished from the theatre; both tragedy and comedy retraced their steps, and approached more nearly to the field of human action, passion, and suffering; and, down to the revolution, a more natural style of drama occupied the stage. It was supported by men of the highest genius, who, but for one great leading error, might perhaps have succeeded in giving to the art its truest and most energetic character. The talents of Otway, in his scenes of passionate affection, rival at least, and sometimes excel, those of Shakspeare. More tears have been shed, probably, for the sorrows of Belvidera and Monimia than for those of Juliet and Desdemona. The introduction of actresses upon the stage was scarcely known before the Restoration, and it furnished the poets of the latter period with appropriate representatives for their female characters. This more happy degree of personification, as it greatly increased the perfection of the scene, must have animated in proportion the genius of the author. A marked improvement, therefore, may be traced in love scenes, and, indeed, in all those wherein female characters are introduced; that which was to be spoken by a fitting representative was of course written with more care, as it was acted with greater effect. This was an advantage, and a great one, possessed by the theatre succeeding the Restoration. Great dramatic force and vigour marked the dramatic compositions of this age. It was not, indeed, equal to that of Shakspeare, either in point of the talent called forth, or the quantity of original poetry given to the public; but Otway, and even Lee, notwithstanding his bombastic rant, possessed considerable knowledge of dramatic art and stage-effect. Several plays of this period have kept possession of the stage; less perhaps on account of intrinsic merits, than because some of the broad errors of the earlier age had been removed, and a little more art had been introduced in the combination of the scenes, and disentanglement of the plot. The voice of criticism was frequently heard; the dramatic rules of the ancients were known and quoted; and though not recognized in their full extent, had nevertheless some influence in regulating the action of the drama.

Gross immorality of the drama.

In one heinous article, however, the poets of this age sinned at once against virtue, good taste, and decorum; and endangered, by the most profligate and shameless indecency, the cause of morality, which has been often considered as nearly allied with that of the legitimate drama. In the first period of the British stage, the actors were men of decent character, and often acquired considerable independence. The women's parts were acted by boys. Hence, although there were too many instances of low and licentious dialogue, there were few of that abominable species which addresses itself, not to the fancy, but to the passions, and is seductive, instead of being ludicrous. Had Charles II. borrowed from the French monarchs the severe etiquette of their court, when he introduced into England something resembling the style of their plays, he would have asserted what was due to his own dignity, and the cause of sound morals and good manners, by prohibiting this vulgar and degrading license, which in itself was insulting to the presence of a king. It was, however, this prince's lot, in the regulation of his amusements, as well as in his state government, to neglect self-respectability. In his exile he had been "merry, scandalous, and poor;" had been habituated to share familiarly coarse jests and loose pleasures with his dissolute companions; and unfortunately he saw no reason for disusing the license to which he had accustomed himself, when it was equally destructive to his own character and to decorum. What had been merely coarse was, under his influence, rendered vicious and systematic impurity. Scenes, both passionate and humorous, were written in such a style as if the authors had studied whether the grave seduction of the heroic, or the broad infamy of the comic scenes, should contain the grossest insult to public decency. The female performers were of a character proper to utter whatever ribaldry the poet chose to put into their mouths; and as they practised what they taught, the king himself, and the leading courtiers, formed connections which gave the actress a right to be saucy in their presence, and to reckon upon their countenance when practising in public the effrontery which marked their intercourse in private life. How much this shocked the real friends of Charles, is shown by its effects upon Evelyn, whose invaluable *Diary* we have already quoted: "This night was acted my Lord Broghill's tragedy called Mustapha, before their majesties at court, at which I was present; though very seldom now going to the public theatres, for many reasons, as they are now abused to an atheistical liberty. Foul and indecent women now, and never till now, are permitted to appear and act, who, inflaming several young noblemen and gallants, became their misses, and some their wives: witness the Earl of Oxford, Sir R. Howard, P. Rupert, the Earl of Dorset, and another greater person than any of them, who fell into their snares, to the reproach of their noble families, and ruin of both body and soul." He elsewhere repeatedly expresses his grief and disgust at the pollution and degeneracy of the stage. (Evelyn's *Works*, vol. i. p. 392.) In a letter to Lord Cornbury (son of the great Clarendon), he thus expresses himself: "In the town of London there are more wretched and indecent plays permitted than in all the world besides;" and adds shortly after, "If my Lord Chancellor would but be instrumental in reforming this one exorbitancy, it would gain both the king and his lordship multitudes of blessings. You know, my lord, that I (who have written plays, and am a scurvy poet too sometimes) am far from puritanisme; but I would have no reproach left our adversaries, in a theme which may so conveniently be reformed. Plays are now with us become a licentious exercise, and a vice, and neede severe censors, that should look as well to their morality as to their lines and numbers." And, at the hazard of multiplying quotations, we cannot suppress the following:—1st March 1671. "I walked with him (the king) through St James's Park to the garden, where I both heard and saw a very familiar discourse betwixt— (*i. e.* the king) and Mrs Nelly (Gwyn), as they called an impudent comedian, she looking out of her terrace at the top of the wall, and —— [the king] standing in the green walk under it. I was heartily sorry at this scene."

The foul stain, so justly censured by a judge so competent and so moderate as Evelyn, was like that of the leprosy in the Levitical law, which sunk into and pervaded the very walls of the mansion; it became the leading characteristic of the English theatre, of its authors, and of its players. It was, however, especially in comedy that this vice was most manifest; and, to say truth, were not the eyes of antiquaries, like the ears of confessors, free from being sullied by the impurities committed to them, the comedies of this period, as well as the comic scenes introduced to relieve the tragedies, are fitter for a brothel than for the library of a man of letters.

It is a pity that we are under the necessity of drawing the character of the drama at this age from a feature so coarse and disgusting. Unquestionably, as the art in other respects made progress, it might, but for this circumstance, have reached an uncommon pitch of perfection. The comedies of Congreve contain probably more wit than was ever before embodied upon the stage; each word was a jest, and yet so characteristic, that the repartee of the servant is distinguished from that of the master; the jest of the coxcomb from that of the humorist or fine gentleman of the piece. Had not Sheridan lived in our own time, we could not have conceived the possibility of rivalling the comedies of Congreve. This distinguished author understood the laws of composition, and combined his intrigue with an art unusual on the British stage. Nor was he without his rivals, even where his eminence was most acknowledged. Vanburgh and Farquhar, inferior to Congreve in real wit, and falling into the next period, were perhaps his equals in the composition of acting plays. Like other powerful stimulants, the use of wit has its bounds, which Congreve is supposed sometimes to have exceeded. His dialogue keeps the attention too much upon the stretch, and, however delightful in the closet, fatigues the mind during the action. When you are perpetually conscious that you lose something by the slightest interruption of your attention, whether by accident or absence of mind, it is a state of excitement too vivid and too constant to be altogether pleasant; and we feel it possible that we might sometimes wish to exchange a companion of such brilliant powers, for one who would afford us more repose and relaxation.

The light, lively, but somewhat more meagre dialogue of the latter dramatists of the period, and of that which succeeded, was found sufficient to interest, yet was not so powerful as to fatigue the audience. Vanburgh and Farquhar seemed to have written more from the portraits of ordinary life; Congreve from the force of his own conception. The former, therefore, drew the characters of men and women as they found them; selected, united, and heightened for the purpose of effect, but without being enriched with any brilliancy foreign to their nature. But all the personages of Congreve have a glimpse of his own fire, and of his own acuteness. He could not entirely lay aside his quick powers of perception and reply, even when he painted a clown or a coxcomb; and all that can be objected, saving in a moral sense, to this great author, is his having been too prodigal of his wit; a faculty used by most of his successors with rigid economy.

That personification of fantasy or whim called characters of humour, which Ben Jonson introduced, was revived during this period. Shadwell, now an obscure name, endeavoured to found himself a reputation, by affecting to maintain the old school, and espousing the cause of Ben Jonson against Dryden and other innovators. But although there was considerable force of humour in some of his forgotten plays, it was Wycherly upon whom fell the burthen of upholding the standard of the Jonsonian school. The *Plain Dealer* is indeed imitated from Molière; but the principal character has more the force of a real portrait, and is better contrasted with the perverse, bustling, masculine, petty-fogging, and litigious character of Widow Blackacker, than Alceste is with any of the characters in the *Misanthrope.* The other plays of this author are marked by the same strong, masculine, and forcible painting, which approaches more to the satire of Jonson, than to the ease of Vanburgh, the gaiety of Farquhar, or the wit of Congreve. Joining, however, the various merits of these authors, as belonging to this period, they form a galaxy of comic talent scarce to be matched in any other age or country; and which is only obscured by those foul and impure mists which their pens, like the raven wings of Sycorax, had brushed from fern and bog.

Morals repeatedly insulted long demanded an avenger; and he arose in the person of Jeremy Collier. It is no disgrace to the memory of this virtuous and well-meaning man, that, to use the lawyer's phrase, he pleaded his cause too high; summoned unnecessarily to his aid the artillery with which the Christian fathers had fulminated against the heathen drama; and pushing his arguments to extremity, directed it as well against the use as against the abuse of the stage. Those who attempted to reply to him availed themselves, indeed, of the weak parts of his arguments; but, upon the main points of impeachment, the poets stood self-convicted. Dryden made a manly and liberal submission, though not without some reflections upon the rudeness of his antagonist's attacks. "I shall say the less of Mr Collier, because in many things he has taxed me justly; and I have pleaded guilty to all thoughts and expressions of mine which can be truly accused of obscenity, profaneness, or immorality, and retract them. If he be my enemy, let him triumph; if he be my friend, as I have given him no occasion to be otherwise, he will be glad of my repentance. It becomes me not to draw my pen in the defence of a bad cause, when I have so often drawn it for a good one. Yet it were not difficult to prove, that in many places he has perverted my meaning by his glosses, and interpreted my words into blasphemy and bawdry, of which they were not guilty; besides, that he is too much given to horse-play in his raillery, and comes from battle like a dictator from the plough. I will not say, 'the zeal of God's house has eaten him up;' but I am sure it has devoured some part of his good manners and civility." Congreve, less prudent, made an angry and petulant defence, yet tacitly admitted the charge brought against him, by retrenching in the future editions of his plays, passages of grossness and profaneness, which the restless antiquary still detects in the early copies. And, on the whole, Collier's satire was attended with such salutary effects, that men started at the mass of impudence and filth which had been gradually accumulated in the theatre during the last reigns; and if the Augean stable was not sufficiently cleansed, the stream of public opinion was fairly directed against its conglomerated impurities. Since that period, indecency, that easy substitute for wit and pleasantry, has been gradually banished from the drama, where the conversation is now (according to Sheridan) at least always moral, if not entertaining.

During the second period of the British drama, great improvement was made in point of art. The principles of dramatic composition were more completely understood, and the poets themselves had written so much upon the subject, that, as Dryden somewhere complains, they had taught their audience the art of criticising their performances. They did not, however, so far surrender the liberties and immunities of their predecessors, as to receive laws from the French critics. The rules of the unities were no further adopted by Otway, Congreve, and the writers of the time, than their immediate purpose admitted. It was allowed on all hands that unnecessary and gross irregularities were to be avoided, but no precise rule was adopted. Poets argued upon the subject according to caprice, and acted according to convenience. Gross and palpable extensions of time, and frequent changes of place, were avoided; and, unless in tragi-comedies, authors studied to combine the intrigue of their play into one distinct and progressive action. The genius by which this art was supported was neither so general nor so profuse as that which decorated the preceding period. It was enough, however, to support the honour of the drama; and if the second period has produced fewer masterpieces of talent, it has exhibited more plays capable of being acted.

Third period of the English drama.

III. In the third period of dramatic history, the critics began to obtain an authority for which they had long struggled, and which might have proved fatal to the liberties of the stage. It is the great danger of criticism, when laying down abstract rules without reference to any example, that these regulations can only apply to the form, and never to the essence, of the drama. They may assume that the plot must be formed on a certain model, but they cannot teach the spirit which is to animate its progress. They cannot show how a passion should be painted, but they can tell to a moment when the curtain should be dropped. The misfortune is, that, while treating of these subordinate considerations, critics exalt them to an undue importance in their own minds and that of their scholars. What they carve out for their pupils is a mere dissection of a lifeless form; the genius which animated it escapes, as the principle of life glided from the scalpel of those anatomists who sought to detect it in the earlier days of that art. Rymer had, as early as 1688, discovered that our poetry of the last age was as rude as its architecture. "One cause thereof," he continues, "might be, that Aristotle's *Treatise of Poetry* has been so little studied amongst us; it was, perhaps, commented upon by all the great men in *Italy*, before we well knew (on this side of the Alps) that there was such a book in being." Accordingly, Rymer endeavours to establish what he calls the Rule of Reason over Fancy, in the contrivance and economy of a play. "Those who object to this subjugation," he observes, "are mere fanatics in poetry, and will never be saved by their good works." The species of reason, however, to which Rymer appeals, resembles, in its occult nature, that which lies hidden in the depths of municipal law, and which is better known to the common class of mankind under the name of Authority. Because Aristotle assigns Pity and Terror as the objects of tragedy, Rymer resumes the proposition, that no other source of passion can be legitimate. To this he adds some arbitrary rules, of which it would be difficult to discover the rationale. It was the opinion, we are told, of the ancients, "that comedy (whose province was humour and ridiculous matter only) was to represent worse than the truth, history to describe the truth, but tragedy was to invent things better than the truth. Like good painters, they must design their images like the life, but yet better and more beautiful than the life. The malefactor of tragedy must be a better sort of malefactor than those that live in the present age: For an obdurate, impudent, and impenitent malefactor, can neither move compassion nor terror, nor be of any imaginable use in tragedy." It would be difficult to account for these definitions upon any logical principle, and impossible for an admirer of the drama to assent to a rule which would exclude from the stage Iago and Richard III. It is equally difficult to account for the *rationale* of the following dogmas: "If I mistake not, in poetry no woman is to kill a man, except her quality gives her the advantage above him; nor is a servant to kill his master; nor a private man, much less a subject, to kill a king, nor on the contrary. Poetical decency will not suffer death to be dealt to each other by such persons, whom the laws of duel allow not to enter the lists together." (Rymer's *View of the Tragedies of the Last Age.*) Though for these and similar critical conceits it would be difficult to find any just principle, nevertheless, Rymer, Dennis, and other critics, who, mixing observations founded on sound judgment and taste, with others which rested merely upon dauntless assertion, or upon the opinions of Aristotle, began thereby to extend their authority, and produce a more than salutary influence upon the drama. It is true, that both of the aristarchs whom we have named were so ill advised as themselves to attempt to write plays, and thereby most effectually proved that it was possible for a drama to be extremely regular, and at the same time intolerably dull. Gradually, however, their precepts, in despite of their example, gained influence over the stage. They laid down rules in which the audience were taught to regard the trade of a connoisseur as easy and soon learned; and the same quantity of technical jargon which, in the present day, constitutes a judge of painting, was, in the beginning of the eighteenth century, sufficient to elevate a templar into a dramatic critic. The court of criticism, though self-constituted, was sufficiently formidable, since they possessed the power of executing their own decrees. Many authors made their submission; amongst others, Congreve humbled himself in the *Mourning Bride;* and Addison, with anxious and constitutional timidity, sacrificed to the unities in his celebrated tragedy of *Cato*. Being in form and essence rather a French than an English play, it is one of the few English tragedies which foreigners have admired. It was translated into Italian, and admired as a perfect model by Riccoboni, although his taste condemns the silly love intrigue. Its success was contagious. Southerne and Rowe may be considered as belonging to the same school; although the former admired Shakspeare, and the latter formed himself, in some degree, on the model of Otway. Translations of French tragedies became every day more frequent; and their diction and style of dialogue was imitated upon the British stage. The language of tragedy no longer expressed human passion, or intimated what the persons of the drama actually felt, but described and debated alternately what they ought to feel; and sounding sentences, and long similes, exhibiting an active fancy and a cold imagination, supplied at once the place of force and of pathos.

Unfavourable influence of dramatic criticism.

The line between comedy and tragedy was now strictly drawn. The latter was no longer permitted to show that strain of heroic humour which exhibits itself in the character of Falconbridge, Hotspur, and Henry V., as well as Mercutio. All was to be cold and solemn, and in the same key of dull, grave state. Neither was comedy relieved by the touches of pathetic tenderness, and even sublimity, which are to be found in the romantic plays of the earlier period. To compensate the audience for the want of this beautiful variety of passion and feeling, Southerne, as Otway had done before him, usually introduces a few scenes of an under-plot, containing the most wretched and indecent farce, which was so slightly and awkwardly dovetailed into the original tragedy, that they have since been cancelled as impertinent intrusions, without being so much as missed. Young, Thomson, and others who followed the same wordy and declamatory system of composition, contributed rather to sink than to exalt the character of the stage. The two first were both men of excellent genius, as their other writings have sufficiently testified; but, as dramatists, they wrought upon a false model, and their productions are of little value.

It is a remarkable instance of the decay of dramatic art at this period, that several of the principal authors of the time felt themselves at liberty to write imitations of old plays belonging to the original school, by way of adapting them to the taste of their own age. The *Fair Penitent* of Rowe is well known as a poor imitation of Massinger's *Fatal Dowry*. It does not greatly excel the original in the management and conduct of the piece; and, in every thing else, falls as far beneath it as the baldest translation can sink below the most spirited original.

It would appear that the players of this period had adopted a mode of acting correspondent to the poetical taste of the time. Declamation seems to have been more in fashion in the school of Booth and Betterton than that vivacity of action that exhibits at once with word, eye, and gesture, the immediate passion which it is the actor's part to express. "I cannot help," says Cibber, "in regard to truth, remembering the rude and riotous havock we made of all the late dramatic honours of the theatre: all became at once the spoil of ignorance and self-conceit. Shakespeare was defaced, and tortured in every signal character; *Hamlet* and *Othello* lost, in one hour, all their good sense, their dignity, and fame; *Brutus* and *Cassius* became noisy blusterers, with bold unmeaning eyes, mistaken sentiments, and turgid elocution." (Cibber's *Memoirs.*)

Lillo deav to en the s of tr

A singular attempt to deviate from the prevailing taste in tragedy was made by Lillo, with the highly laudable purpose of enlarging the sphere of dramatic utility. He conceived that plays founded upon incidents of private life might carry more immediate conviction to the mind of the hearers, and be the means of stifling more vices in the bud, than those founded on the more remote and grander events of history. Accordingly, he formed his plots from domestic crimes, and his characters never rose above the ranks of middle life. Lillo had many requisites for a tragedian; he understood, either from innate taste or critical study, the advantage to be derived from a consistent fable; and, in the tragedy of the *Fatal Curiosity*, he has left the model of a plot, in which, without the help of any exterior circumstances, a train of events operating upon the characters of the dramatic persons produce a conclusion at once the most dramatic and the most horrible that the imagination can conceive. Neither does it appear that, as a poet, Lillo was at all inferior to others of his age. He possessed a beautiful fancy; and much of his dialogue is as forcibly expressed as it is well conceived. On some occasions, however, he sinks below his subject; and on others, he appears to be dragged down to the nether sphere in which it is laid, and to become cold and creeping, as if depressed with the consciousness that he was writing upon a mean subject. *George Barnwell* never rises above an idle and profligate apprentice; Milwood's attractions are not beyond those of a very vulgar woman of the town; Thoroughgood, as his name expresses, is very worthy and very tiresome; and there is, positively, nothing to redeem the piece, excepting the interest arising from a tale of horror, and the supposed usefulness of the moral. The *Fatal Curiosity* is a play of a very different cast, and such as might have shaken the Grecian stage even during the reign of terror. But the powers of the poet prove unequal to the concluding horrors of his scene. Old Wilmot's character, as the needy man who had known better days, exhibits a mind naturally good, but prepared for acting evil, even by the evil which he has himself suffered, and opens in a manner which excites the highest interest and expectation. But Lillo was unable to sustain the character to the close. After discovering himself to be the murderer of his son, the old man falls into the common cant of the theatre; he talks about computing sands, increasing the noise of thunder, adding water to the sea, and fire to Ætna, by way of describing the excess of his horror and remorse; and becomes as dully desperate, or as desperately dull, as any other despairing hero in the last scene of a fifth act.

Genteel comedy.

During this third period of the drama, comedy underwent several changes. The department called genteel comedy, where the persons as well as the foibles ridiculed were derived chiefly from high life, assumed a separate and distinct existence from that which ransacked human nature at large for its subject. Like the tragedy of the period, this particular species of comedy was borrowed from the French. It was pleasing to the higher classes, because it lay within their own immediate circle, and turned upon the topics of gallantry, persiflage, affectation, and raillery. It was agreeable to the general audience, who imagined they were thereby admitted into the presence of their betters, and enjoyed their amusement at their expense. The *Careless Husband* of Cibber is, perhaps, the best English play on this model. The general fault to which they are all liable is their tendency to lower the tone of moral feeling; and to familiarize men, in the middling, with the cold, heartless, and selfish system of profligate gallantry practised among the higher ranks. We are inclined to believe that, in a moral point of view, genteel comedy, as it has been usually written, is more prejudicial to public morals, than plays the tendency of which seems at first more grossly vicious. It is not so probable that the *Beggar's Opera* has sent any one from the two-shilling gallery to the highway, as that a youth entering upon the world, and hesitating between good and evil, may be determined to the worse course by the gay and seductive example of *Lovemore* or *Sir Charles Easy*. At any rate, the tenderness with which vices are shaded off into foibles familiarizes them to the mind of the hearer, and gives a false colouring to those crimes which should be placed before the mind in their native deformity. But the heaviness of this class of plays, and the difficulty of finding adequate representatives for those characters which are really well drawn, are powerful antidotes to the evil which we complain of. That which is dully written, and awkwardly performed, will not find many imitators.

Comedy of intrigue.

The genteel comedy being a plant of foreign growth, never obtained exclusive possession of the English stage, any more than court dresses have been adopted in our private societies. The comedy of intrigue, borrowed, perhaps, originally from the Spaniards, continued to be written and acted with success. Many of Cibber's pieces, of Centlivre's, and others, still retain their place on the stage. This is a species of comedy easily written, and seen with pleasure, though consisting chiefly of bustle and complicated incident; and requiring much co-operation of the dress-maker, scene-painter, and carpenter. After all the bustle, however, of surprise, and disguise, and squabble; after every trick is exhausted, and every stratagem played off, the writer too often finds himself in a labyrinth from which a natural mode of extrication seems altogether impossible. Hence the intrigue is huddled up at random; and the persons of the drama seem, as if by common consent, to abandon their dramatic character before throwing off their stage-dresses. The miser becomes generous; the peevish cynic good humoured; the libertine virtuous; the coquette is reformed; the debauchee is reclaimed; all vices natural and habitual are abandoned by those most habitually addicted to them: a marvellous reformation, which is brought about entirely from the consideration that the play must now be concluded. It was when pressed by this difficulty that Fielding is said to have damned all fifth acts.

English opera.

The eighteenth century, besides genteel comedy, and comedy of intrigue, gave rise to a new species of dramatic amusement. The Italian opera had been introduced into this country at a great expense, and to the prejudice, as it was supposed, of the legitimate drama. Gay, in aiming at nothing beyond a parody of this fashionable entertainment, and making it the vehicle of some political satire against Sir Robert Walpole's administration, unwittingly laid the foundation of the English opera. The popularity of his piece was unequalled; partly owing to its peculiar humour, partly to its novelty, partly to the success of the popular airs, which every body heard with delight, and partly to political motives. The moral tendency of the *Beggar's Opera* has been much questioned; although, in all probability, the number of highwaymen is not more increased by the example of Macheath, than that of murderers is diminished by the catastrophe of George Barnwell. Many years ago, however, an unhappy person, rather from a perverted and most misplaced ambition, than from the usual motives of want and desperation, chose, though in easy circumstances, and most respectably connected, to place himself at the head of a band of thieves and housebreakers, whose depredations he directed and shared. On the night on which they committed the crime for which he suffered, and when they were equipped for the expedition, he sung to his accomplices the chorus of the *Beggar's Opera*, "Let us take the road." But his confederates, professional thieves, and who pursued, from habit and education, the desperate practices which Mr B—— adopted from an adventurous spirit of profligate quixotry, knew nothing at all of Gay or the *Beggar's Opera;* and, in their several confessions and testimonies, only remembered something of a *flash-song*, about "turning lead to gold." This curious circumstance, while it tends to show that the drama may affect the weak part of a mind, predisposed to evil by a diseased imagination, proves the general truth of what Johnson asserts in the *Life of Gay*, that "highwaymen and housebreakers seldom mingle in any elegant diversions; nor is it possible for any one to imagine that he may rob with safety because he sees Macheath reprieved on the stage."

This play is now chiefly remarkable as having given rise to the English opera. In this pleasing entertainment, it is understood that the plot may be light and the characters superficial, provided that the music be good and adapted to the situation, the scenes lively and possessed of comic force. Notwithstanding the subordinate nature of this species of composition, it approaches, perhaps, more closely to the ancient Grecian drama than any thing which retains possession of our stage. The subjects, indeed, are as totally different as the sublime from the light and the trivial. But, in the mixture of poetry and music, and in the frequent introduction of singing characters unconnected with the business of the piece, and therefore somewhat allied to the chorus, the English opera has some general points of resemblance with the Grecian tragedy. This species of dramatic writing was successfully practised by Bickerstaff, and has been honoured by the labours of Sheridan.

Fourth period of the English drama.

IV. With the fourth era of our dramatic history commenced a return to a better taste, introduced by the celebrated David Garrick. The imitations of French tragedy, and the tiresome uniformity of genteel comedy, were ill adapted to the display of his inimitable talent. And thus, if the last generation reaped many hours of high enjoyment from the performances of this great actor, the present is indebted to him for having led back the public taste to the dramas of Shakspeare.

Revival of the plays of Shakspeare.

The plays of this great author had been altogether forgotten, or so much marred and disguised by interpolations and alterations, that he seems to have arisen on the British stage with the dignity of an antique statue disencumbered from the rubbish in which it had been enveloped since the decay of the art. But, although Garrick showed the world how the characters of Shakspeare might be acted, and so far paved the way for a future regeneration of the stage, no kindred spirit arose to imitate his tone of composition. His supremacy was universally acknowledged; but it seemed as if he was regarded as an object of adoration, not of imitation; and that authors were as much interdicted the treading his tragic path, as the entering his magic circle. It was not sufficiently remembered that the faults of Shakspeare, or rather of his age, are those into which no modern dramatist is likely to fall; and that he learned his beauties in the school of nature, which is ever open to all who profess the fine arts. Shakspeare may, indeed, be inimitable, but there are inferior degress of excellence, which talent and study cannot fail to attain; and the statuary were much to blame who, in despair of modelling a Venus like that of Phidias, should set himself to imitate a Chinese doll. Yet such was the conduct of the dramatists of Britain long after the supremacy of Shakspeare had been acknowledged. He reigned a Grecian prince over Persian slaves; and they who adored him did not dare attempt to use his language. The tragic muse appeared to linger behind the taste of the age, and still used the constrained and mincing measure which she had been taught in the French school. Hughes, Cumberland, and other men of talent, appeared in her service; but their model remained as imperfect as ever; and it was not till our own time that any bold efforts were made to restore to tragedy that truth and passion, without which declamation is only rant and impertinence. Horace Walpole, however, showed what might be done by adopting a more manly and vigorous style of composition; and Home displayed the success of a more natural current of passion. The former, chusing a theme not only totally unfit for representation, but from which the mind shrinks in private study, treated it as a man of genius, free from the trammels of habit and of pedantry. His characters in the *Mysterious Mother* do not belong to general classes, but have bold, true, and individual features; and the language approaches that of the first age of the English drama. The *Douglas* of Home is not recommended by this species of merit. In diction and character it does not rise above other productions of the period. But the interest turns upon a passion which finds a response in every bosom; for those who are too old for love, and too young for ambition, are all alike awake to the warmth and purity of maternal and filial affection. The scene of the recognition of Douglas's birth possesses a power over the affections, which, when supported by adequate representation, is scarcely equalled in the circle of our drama. It is remarkable that the ingenious author was so partial to this theatrical situation, as to introduce it in several of his other tragedies.

Tragedy of this period.

Come of this period

The comedy of the fourth period is chiefly remarkable for exhibiting *The Rivals* and the *School for Scandal*. Critics prefer the latter, whilst the general audience reap, perhaps, more pleasure from the former; the pleasantry being of a more general cast, the incident more complicated and varied, and the whole plot more interesting. In both these plays, the gentlemanlike ease of Farquhar is united with the wit of Congreve. Indeed, the wit of Sheridan, though equally brilliant with that of his celebrated predecessor, flows so easily, and is so happily elicited by the line of the dialogue, that, in admiring its sparkles, we never once observe the stroke of the flint which produces them. Wit and pleasantry seemed to be the natural atmosphere of this extraordinary man, whose history was at once so brilliant and so melancholy. Goldsmith was, perhaps, in relation to Sheridan what Vanburgh was to Congreve. His comedies turn on an extravagance of intrigue and disguise, and so far belong to the Spanish school. But the ease of his humorous dialogue, and the droll yet true conception of the characters, make sufficient amends for an occasional stretch in point of probability. If all who draw on the spectators for indulgence were equally prepared to compensate by a corresponding degree of pleasure, they would have little occasion to complain. The elder Colman's *Jealous Wife*, and some of his smaller pieces, are worthy, and it is no ordinary compliment, of being placed beside these masterpieces. We dare not rank Cumberland so high, although two or three of his numerous efforts retain possession of the stage. *The Wheel of Fortune* was certainly one of the best acting plays of its time, but it was perhaps chiefly on account of the admirable representative which the principal character found in Mr John Kemble.

The plays of Foote, the modern Aristophanes, who ventured, by his powers of mimicking the mind as well as the external habits, to bring living persons on the stage, belong to this period, and make a remarkable part of its dramatic history. But we need not dwell upon it. Foote was an unprincipled satirist; and while he affected to be the terror of vice and folly, was only anxious to extort forbearance-money from the timid, or to fill his theatre at the indiscriminate expense of friends and enemies, virtuous or vicious, who presented foibles capable of being turned into ridicule. It is a just punishment of this course of writing, that Foote's plays, though abounding in comic and humorous dialogue, have died with the parties whom he ridiculed. When they lost the zest of personality, their popularity, in spite of much intrinsic merit, fell into utter decay.

Meantime dramatic composition of the higher class seemed declining. Garrick in our fathers' time, Mrs Siddons in ours, could neither of them extract from their literary admirers any spark of congenial fire. No part written for either of these astonishing performers has survived the transient popularity which their talents could give to almost any thing. The truth seems to be, that the French model had been wrought upon till it was altogether worn out; and a new impulse from some other quarter—a fresh turning up of the soil, and awakening of its latent energies by a new mode of culture—was become absolutely necessary to the renovation of our dramatic literature. England was destined to receive this impulse from Germany, where literature was in the first luxuriant glow of vegetation, with all its crop of flowers and weeds rushing up together. There was good and evil in the importation derived from this superabundant source. But the evil was of a nature so contrary to that which had long palsied our dramatic literature, that, like the hot poison mingling with the cold, it may in the issue bring us nearer to a state of health.

Th drama re ves a ne im- pu e from G many.

The affectation of Frederic II. of Prussia, and of other German princes, for a time suppressed the native literature, and borrowed their men of letters from France, as well as their hair-dressers,—their dramas as well as their dressed dishes. The continental courts, therefore, had no share in forming the national drama. To the highest circle in every nation that of France will be most acceptable, not only on account of its strict propriety and conformity to *les convenances*, but also as securing them against the risk of hearing bold and offensive truths uttered in the presence of the sovereign and the subject. But the bold, frank, cordial, and rough character of the German people at large did not relish the style of the French tragedies translated for their stage; and this cannot be wondered at, when the wide difference between the nations is considered.

The natural character of the Germans is diametrically opposite to that of the French. The latter are light almost to frivolity, quick in seeing points of ridicule, slowly awakened to those of feeling. The Germans are of an abstracted, grave, and somewhat heavy temper; less alive to the ridiculous, more easily moved by an appeal to the passions. That which moves a Frenchman to laughter, affects a German with sorrow or indignation; and in that which touches the German as a source of the sublime or pathetic, the quick-witted Frenchman sees only subject of laughter. In their theatres the Frenchman comes to judge, to exercise his critical faculties, and to apply the rules which he has learned, fundamentally or by rote, to the performance of the night. A German, on the contrary, expects to receive that violent excitation which is most pleasing to his imaginative and somewhat phlegmatic character. While the Frenchman judges of the form and shape of the play, the observance of the unities, and the denouement of the plot, the German demands the powerful contrast of character and passion—the sublime in tragedy and the grotesque in comedy. The former may be called the formalist of dramatic criticism, keeping his eye chiefly on its exterior shape and regular form; the latter is the fanatic, who, disregarding forms, requires a deep and powerful tone of passion and of sentiment, and is often content to surrender his feelings to inadequate motives.

G eral ch cter of e G man dr a.

From the different temper of the nations, the merits and faults of their national theatres became diametrically opposed to each other. The French author is obliged to confine himself, as we have already observed, within the circle long since described by Aristotle. He must attend to all the decorum of the scene, and conform to every regulation, whether rational or arbitrary, which has been entailed on the stage since the days of Corneille. He must never so far yield to feeling as to lose sight of grace and dignity. He must never venture so far in quest of the sublime, as to run the risk of moving the risible faculties of an audience, so much alive to the ridiculous, that they will often find or make it in what is to others the source of the grand or the terrible. The Germans, on the contrary, have never subjected their poets to any arbitrary forms. The division of the empire into so many independent states has prevented the ascendency of any general system of criticism; and their national literature was not much cultivated, until the time when such authority had become generally unpopular. Lessing had attacked the whole French theatrical system in his *Dramaturgie* with the most bitter raillery. Schiller brought forward his splendid dramas of romance and of history. Goethe crowded the stage with the heroes of ancient German chivalry. No means of exciting emotion were condemned as irregular, providing emotion was actually excited. And there can be no doubt that the license thus given to the poet, the willingness with which the audience submitted to the most extravagant postulates on their part, left them at liberty to exert the full efforts of their genius.

Lessing, Schiller, and Goethe, became at once the fathers and the masters of the German theatre; and it must be objected to these great men, that, in the abundance of their dramatic talent, they sometimes forgot that their pieces, in order to be acted, must be adapted to the capabilities of a theatre; and thus wrote plays altogether incapable of being represented. Their writings, although affording many high examples of poetry and passion, are marked with faults which the exaggeration of their followers has often carried into total extravagance. The plays of chivalry and of history were followed by an inundation of imitations, in which, according to Schlegel, "there was nothing historical but the names and external circumstances; nothing chivalrous but the helmets, bucklers, and swords; and nothing of old German honesty but the supposed rudeness. The sentiments were as modern as they were vulgar; from chivalry pieces, they were converted into cavalry plays, which certainly deserve to be acted by horses rather than men." (Schlegel *on the Drama.*)

It is not the extravagance of the apparatus alone, but exaggeration of character and sentiment, which have been justly ascribed as faults to the German school. The authors appear to have introduced too harshly, brilliant lights and deep shadows; the tumid is too often substituted for the sublime; and faculties and dispositions the most opposed to each other are sometimes described as existing in the same person.

In German comedy the same faults predominate in a much greater degree. The pathetic comedy, which might be rather called domestic tragedy, became, unfortunately, very popular in Germany; and found a champion in Kotzebue, who carried its conquests over all the Continent. The most obvious fault of this species of composition is the demoralizing falsehood of the pictures which it offers to us. The vicious are frequently presented as objects less of censure than of sympathy; sometimes they are selected as objects of imitation and praise. There is an affectation of attributing noble and virtuous sentiments to the persons least qualified by habit or education to entertain them; and of describing the higher and better educated classes as uniformly deficient in those feelings of liberality, generosity, and honour, which may be considered as proper to their situation in life. This contrast may be true in particular instances, and being used sparingly, might afford a good moral lesson; but, in spite of truth and probability, it has been assumed, upon all occasions, by these authors, as the groundwork of a sort of intellectual jacobinism; consisting, as Mr Coleridge has well expressed it, "in the confusion and subversion of the natural order of things, their causes and their effects; in the excitement of surprise, by representing the qualities of liberality, refined feeling, and a nice sense of honour in persons and in classes of life where experience teaches us least to expect them; and in rewarding with all the sympathies that are the dues of virtue, those criminals whom law, reason, and religion, have excommunicated from our esteem."

The German taste was introduced upon the English theatre within these twenty years. But the better productions of her stage have never been made known to us; for, by some unfortunate chance, the wretched pieces of Kotzebue have found a readier acceptance or more willing translators, than the sublimity of Goethe, the romantic strength of Schiller, or the deep tragic pathos of Lessing. They have tended, however, wretched as the model is, to introduce on our stage a degree of sentiment, and awaken among the audience a strain of sensibility, to which we were previously strangers.

George Coleman's comedy of *John Bull* is by far the best effort of our late comic drama. The scenes of broad humour are executed in the best possible taste; and the whimsical, yet native characters, reflect the manners of real life. The sentimental parts, although one of them includes a finely wrought up scene of paternal distress, partake of the *falsetto* of German pathos. But the piece is both humorous and affecting; and we readily excuse its obvious imperfections, in consideration of its exciting our laughter and our tears.

Joanna Baillie.

Whilst the British stage received a new impulse from a country whose literature had hitherto scarce been known to exist, she was enriched by productions of the richest native genius. A retired female, thinking and writing in solitude, presented to her countrymen the means of regaining the true and manly tone of national tragedy. She has traced its foundation to that strong instinctive and sympathetic curiosity, which tempts men to look into the bosoms of their fellow-creatures, and to seek, in the distresses or emotions of others, the parallel of their own passions. She has built on the foundations which she laid bare, and illustrated her precepts by examples which will long be an honour to the age in which they were produced and admired, yet its disgrace, when it is considered that they have been barred their legitimate sphere of influence upon the public taste.

Maturin, Coleridge, and others.

Besides this gifted person, the names of Coleridge, of Maturin, and other men of talents, throng upon our recollection; and there is one who, to judge from the dramatic sketch he has given us in *Manfred*, must be considered as a match for Æschylus, even in his sublimest moods of horror. It is no part of our plan, however, to enter upon the criticism of our contemporaries.[1] Suffice it to say, that the age has no reason to apprehend any decay of dramatic talent.

Neither can our actors be supposed inadequate to the representation of such pieces of dramatic art as we judge our authors capable of producing. We have lost Mrs Siddons and John Kemble, but we still possess ~~Kean~~, Young, and Miss O'Neil; and the stage has to boast other tragic performers of merit. In comedy perhaps it was never more strong. In point of scenery and decoration, our theatres are so amply provided, that they may rather seem to exceed than to fall short of what is required to form a classical exhibition.

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Where then are we to look for that unfortunate counterbalance, which confessedly depresses the national drama, in despite of the advantages we have enumerated? We apprehend it will be found in the monopoly possessed by two large establishments, which, unhappily for the progress of national taste, and, it is said, without any equivalent advantage to the proprietors, now enjoy the exclusive privilege of dramatic representation. It must be distinctly understood, that we attribute these disadvantages to the *system* itself, and by no means charge them upon those who have the administration of either theatre. The proprietors have a right to enjoy what the law invests in them; and the managers have probably discharged their duty to the public as honourably as circumstances would admit of; but the system has led into errors which affect public taste, and even public morals. We shall briefly consider it as it influences, 1*st*, the mode of representation; 2*dly*, the theatrical authors and performers; and, 3*dly*, the quality and composition of the audience.

The *first* inconvenience arises from the great size of the theatres, which has rendered them unfit for the legitimate purposes of the drama. The persons of the performers are, in these huge circles, so much diminished, that nothing short of the mask and buskin could render them distinctly visible to the audience. Show and machinery have therefore usurped the place of tragic poetry; and the author is compelled to address himself to the eyes, not to the understanding or feelings, of the spectators. This is of itself a gross error. Every thing beyond correct costume and theatrical decorum is foreign to the legitimate purposes of the drama, as tending to divide the attention of the audience; and the rivalry of the scene-painter and the carpenter cannot be very flattering to any author or actor of genius. Besides, all attempts at decoration, beyond what the decorum of the piece requires, must end in paltry puppet-show exhibition. The talents of the scene-painter and mechanist cannot, owing to the very nature of the stage, make battles, sieges, &c. any thing but objects of ridicule. Thus we have enlarged our theatres, so as to destroy the effect of acting, without carrying to any perfection that of pantomime and dumb show.

Secondly, The monopoly of the two large theatres has operated unfavourably both upon theatrical writers and performers. The former have been in many instances, if not absolutely excluded from the scene, yet deterred from approaching it, in the same manner as men avoid attempting to pass through a narrow wicket, which is perpetually thronged by an importunate crowd. Allowing the managers of these two theatres, judging in the first and in the last resort, to be possessed of the full discrimination necessary to a task so difficult; supposing them to be at all times alike free from partiality and from prejudice; still the number of plays thrust upon their hands must prevent their doing equal justice to all, and must frequently deter a man of real talents, either from pride or modesty, from entering a competition clogged with delay, solicitation, and other circumstances, *haud subeunda ingenio suo.* It is unnecessary to add, that increasing the number of theatres, and diminishing their size, would naturally tend to excite a competition among the managers, whose interest it is to make experiments on the public taste; and that this would infallibly secure any piece of reasonable promise a fair opportunity of being represented. It is by such a competition that genius is discovered; it is thus that horticulturists raise whole beds of common flowers, for the chance of finding among them one of those rare varieties which are the boast of their art.

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[1] This and other similar expressions, which now excite a melancholy interest, are suffered to remain, for the reason stated in the note, page 147.

The exclusive privilege of the regular London theatres is equally, or in a greater degree, detrimental to the performer; for it is with difficulty that he fights his way to a London engagement; and when once received, he is too often retained for the mere purpose of being laid aside, or *shelfed* as it is technically called; that is, rendered a weekly burden upon the pay-list of the theatre, without being produced above four or five times in the season to exhibit his talents. Into this system the managers are forced, from the necessity of their situation, which compels them to enlist in their service every performer who seems to possess buds of genius, although it ends in their being so crowded together that they have no room to blossom. In fact, many a man of talent thus brought from the active exercise of a profession, to be paid for remaining inactive in obscurity in London, and supported by what seems little short of eleemosynary bounty, either becomes careless of his business or disgusted with it; and, at any rate, stagnates in that mediocrity to which want of exercise alone will often condemn talent.

Thirdly, and especially, the magnitude of these theatres has occasioned them to be destined to company so scandalous, that persons not very nice in their taste of society must yet exclaim against the abuse as a national nuisance. We are aware of the impossibility of excluding a certain description of females from public places in a corrupt metropolis like London; but in theatres of moderate size, frequented by the better class, these unfortunate persons would feel themselves compelled to wear a mask at least of decency. In the present theatres of London, the best part of the house is openly and avowedly set off for their reception; and no part of it that is open to the public at large is free from their intrusion, or at least from the open display of the disgusting improprieties to which their neighbourhood gives rise. And these houses, raised at an immense expense, are so ingeniously misconstructed, that in the private boxes you see too little of the play, and in the public boxes greatly too much of a certain description of the company. No man of delicacy would wish the female part of his family to be exposed to such scenes; no man of sense would wish to put youth of the male sex in the way of such temptation. This evil, if not altogether arising from the large size of the theatres, has been so incalculably increased by it, that, unless in the case of strong attraction, prostitutes and their admirers usually form the principal part of the audience. We censure, and with justice, the corruption of morals in Paris. But in no public place in that metropolis is vice permitted to bear so open and audacious a front as in the theatres of London. Barefaced vice is never permitted to insult decency. Those who seek it must go to the haunts to which it is limited. In London, if we would enjoy our most classical public amusement, we are braved by her on the very threshold.

We notice these evils, without pretending to point out the remedy. If, however, it were possible so to arrange interests, that the patents of the present theatres should cover four, or even six, of smaller size, dedicated to the same purpose, we conceive that more good actors would be found, and more good plays written; and, as a necessary consequence, that good society would attend the theatre in sufficient numbers to enforce respect to decency. The access to the stage would be rendered easy to both authors and actors; and although this might give scope to some rant and false taste, it could not fail to call forth much excellence, that must otherwise remain latent or repressed. The theatres would be relieved of the heavy expense at present incurred, in paying performers who do not play; and in each maintaining three theatrical corps for the separate purposes of tragedy, comedy, and musical pieces; only one of which can be productive labourers on the same evening, though all must be supported and paid. According to our more thrifty plan, each of these companies would be earning at the same time the fruits of their professional industry. The hours of representation, in one or more of these theatres, might be rendered more convenient to those in high life, whilst the middling classes might enjoy a rational and classical entertainment after the business of the day.

Such an arrangement might indeed be objected to by those who entertain a holy horror of the very name of a theatre, and who imagine impiety and blasphemy are inseparable from the drama. We have no room left to argue with such persons, or we might endeavour to prove that the dramatic art is in itself as capable of being directed either to right or wrong purposes, as the art of printing. It is true, that even after a play has been formed upon the most virtuous model, the man who is engaged in the duties of religion will be better employed than he who is seated in a theatre, and listening to it. To those abstracted and enrapt spirits, who feel or suppose themselves capable of remaining constantly involved in heavenly thoughts, any sublunary amusement may justly seem frivolous. But the mass of mankind are not so framed. The Supreme Being, who claimed the seventh day as his own, allotted the other six days of the week for purposes merely human. When the necessity of daily labour is removed, and the call of social duty fulfilled, that of moderate and timely amusement claims its place, as a want inherent in our nature. To relieve this want, and fill up the mental vacancy, games are devised, books are written, music is composed, spectacles and plays are invented and exhibited. And if these last have a moral and virtuous tendency; if the sentiment expressed tend to rouse our love of what is noble, and our contempt of what is mean; if they unite hundreds in a sympathetic admiration of virtue, abhorrence of vice, or derision of folly; it will remain to be shown how far the spectator is more criminally engaged, than if he had passed the evening in the idle gossip of society, in the feverish pursuits of ambition, or in the unsated and insatiable struggle after gain—the graver employments of the present life, but equally unconnected with our existence hereafter. (D. D. D.)

DRAMBURG, a circle in Prussian Pomerania, in the government of Stralsund, extending over 550 square miles, and comprehending three cities, seventy-one villages, and ninety hamlets, with 21,285 inhabitants. The capital is a city of the same name, situated on the river Drage, and containing 277 houses and 1808 inhabitants, who make gloves and linen cloth.

DRAMMEN, a city of Norway, situated on the river of that name, in the province of Aggerhuus. It is an open city, well built, near a mile in length. It contains 900 houses and 5412 inhabitants. The trade consists in making leather, oil, and sailcloth; in the export of timber and iron, and in the pursuit of the fishery. There are many vessels belonging to the port, but chiefly of small tonnage.

DRAN, HENRI-FRANÇOIS LE, a celebrated French surgeon, born at Paris in 1685, was the son of a surgeon of the same name, who, while serving with the army, had been distinguished for practical dexterity in the treatment of gunshot wounds. Young Le Dran entered on the surgical career under the auspices and direction of his father, and early attained to eminence in his profession. He became surgeon-major and demonstrator of anatomy at La Charité, member of the royal academy of surgery, consulting surgeon of the camps and armies of the king, and associate of the Royal Society of London. Apart from his professional pursuits, almost no particulars of his life have been preserved. He died at Paris on the 17th October 1770, at the advanced age of eighty-five. Le Dran was the author of a variety of works on surgery, of which we shall here subjoin a very brief account. 1. *Parallèle des différentes manières de tirer la Pierre hors de la Vessie*, Paris, 1730, 1740, 8vo, with plates; translated into German, Berlin, 1737, 8vo, and into English, London, 1738, 8vo. Le Dran, in this work, condemns the small, and shows himself a partizan of the large apparatus; recommending, however, that the incision should be made a little lower than Collot had been accustomed to make it, and that it should be of an extent sufficient to prevent the dilaceration of the bladder. He approves of the high apparatus only in the case where the bladder is sound and the calculus very voluminous. In order to obviate the too frequent lesion of the rectum in using the probe described by Albinus for the lateral operation of Rau, Le Dran invented a new sound, which enabled him to avoid such a casualty, and contributed materially to his success. 2. *Observations de Chirurgerie, auxquelles on a joint plusieurs Réflexions en faveur des Etudiants*, Paris, 1731, 2 vols. 12mo: translated into German, Nuremberg, 1738, 8vo, and into English, 1739, 8vo. This collection is rich in facts well chosen, and reported with candour and precision. The author does not dissemble his faults, and speaks of his success without ostentation. 3. *Traité des opérations de Chirurgerie*, Paris, 1731 and 1742, 8vo; London, 1749, 8vo, with additions by Cheselden. This work, in which the author ascribes an imaginary influence to the animal spirits, is nevertheless valuable, as containing an accurate description of a great number of operations, and many practical facts alike curious and interesting. If a new method is spoken of, he never fails to indicate the author of the discovery. 4. *Reflexions pratiques sur les plaies d'armes à feu*, Paris, 1737, 1740, 1759, 12mo; Amsterdam, 1745, 12mo; Nuremberg, in German, 1740, 8vo. To the excellent precepts of Ambroise Paré, the author has here added the fruits of his own experience; and he has contributed to check in some cases the use, then too exclusive, of the seton. He has also advocated the method of large incisions, and justly proscribed the application of sindons or pledgets of linen soaked with brandy, in the first dressing of gunshot wounds. 5. *Suite du Parallèle de la Taille*, Paris, 1756, 8vo. 6. *Consultations sur la plupart des Maladies qui sont du ressort de la Chirurgerie*, Paris, 1765, 8vo. 7. *Traité économique de l'Anatomie du corps humain*, Paris, 1768, 12mo. This work is full of superannuated hypotheses and material omissions. 8. *Récit d'une guérison singulière du plomb fondu dans la Vessie*, and *Lettre sur la dissolution du plomb dans cet organe*, Paris, 1749. Here Le Dran gives an account of his experiments for dissolving lead by means of mercury, and evinces great credulity in attributing to mercury certain imaginary qualities. Besides the works above enumerated, a great number of interesting observations by Le Dran may be found in the *Mémoires* of the Academy. (A.)

DRASTIC, in *Physic*, an epithet bestowed on such medicines as are of present efficacy, and potent in operation. It is commonly applied to emetics and cathartics.

DRAVE, a river, which, taking its rise near Innichen, in Tyrol, on the borders of Salzburg, traverses Carinthia and Styria, and after receiving the Mur at Legrad, and separating Croatia and Sclavonia from Hungary, falls into the Danube below Essek. It is navigable from Villach in Carinthia. Some gold is collected from its bed by washing.

DRAWBACK, in commerce, certain duties, either of the customs or of the excise, allowed upon the exportation of some of our own manufactures, or upon certain foreign merchandises which have paid duty on importation. See COMMERCE.

DRAWING.

DRAWING is the art of representing forms upon a flat surface, by means of any sort of instruments, such as pencils, chalks, and the like. It is also a word used to denote the forms or contours of the figures in compositions, or in sculpture generally. Thus we say that the drawing in a picture, or the drawing of a statue, or any other figure, is of a high or an inferior kind, good or bad.

History.

This art is well known to be of the most remote antiquity, and it has been in use amongst the most barbarous and most civilized nations for a variety of purposes. The hieroglyphic figures, whether carved or painted, upon the ancient Egyptian obelisks and temples, the ornaments of the same description upon their buildings and sarcophagi, together with the like productions amongst the Mexicans, prove the ancient origin of the art. Some of the purest and best of the Egyptian sculptures, and particularly the figures of the harpers, described and illustrated by Bruce the traveller, exhibit a knowledge and correctness of taste in the art far surpassing what is usually admitted, and show that the Greek school in this, as well as in their other acquirements, was greatly indebted to the Egyptians for pointing out the road to that excellence of form and dignity of character and expression which their matchless works possess.

Greece and Rome.

Although examples of drawings by the Greeks have not come down to us, their magnificent statues assure us that their proficiency in the art must have been of the highest order; and certain expressions of Pliny, in describing their pictures, evidently indicate that the Greeks must have attained to the utmost excellence in drawing, at the period of their glory as a nation. It is not our intention to load this article with ancient historical information respecting the fine arts, otherwise many curious anecdotes might be introduced; but we cannot pass over the mention of Alexander's emotion on seeing a picture of Palamedes when betrayed by his friends, which forcibly reminded the hero of his own treatment of Aristonicus; nor can we refrain from noticing the picture of Agamemnon and Iphigenia by Timanthes, so highly extolled by Cicero Quintilian, Valerius Maximus, and Pliny, as satisfactory proofs of the excellence of the ancients in drawing and painting, as well as in their scupltures and architecture. From the emotions which the higher excellencies of the pictures by the Greek artists produced in these gifted men, a fair inference may be drawn as to the perfection to which the art must have attained at the period of Grecian glory; and consequently drawing, even in the confined sense of the word, must have also been in a corresponding state of advancement. Their principal schools were at Sicyon, Rhodes, Athens, and Corinth; and when Greece was subdued by the Romans, the conquerors, alive to the benefits to be derived from the sciences and arts, encouraged the cultivation of them in their own capital, to which the

Greek artists resorted, and laid the foundation of the Roman school.

Reval of t e finrts.

From the conquests of Alaric and Attila in the fifth century, the arts lay prostrate and neglected, until their revival about the year 1450 at Florence, where Dominico Ghirlandaio, the master of Michel Angelo, practised painting with considerable reputation, which his pictures show he well merited.

Miel Anlo.

We have now arrived at the golden age of the arts amongst the moderns, for Michel Angelo must be admitted to have been the first to discover and practise them with the classical discernment and skill which ultimately led him to the highest eminence amongst his contemporaries as a painter, a sculptor, an architect, and engineer, and deservedly placed his reputation on a level with the greatest names of antiquity. Till his time painters were considered as mere mechanics or labourers, and their employment was almost entirely confined to making representations of saints, and other figures used by the superstitious of the age. It was at this period, and surrounded by the wretched examples of such artists as Cimabue, Giotto, and others, that Michel Angelo, upon examining the torso of the Belvidere, instantly abandoned the barbarous taste and style of his master, and bounded into that sublime path which has been the admiration of all. "The poetry of the art," says Sir Joshua Reynolds, "he possessed in the most eminent degree; and the same daring spirit which first urged him to explore the unknown regions of the imagination, impelled him forward in his career beyond those limits which his followers, destitute of the same incentives, had not strength to pass. He was the bright luminary from whom painting has borrowed a new lustre, under whose hands it assumed a new appearance, and became another and superior art."

Raelle Sao.

Raffaelle Santio, the pupil of Pietro Perugino, was born on Good Friday in the year 1483, and died on Good Friday in the year 1520, so that he only lived thirty-seven years. He must be admitted to have surpassed all the moderns in drawing and painting, though his design does not possess those sublime conceptions to be found in the works of his rival Michel Angelo. Generally speaking, the choice of his subjects is simple and pleasing, for he cared not to grapple with those severe attitudes and expressions to be found in the works of his gifted contemporary; but his compositions are invariably correct and harmonious, and his drawing careful, elegant, and pure. It is to his school that we would recommend the student to look for those examples which will be of the greatest practical benefit to him in drawing; a circumstance which ought to be his first and principal aim.

It is not the proper place here to enter into the history of painting in Italy after its revival by the two great masters whose names and characteristic excellencies we have just mentioned. This we reserve for the article PAINTING; and we now proceed to explain the practical details of the management and manipulation of drawing in its various styles.

Drawing, as we have already stated, is that part of the art which represents the forms of objects upon a flat surface, and may be divided into outlining and shading; and as the chief attributes of almost all objects are embraced in the correctness of their forms, the student of art should labour with the utmost pains and assiduity in order to acquire severe accuracy in his outline, without which the most dexterous shading and finishing will be worse than thrown away.

In whatever department the genius of the student may lead him to practise, habits of correctness will be most successfully cultivated by drawing the human figure, the knowledge of which is the basis of all true excellence. The study ought to be begun by copying the most simple parts, such as we have exhibited in Plates CXC., CXCI., CXCII., CXCIII.; and the greatest anxiety to attain accuracy in the gentle undulations of form ought to be evinced. We would recommend that perspective should be studied at the earliest stage of the pupil's practice. By means of a knowledge of its rules, which are simple, much time will be spared to the student, and excellence more speedily acquired than when directed only by his eye in the practice of drawing, whatever the object may be.

Drawing in chalk.

Although it matters little what the instrument may be which is used in the practice of drawing, yet, upon the whole, we would recommend black and white chalks as the most to be preferred. They are easily procured, and convenient for use. They are usually fixed in an instrument of brass or steel, as represented below, the white chalk being placed at the one end, and the black at the other.

The paper should be slightly tinged with colour, so that the white chalk which is put upon the lights may tell properly. Crayon paper is the best. The outline being carefully made, first with charcoal as slightly as possible, and then corrected and smoothed with the black chalk, the shading may be executed as the taste of the student inclines. It may either be done with careful hatchings at particular angles, or in one solid smooth mass, or by a combination of both, which is probably the most advisable mode of practice. Too much attention to elaborate hatchings may divert the attention of the student from the more essential excellencies of the outline, and proper balance of light and shade; and a too careless manner in using his materials may lead to equal disadvantages, for in art, as in every thing else, carelessness in the beginning can never lead to excellence in the end. Much time in laying in the shadows may be spared by using an instrument called a stump, made of a piece of shamois leather rolled up in a cylindrical form, in a tight manner, tied round with thread, and shaped to a blunt point, as represented below.

A little chalk-powder may be dusted upon the shadow if extensive, and rubbed in with the instrument above described, and afterwards the part finished up with the chalk. The white chalk should not be used until the drawing is completed with the black, otherwise it is apt to get injured by admixture, which in no instance should be the case, for there ought always to be a space between the two chalks occupied by the tint of the paper.

The black chalk will be found to work very well upon white as well as coloured paper; but the process is more tedious, in consequence of all the middle or light tints having to be attended to and executed, which, in the case of the other paper, the tint produces. Errors in outline or shading may be rectified by rubbing out the defect with a piece of bread squeezed into a convenient shape between the finger and thumb.

After the student has acquired some degree of proficiency in using the chalk, and imitating any drawing or print which may be given him, he should next begin to copy from real substances, or what is technically termed drawing from "the round."

Here a wide field is opened up to him in the study of the antique statues; and while striving to attain accuracy in copying these noble reliques of art, he should consider deeply their high character and expression. It is not to be expected that a very extensive set of examples of the antique, or a discussion and detail of their merits, can be given here; all that we can do is to lead the student to the proper source whence he may draw supplies; and with this view we would recommend him to peruse and contemplate the statues of the Apollo Belvidere, the Venus de' Medici, the Gladiator Borghese, the Torso of the Belvidere, and the matchless group of the Laocoon, at the time he is copying them in the way of practice. See Plates CXCIV., CXCV., CXCVI., CXCVII., CXCVIII.

Red chalk.

We have hitherto only considered the drawing of the human figure, and that in black and white chalks. Another very good way of producing a spirited effect is, by a union of both these with red chalk, a method much practised by the old masters in their academy figures, &c.

Measurement of the human figure.

The following are the measures of the human body, as taken by Fresnoy from the ancient statues. The ancients have commonly allowed eight heads to their figures, though some of them have allowed but seven. The figure is ordinarily divided into ten faces; that is to say, from the crown of the head to the sole of the foot, in the following manner:

From the crown of the head to the forehead is the third part of a face.

The face begins at the root of the lowest hairs which are upon the forehead, and ends at the bottom of the chin.

The face is divided into three proportionable parts, the first contains the forehead, the second the nose, and the third the mouth and the chin; from the chin to the pit betwixt the collar-bones is two lengths of a nose.

From the pit betwixt the collar-bones to the bottom of the breast one face.

From the bottom of the breast to the navel one face.

From the navel to the genitories one face.

From the genitories to the upper part of the knee two faces.

The knee contains half a face.

From the lower part of the knee to the ankle two faces.

From the ankle to the sole of the foot half a face.

A man, when his arms are stretched out, is from the longest finger of his right hand to the longest finger of his left, as broad as he is long.

From one side of the breast to the other, two faces.

The bone of the arm, called humerus, is the length of two faces from the shoulder to the elbow.

From the end of the elbow to the root of the little finger, the bone called cubitus, with part of the hand, contains two faces.

From the box of the shoulder-blade to the pit betwixt the collar-bones, one face.

If you would be satisfied in the measure of breadth from the extremity of one finger to the other, so that this breadth should be equal to the length of the body, you must observe that the boxes of the elbows with the humerus, and of the humerus with the shoulder-blade, bear the proportion of half a face when the arms are stretched out.

The sole of the foot is the sixth part of the figure.

The hand is the length of a face.

The thumb contains a nose.

The inside of the arm, where the muscle disappears which makes the breast (called the pectoral muscle), to the middle of the arm, four noses.

From the middle of the arm to the beginning of the head five noses.

The longest toe is a nose long.

The utmost parts of the teats and the pit betwixt the collar-bones of a woman make an equilateral triangle.

For the breadth of the limbs no precise measures can be given, because the measures themselves are changeable, according to the quality of the persons, and according to the movement of the muscles.

The best example of the measures of an ancient statue are by Audran, an author whom Sir Joshua Reynolds recommends as being the most useful; and on this department of our subject we now add the following table of the measurements and comparisons of the three celebrated statues of the Apollo, the Venus, and the Hercules, as published by Volpato and Morghen at Rome, in a work called *Il Principi del Disegno.* To preserve uniformity in the measurements, the head of each figure is divided into twelve parts, and each part into six minutes.

	APOLLO.		VENUS.		HERCULES.	
	Parts.	Min.	Parts.	Min.	Parts.	Min.
From the beginning of the head to the root of the hairs	3	0	3	0	3	0
From the root of the hairs to the eyebrows, or beginning of the nose	3	0	3	0	3	0
From the eyebrows to the end of the nose	3	0	3	0	3	0
From the end of the nose to the bottom of the chin	3	0	3	0	3	0
From the chin to the articulation of the clavicle with the sternum	5	1	4	3½	6	0
From the clavicle to the end of the breast	9	3½	10	5	9	4
From the end of the breast to the middle of the umbilicus	10	5½	8	2	10	4
From the umbilicus to the symphysis pubis	7	4½	11	4½	8	2
From the symphysis pubis to the middle of the patella	24	0	18	2	23	3
From the middle of the patella to the beginning of the flank	28	2	27	3	30	1½
From the same to the swell of the foot	23	3½				
From the swell of the foot to the end of the figure, or to the ground	4	4				
From the patella to the ground			25	3		
From the patella to the end of the heel of the right leg					29	2½
The length of the sole of the foot	14	1½				
The highest part of the foot from the ground			3	5½	6	1½
From the instep to the end of the toes			9	0½	10	1½
From the clavicle or collar-bone to the beginning of the deltoid muscle	9	0	6	3		
The length of the whole clavicle on the right side					14	1
From the clavicle to the nipple	10	4½	6	0½	10	4
From one end of the breasts to the other	15	0	11	2	15	1½
The greatest breadth of the trunk, taken a little below the beginning of the thorax	18	3			22	4

	APOLLO.		VENUS.		HERCULES.	
	Parts.	Min.	Parts.	Min.	Parts.	Min.
The breadth of the trunk from the end of the breast			15	4½		
The narrowest part of the same, taken at the beginning of the flank	15	3	15	1	19	3½
The greatest breadth of the ossa ilei, where the flanks project most	16	4	17	5	21	1½
From the highest part of the deltoid muscle to the end of the biceps	17	0½				
From the beginning of the os humeri to the cubit			20	2	22	1½
From the end of the biceps to the beginning of the hand	16	0	14	0	15	1½
The greatest breadth of the fore-arm in front	4	5	5	0	8	2
The greatest breadth of the arm in front	5	3	4	5	6	1
Breadth of the pulse of the arm in front					5	1
The greatest breadth from one trochanter to the other	17	5	19	3	22	0
The greatest breadth of the thigh in front	9	2½	9	5		
The greatest breadth of the left thigh					11	0½
The greatest breadth of the knee opposite the middle of the patella	5	3½	5	0	6	4
The greatest breadth of the calf of the leg	6	3½	6	3½	7	5½
The greatest breadth between the inner and outer ankle	4	0½	4	0	4	3
The narrowest part of the foot	3	3	3	3	3	5
The broadest part of the same	5	0	5	1	6	4½
From the last vertebra of the neck to the lower part of the os sacrum					38	4
From the end of the os sacrum to the end of the glutæus					6	4
From the end of the glutæus to the beginning of the gastrocnemius muscle					15	4
From the beginning of the gastrocnemius to the end of the figure					30	1

In the foregoing table, we by no means have set down the ancient formula as an infallible guide, since the changes which the human form undergoes from infancy to old age preclude the possibility of limiting its measurements to definite proportions, and much depends upon the order or rank of the figure to be represented. Thus the Apollo Belvidere and the Venus de' Medici have more than ten faces in their length; and in other respects these figures, which by their authors were intended to represent divinities, are considerably different in their proportions from others of the antique statues. It is enough if something approximating to accuracy of measurement be kept in view when the student is engaged in making his drawing; and this he should do without the use of compasses or any other mathematical means, which ultimately cramp his powers of imitation, and retard his progress towards perfection.

Lig and sha, or chia oscu.

Light and shade are the means by which the actual appearance of substance in the object represented is conveyed, and they should be studied with every attention, from the objects themselves which are assumed as the models for imitation. No rules can be laid down so good as the study of nature herself, and no language can explain the beauties of her varied appearances of lights, shadows, or reflections.

It is by means of light and shade also that the figures in a picture or composition are made to keep their proper places: thus the principal figure is generally illuminated with the strongest and broadest light, and the others kept subordinate. It is with considerable diffidence, however, that we state this as the practice most to be approved of: every artist, and indeed every school, has a peculiar mode of management in this, and we are aware that a different practice has often produced excellent results.

The general rule with regard to the relative proportions of light, shadow, and middle tint in a well-ordered effect is, that there should be rather more shadow than light, and more middle tint than either of the former, provided the subject does not require a different arrangement. In the infinite variety of forms of composition of the various schools, rules for the attainment of excellence can hardly be laid down with safety; and we must on this account refer the student to the contemplation of the works of the most esteemed masters, for examples to direct him in the practice of the chiar' oscuro of his pictures.

An omy.

The study of anatomy is of the utmost importance towards a correct knowledge of the human figure, and is most beneficial in leading the way to an accurate representation of its various parts and attitudes. Without it no proper estimate can be formed of the movements of the joints of the limbs, nor of the swellings and undulations of the muscles, which, when in action, are constantly varying, and must be seized at the moment. It was by the careful study of this branch of science that Michel Angelo, Leonardo da Vinci, and other eminent artists, attained to such excellence in representing the forms when engaged in action, and displayed that accuracy of outline and show of energy which appear in the various members of their figures.

Drawing in Indian ink, sepia, bistre, &c.

The most necessary preparation for all drawings executed with Indian ink, sepia, bistre, or the like, is an accurate outline, which should be made with a black-lead pencil, or pen and ink if the work is only meant to be finished in a sketchy manner. Care must be taken in both to regulate the strength of the touch or line by the nearness or distance of the object represented. The shades should be laid in a good deal lighter at first than they are intended to be when the drawing is finished, and the hard edges of the touches softened with a water brush. The greater the attention paid to the subject as a whole in this stage, and the broader and less minute the washes are laid on, the better; for it is only as the drawing advances towards completion that the minutiæ should be attended to. In Plate CCI. we have given an example of the method of proceeding with a drawing washed in with one colour only. Fig. 1 exhibits the outline; fig. 2 the first broad wash; fig. 3 the second working; and fig. 4 the finished drawing. Each shading should be allowed to dry thoroughly before the succeeding wash is laid on; and there are many modes, we had almost said tricks, by which certain excellent effects are produced, which are only to be acquired by practice. Thus the use of a sharp pointed penknife will be found most serviceable in taking out irregularly-formed lights in the foreground; and much advantage will be found in wiping out lights and middle tints with a towel or handkerchief during the progress of the work; but regarding these no rules can be laid down. The artist must use his own discretion; though too much of such practice is not to be recommended.

The study of landscape ought to be commenced by imitating the most simple forms, as in the following figures.

Fig. 1.

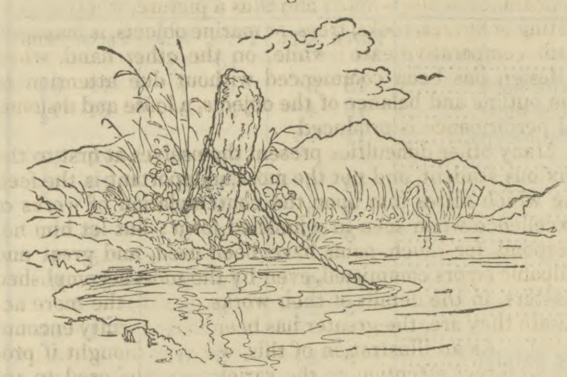


Fig. 2.

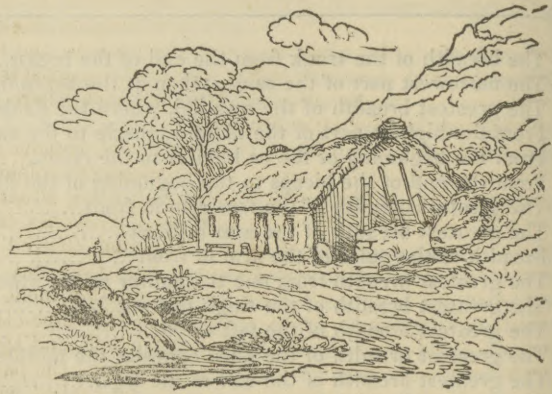


Fig. 3.

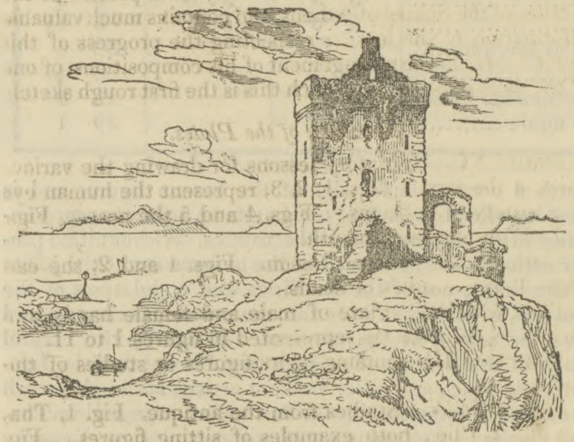
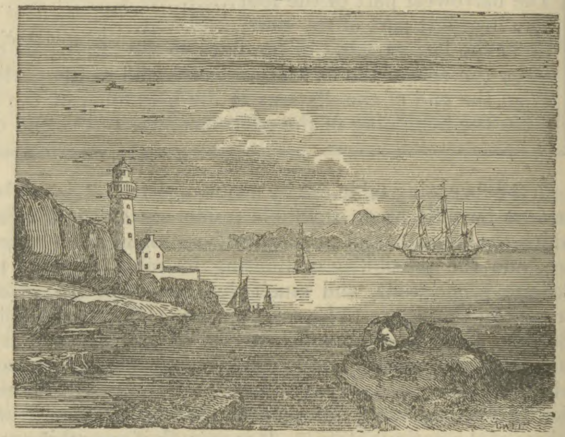


Fig. 4.



These or similar figures may be copied two or three times over before attempting such a work as we have given in Plate CCI. Plate CC. exhibits two examples of the style of sketching landscape by Claude; and we strongly recommend Turner's *Liber Studiorum* to the careful perusal of the young artist in this department. The studies of the human figure by Raffaelle, Parmegiano, and others, or their imitations by Rodgers, are the best.

Drawing in water colours.

There is no branch of the art in which such a variety of means may be adopted for attaining the same end, namely, the imitation of nature, as in water-colour drawing; consequently we shall not attempt to lay down particular rules for the guidance of the student. Practice, as we have already stated, is the only means of arriving at the wished-for perfection; we shall therefore limit our notice to a few of the details most in use among painters in water colours.

Paper.

The substances used in painting in water colours are to be had in all the shops in prepared cakes, which are rubbed down upon a stone pallet or plate with a little water. The paper upon which the drawing is to be made may be either smooth or rough; and if greasy on the surface, so that the colours do not adhere pleasantly, it may be sponged over, or the colours may be mixed with a little ox-gall, either in its native or prepared state. One drop of gall in the former condition, or the size of a large pin head in the latter, will be enough to saturate a tea-cupful of water for the purpose of mixing with or softening off the colours.

Ox gall.

Colours.

The paints chiefly used are ultra-marine blue, indigo, Antwerp and cobalt blues, gamboge, ochre, Indian, and crome yellows, Indian red, vermilion, lake, carmine, burnt ochre, and brown pink reds; and although these may be denominated the primaries out of which all other modifications of tints can be made up, yet we may add to them a number of browns which will be found to be serviceable, such as terra di sienna, both raw and burnt, Vandyke brown, umber, sepia, &c.

Pasti the p on th board fram

The paper ought to be stretched upon a drawing board or frame, which is effected by soaking it in water, or by sponging it over on both sides, then removing the superabundant water with a piece of blotting paper or towel, and afterwards folding back the edge for about an inch all round, and applying the paste to the folded portion, and also to that part of the drawing board which the paper is to adhere to. The part so pasted should be pressed strongly, or the finger may be dipped into the paste and rubbed upon the pasted edge, and then the paper sponged all over, that the pasted edge may be permitted to dry more quickly than the centre part. Care must be taken not to let any of the paste touch the middle of the paper, which would destroy the drawing when cut from the board.

Whatever may be the subject, it will be advisable to begin with light colour, and gradually work up both effect of light and shadow, and strength of tint, in a broad manner, without much attention to minutiæ, as already described in Indian ink drawing. The earlier water-colour painters were in the practice of working with a gray or neuter tint at the commencement of their drawings; and as this method is very simple, it will be the best for beginners, though in the end there will not be produced that richness of effect, and freshness, depth, and warmth of colour, which is the result of the contrary practice of the best masters of the present day; we mean the laying on of the colours almost at once, without any under preparation of neuter tint. In landscape painting, the paper where the sky is represented ought to be well soaked with water from a sponge, and afterwards dried moderately with a towel or piece of bibulous paper, to make the tints lie on

Sky.

Foreground.

more solidly. The tints are then to be blended into each other while the surface is damp, and this should be done with large brushes. After the sky and distance are laid in, the middle and foregrounds should be added, and the details worked out as the taste or ability of the artist may lead him, for it is impossible to prescribe rules where no two artists follow the same practice.

Ultramarine.

The appearance of air may be given to the distance by washes of ultramarine or other semi-transparent colours; and the spaces where sharp distinct lights are situated may be scraped out with a pen-knife, or the touches may be laid in with clean water, and after being allowed to remain upon the paper for a minute or less, they may be rubbed out with a piece of stale bread. Another mode of leaving out the lights is to touch the places with pipe-clay, used in a liquid state, with a camel's hair pencil, and after wards the colour may be freely laid over them; the parts where the clay is laid have then only to be rubbed with bread or Indian rubber, to remove the tint, and expose the clean paper. Should any error, either in outline or effect of chiar' oscuro, have been committed, the whole space can be removed with a sponge and water, without much injury to the paper; indeed many of the best artists of the present day rub out and lay in their colours almost alternately, by which means a very great variety of surface and tint is obtained which could not be effected by any other practice.

Removing of errors.

We have thus endeavoured to give what we hope will be found a satisfactory account of practical drawing, whether in chalk or water colour; and it now remains for us to recommend, for the student's careful perusal, Leonardo da Vinci *on Painting;* the works of Sir Joshua Reynolds; Burnet *on Light and Shadow in Painting, on Colour in Painting, on Composition in Painting;* the works of the old masters, whether their drawings or etchings; and, above all, the study of nature. Every one who has long been in the habit of copying from drawings alone, of whatever description, must have felt considerable diffidence in attempting to draw from real objects or from nature. This arises from the fear of being unable properly to reduce and hold in their relative place, on a sheet of paper, the objects which present themselves to the eye. To remove this obstacle, we would recommend that too much should not be attempted at the first, but the most simple subjects chosen, and these represented in a careful manner; the outline on the light side of the objects to be done in a delicate manner, and that on the shadow side in a bold style, and the shading to be also conducted upon similar principles. The most careful attention to representing the various forms should be practised in the outline, for on the accuracy of it depends the balance or fitness of the whole design or picture. By thus habituating the eye to a correct delineation of the parts, it has little difficulty in coming at the power of representing the general effect and appearance of the whole; and thus a picture, whether consisting of figures, rocks, trees, or marine objects, is managed with comparative ease; while, on the other hand, when a design has been commenced without due attention to the outline and balance of the objects, a loose and disjointed performance is produced.

Drawing from nature.

Many other difficulties present themselves at first to the anxious student, and not the most unimportant is the feeling which seizes him upon the contemplation of works of excellence when seen in a finished form; but let him not despond, for much pains have been used, and great and palpable errors committed, even by the most accomplished masters, in the details of their works, which, the more accurate they are, the greater has been the difficulty encountered. As an illustration of this, we have thought it proper to direct attention to the variety of lines used to represent the objects of Plate CXCIX., taken from a sketch by Raffaelle. The subject is the study for a portion of the picture of the School of Athens, and contains much valuable information to the learner respecting the progress of this great master in the management of his compositions, of one of the most important of which this is the first rough sketch.

Description of the Plates.

Plate CXC. Initiatory lessons for drawing the various parts of the face. Figs. 1, 2, 3, represent the human eye in a variety of positions. Figs. 4 and 5 the nose. Figs. 6, 7, 8, the nose and mouth.

Plate CXCI. Second lesson. Figs. 1 and 2, the ear. Figs. 3, 4, 5, studies of heads.

Plate CXCII. Plate of male and female hands in a variety of positions, as represented in figures 1 to 11.

Plate CXCIII. contains eight figures or studies of the human foot.

Plate CXCIV. Studies from the antique. Fig. 1, Thalia; fig. 2, Clio; both examples of sitting figures. Fig. 3, Bacchus. Fig. 4, Venus of Arles. Fig. 5, a Discobolus.

Plate CXCV. Studies from the antique. Fig. 1, Hercules and Telephus. Fig. 2, the Torso of Michel Angelo. Fig. 3, Jason. Fig. 4, the Dying Gladiator.

Plate CXCVI. Studies from the antique. Fig. 1, Venus de' Medicis. Fig. 2, Venus of the Capitol.

Plate CXCVII. Study from the antique. Fig. 1, the Apollo Belvidere.

Plate CXCVIII. Study from the antique. Fig. 1, Group of the Laocoon.

Plate CXCIX. Specimen of sketching by Raphael.

Plate CC. Specimens of sketching by Claude Lorraine.

Plate CCI. Example of the mode of conducting a drawing in Indian ink, bistre, sepia, &c., from outline to finished performance. (G. G. G.)

DRAY, a kind of cart used by brewers for carrying barrels of beer or ale; also a sledge drawn without wheels.

DRAY, among sportsmen, denotes squirrel nests built on the tops of trees.

DRAYTON, MICHAEL, an eminent English poet, was born at Harshull, in the parish of Atherston, in 1563, and was descended of an ancient family in Warwickshire. His propensity to poetry showed itself even from his infancy; and we find that his principal poems had been published, and he himself distinguished as a poet, by the time he had attained about thirty years of age. It appears from his poem of Moses's Birth and Miracles, that he was a spectator at Dover of the Spanish Armada; and it is not improbable that he was there engaged in some military employment. It is certain, indeed, that, owing both to his merit as a writer and to his valuable qualities as a man, he was held in high estimation, and warmly patronized by several personages of consequence, particularly by Sir Henry Goodere, Sir Walter Aston, and the Countess of Bedford, to the first of whom he owns himself indebted for the greater part of his education, whilst by the second he was for many years supported. Amongst his poems the most celebrated is the *Poly-Olbion*, a chorographical description of England, with its productions, antiquities, and curiosities, in dodecasyllabic verse. This he dedicated to Prince Henry, by whose encouragement it was written; and whatever may be thought of the poetry, his descriptions are allowed to be exact. In 1626 we find him styled poet-laureat in a copy of verses written in commendation of Abraham Holland; but as Ben Jonson then held that office, it is to be understood in a loose sense as a term of commendation; and, in fact, it was bestowed on others as well as Drayton, without being confined strictly to the office commonly known by that appellation. He died in 1631; and was buried amongst the poets in Westminster Abbey, where his bust is still to be seen, with an epitaph penned by Ben Jonson.

DREAMS are all those thoughts which pass through the mind, and those imaginary transactions in which we often fancy ourselves engaged when in the state of sleep.

Scarcely any part of nature is less open to our observation than the human mind in this state. The dreamer himself cannot well observe the manner in which dreams arise or disappear in his own mind. When he awakes, he cannot recollect the circumstances of his dreams with sufficient accuracy. Were we to watch over him with the most vigilant attention, we could not perceive with certainty what emotions were excited in his mind, or what thoughts passed through it, during his sleep. But though we could ascertain these phenomena, many other difficulties would still remain. What parts of a human being are active, and what dormant, when he dreams? Why does he not always dream while asleep? Or why dreams he at all? Do any circumstances in our constitution, situation, and peculiar character, determine the nature of our dreams?

In treating of this subject, we shall endeavour to lay before our readers such facts as have been ascertained concerning dreaming, together with the most plausible conjectures which have been offered to explain the phenomena of dreams.

In dreaming we are not conscious of being asleep. This is well known from a great variety of circumstances. When awake, we often recollect our dreams; and we remember, on such occasions, that whilst those dreams were passing through our minds, it never occurred to us that we were separated by sleep from the active world. Persons are often observed to act and talk in dreaming as if they were busily engaged in the intercourse of social life.

In dreaming we do not consider ourselves as witnessing or bearing a part in a fictitious scene. We seem not to be in a similar situation with the actors in a dramatic performance, or the spectators before whom they exhibit, but engaged in the business of real life. All the varieties of thought that pass through our minds when awake may also occur in dreams; all the images which imagination presents in the former state may be called up in the latter; the same emotions may be excited, and we are often actuated by equal violence of passion; none of the transactions in which we are capable of engaging whilst awake is impossible in dreams; in short, our range of action and observation is as wide in the one state as in the other; and whilst dreaming, we are not sensible of any distinction between our dreams and the events and transactions in which we are actually concerned in our intercourse with the world.

It is said that all men are not liable to dream. Dr Beattie, in a very pleasing essay on this subject, relates that he knew a gentleman who never dreamed except when his health was in a disordered state; and Locke mentions that a certain person of his acquaintance was almost a stranger to dreaming until the twenty-sixth year of his age, when he began to dream in consequence of having had a fever. These instances, however, are too few, and we have not been able to obtain more; and, besides, it does not appear that those persons had always attended, with the care of a philosopher making an experiment, to the circumstances of their sleep. They might dream, but not recollect their dreams on awaking; and they might both dream and recollect their dreams immediately upon awaking, yet afterwards suffer the remembrance of them to slip out of their memory. We do not advance this, therefore, as a certain fact concerning dreaming; we are rather inclined to consider it as a mistake. But though it appears to be by no means certain that any of the human race are throughout the whole of life absolute strangers to dreaming; yet it is well known that all men are not equally liable to dream. The same person dreams more or less at different times; and as one person may be more exposed than another to those circumstances which promote this exercise of fancy, one person may therefore dream more than another. The same diversity will naturally take place in this as in other accidents to which mankind are in general liable.

Though in dreams imagination appears to be free from all restraint, and indulges in the most wanton freaks, yet it is generally agreed that the imaginary transactions of the dreamer bear always some relation to his particular character in the world, his habits of action, and the circumstances of his life. The lover, we are told, dreams of his mistress, the miser of his money; the philosopher renews his researches in sleep often with the same pain and fatigue as when awake; and even the merchant at times returns to balance his books, and computes the profits of an adventure, when slumbering on his pillow. And not only do the more general circumstances of a person's life influence one's dreams; the passions and habits are nearly the same when asleep as when awake. A person whose habits of life are virtuous, does not in his dreams plunge into a series of crimes; nor are the vicious reformed when they pass into this imaginary world. The choleric man finds himself offended by slight provocations in his dreams as well as in his ordinary intercourse with the world; and a mild temper continues pacific even in sleep.

The character of a person's dreams is influenced by his circumstances when awake in a still more unaccountable manner. Certain dreams usually arise in the mind after a person has been in certain situations. Dr Beattie relates that once, after riding thirty miles in a high wind, he passed a part of the succeeding night in dreams beyond description terrible. The state of a person's health, and the manner in which the vital functions are carried on, have a considerable influence in determining the character of dreams. After too full a meal, or after eating of an unusual sort of food, a person is very apt to be harassed with uncomfortable dreams.

In dreaming, the mind for the most part carries on no intercourse through the senses with surrounding objects. Touch a person gently who is asleep, and he feels not the impression. You may awake him by a smart blow; but when the stroke is not sufficiently violent to awake him, he remains insensible of it. We speak softly beside a person asleep, without fearing that he will overhear us. His eyelids are shut; and even though light should fall upon the eyeball, yet still his powers of vision are not wakened to active exertion, unless the light be strong enough to rouse him from sleep. He is insensible both to sweet and to disagreeable smells. It is not easy to try whether his organs of taste retain their activity, without awakening him; yet from analogy it may be presumed that these too are inactive. With respect to the circumstances here enumerated, it is indifferent whether a person be dreaming or buried in deep sleep.

Yet there is one remarkable fact concerning dreaming, which may appear contradictory of what has been here asserted. In dreams we are liable not only to speak aloud in consequence of the suggestions of imagination, but even to get up and walk about, and engage in little enterprises, without awaking. Now, as we are in this instance so active, it seems that we cannot be then insensible of the presence of surrounding objects. The sleep-walker is really sensible in a certain degree of the presence of the objects around him; but he does not attend to them with all their circumstances, nor do they excite in him the same sensations as if he were awake. He feels no terror on the brink of a precipice, and in consequence of being free from fear, he is also without danger in such a situation, unless suddenly awaked. This is one of the most inexplicable phenomena of dreaming.

There is also another fact not quite consonant with what has been above mentioned. It is said that in sleep a person will continue to hear the noise of a cataract in the neighbourhood, or regular strokes with a hammer, or any similar sound sufficiently loud, and continued uninterruptedly from before the time of his falling asleep. We know not whether he awakes on the sudden cessation of the noise; but the fact is asserted on apparently sufficient evidence, and it is curious. Even when awake, if very deeply intent on any piece of study, or closely occupied in business, the sound of a clock striking in the neighbourhood, or the beating of a drum, will escape us unnoticed; and it is therefore the more surprising that we should thus continue sensible to sounds when asleep.

Not only do a person's general character, habits of life, and state of health, influence his dreams; but those concerns in which he has been most deeply interested during the preceding day, and the views which have arisen most frequently to his imagination, very often afford the subjects of his dreams. When we look forward with anxious expectation towards any future event, we are likely to dream either of the disappointment or the gratification of our wishes. If we have been engaged throughout the day either in business or amusements which we have found exceedingly agreeable, or in a way in which we have been extremely unhappy, either our happiness or our misery is likely to be renewed in our dreams.

Though dreams have been regarded amongst almost all nations of the world, at some periods of their history, as prophetic of future events, yet it does not appear that this popular opinion has ever been established on any good grounds. Christianity, indeed, teaches us to believe that the Supreme Being may, and actually does, operate on our minds, and influence at times the determinations of our will, without making us sensible of the restraint to which we are thus subjected; and, in the same manner, no doubt, the suggestions which arise to us in dreams may be produced. The imaginary transactions in which we are then engaged may be such as are actually to occupy us in life; the strange and seemingly incoherent appearances which are presented to the mind's eye in our dreams, may allude to some events which are to befall ourselves or others. It is therefore by no means impossible, or inconsistent with the general analogy of nature, that dreams should have a respect to futurity. We have no reason to regard the dreams related in the Holy Scriptures as not inspired by Heaven, nor to laugh at the idea of a prophetic dream as absurd or ridiculous. At the same time, a mind which, during its waking hours, is filled with anxious thoughts and presentiments of the future, may reproduce these forebodings in its dreams, when the imagination acts over again the scenes of the past day, embellished and diversified with its own peculiar colouring; and as, from the mere law of probabilities, the actual result must sometimes correspond with the anticipative vision, and the dream be realised by the event, the apparent prophetic intimation is thus as much the consequence of natural causes and of the ordinary workings of the mind, as any of the phenomena which it exhibits. To accident alone is to be ascribed that correspondence which, among the uneducated or the unreflecting portion of mankind, passes for divination by means of supernatural agency; and though the cases where it occurs are necessarily few, compared with those in which the event falsifies the prognostications of the dreamer, yet being calculated to make a much stronger impression on the mind, they are remembered, whilst the others are forgotten; and hence the exception is, by a natural transition, converted into the rule.

Yet it would be too much to allow to dreams all that importance which has been ascribed to them by the priesthood among heathens, or by the vulgar among ourselves. We know how easily ignorance imposes on itself, and what arts imposture adopts to impose upon others. We cannot trace any certain connection between our dreams and those events to which the simplicity of the vulgar pretends that they refer. And we cannot, therefore, if disposed to confine our belief to certain or probable truths, join with the vulgar in believing them really referrible to futurity.

It appears that the brutes are also capable of dreaming. The dog is often observed to start suddenly up in his sleep, in a manner which cannot be accounted for in any other way than by supposing that he is roused by some impulse received in a dream. The same thing is observable of others of the inferior animals. That they should dream, is not an idea inconsistent with what we know of their economy and manners in general. We may therefore consider it as a pretty certain truth, that many, if not all, of the lower species are liable to dream, as well as human beings.

It appears, then, that in dreaming we are not conscious of being asleep; that to a person dreaming, his dreams seem realities; that although it be uncertain whether mankind are all liable to dream, yet it is well known that they are not all equally liable to dream; that the nature of a person's dreams depends in some measure on his habits of action, and on the circumstances of his life; that the state of the health, too, and the manner in which the vital functions are carried on, have a powerful influence in determining the character of a person's dreams; that in sleep and in dreaming, the senses are either absolutely inactive, or nearly so; that such concerns as we have been very deeply interested in during the preceding day, are very likely to return upon our minds in dreams in the hours of rest; that dreams may be rendered prophetic of future events; that therefore, wherever we have such evidence of their having been prophetic as we would accept on any other occasion, we cannot reasonably reject the fact on account of its absurdity; that, however, they do not appear to have been actually such, in those instances in which the superstition of nations ignorant of true religion has represented them as referring to futurity, nor in those instances in which they are viewed in the same light by the vulgar among ourselves; and, lastly, that dreaming is not a phenomenon peculiar to human nature, but common to mankind with the brutes.

We scarcely know of any other facts that have been fully ascertained concerning dreaming. But we are by no means sufficiently acquainted with this important phenomenon in the history of mind. We cannot tell by what laws of our constitution we are thus liable to be so frequently engaged in imaginary transactions, nor what are the particular means by which the delusion is accomplished. The delusion is indeed remarkably strong. One will sometimes have a book presented to him in a dream, and fancy that he reads; and actually enter into the nature of the imaginary composition before him, and even remember, after he awakes, what he knows that he only fancied himself reading. Can this be delusion? If delusion, how or for what purposes is it produced? The mind, it would appear, does not, in sleep, become inactive like the body, or at least is not always inactive while we are asleep. When we do not dream, the mind must either be inactive, or the connection between the mind and the body must be considered as in some manner suspended; and, when we dream, the mind, though it probably acts in concert with the body, yet does not act in the same manner as when we are awake. It seems to be clouded or bewildered, in consequence of being deprived for a time of the service of the senses. Imagination becomes more active and more capricious; and all the other powers, especially judgment and memory, get disordered and irregular in their operation.

Various theories have been proposed to explain what appears here most inexplicable. Mr Baxter, in his treatise on the immateriality of the human soul, endeavours to prove that dreams are produced by the agency of some spiritual beings, who either amuse or employ themselves seriously in engaging mankind in all those imaginary transactions with which they are employed in dreaming. This theory, however, is far from being plausible. It leads us entirely beyond the limits of our knowledge; it requires us to believe without evidence; it is unsupported by any analogy; and it creates difficulties still more inexplicable than those which it has been proposed to remove. Until it be made to appear that our dreams cannot possibly be produced without the interference of spiritual agents, possessing such influence over our minds as to deceive us with fancied joys, and to involve us in imaginary afflictions, we cannot reasonably refer them to such a cause. Besides, from the facts which have been stated as well known concerning dreams, it appears that their nature depends both on the state of the human body and on that of the mind. But were they owing to the agency of other spiritual beings, how could they be influenced by the state of the body with reference to health or sickness, fasting or repletion? They must be a curious set of spiritual beings who depend in such a manner on the state of our corporeal frame. Better not to allow them existence at all, than to place them in such a dependence.

Wolfius, and after him Formey, have supposed that dreams never arise in the mind, except in consequence of some of the organs of sensation having been previously excited. Either the ear or the eye, or the organs of touching, tasting, or smelling, communicate information in a tacit and secret manner, and thus partly rouse its faculties from the lethargy in which they are buried in sleep, and engage them in a series of confused and imperfect exertions. But what passes in dreams is so very different from all that we do when awake, that it is impossible for the dreamer himself to distinguish whether his powers of sensation perform any part on the occasion. It is not necessary that imagination should be always excited by immediate sensation. Fancy, even when we are awake, often wanders from the present scene. Absence of mind is incident to the studious; the poet and the mathematician many times forget where they are. We cannot discover from any thing that a person in dreaming displays to the observation of others, that his organs of sensation take part in the imaginary transactions in which he is employed. In those instances, indeed, in which persons asleep are said to hear sounds, the sounds which they hear are said also to influence in some manner the nature of their dreams. But such instances are singular. Since then it appears that the person who dreams is himself incapable of distinguishing, either during his dreams, or by recollection when awake, whether any new impressions are communicated to him in that state by his organs of sensation; that even by watching over him, and comparing our observations of his circumstances and emotions in his dreams with what he recollects of them after awaking, we cannot, except in one or two singular instances, ascertain this fact; and that the mind is not wholly incapable of acting while the organs of sensation are at rest, and on many occasions refuses to listen to the information which they convey; we may without hesitation conclude that the theory of Wolfius and Formey has been too hastily and incautiously advanced.

Other physiologists tell us that the mind when we dream is in a state of *delirium*. Sleep, they say, is attended with what is called a collapse of the brain; during which either the whole or a part of the nerves of which it consists are in a state in which they cannot carry on the usual intercourse between the mind and the organs of sensation. When the whole of the brain is in this state, we become entirely unconscious of existence, and the mind sinks into inactivity; when only a part of the brain is collapsed, as they term it, we are then neither asleep nor awake, but in a sort of delirium between the two. This theory, like that last mentioned, supposes the mind incapable of acting without the help of sensation; it supposes that we know the nature of a state of which we cannot ascertain the phenomena; and it contradicts a well-known fact, in representing dreams as confused images of things around us, instead of fanciful combinations of things not existing together in nature or in human life. For these reasons it must be held as wholly inadmissible.

Of all the writers who have treated of this subject, however, Mr Dugald Stewart is perhaps the only one who, by concentrating the lights of a sound philosophy on the results of refined and accurate observation, has been enabled to classify the phenomena of dreams, and to introduce the order of science into a department of speculative inquiry where fancy had previously reigned paramount. "Dreams," says Mr Addison, "look like the relaxations and amusements of the soul when she is disencumbered of her machine; her sports and recreations when she has laid her charge asleep. The soul is clogged and retarded in her operations when she acts in conjunction with a companion that is so heavy and unwieldy in its motions; but in dreams she converses with numberless beings of her own creation, and is transported into ten thousand scenes of her own raising. She is herself the theatre, the actor, and the beholder." This description, which is not more beautiful than true, will serve to convey some idea of the difficulties of disentangling mental operations necessarily so complex, and of keeping steadily in view the threefold character or agency which the mind exhibits in dreaming; and as the only approximation which has yet been made towards the accomplishment of so interesting an object is contained in Mr Stewart's section on the application of the principles and laws of association to explain the phenomena of dreaming (*Elements of the Philosophy of the Human Mind*, vol. i. p. 327, sixth edition, Lond. 1818, 8vo), we conceive that we cannot do better than subjoin this exquisite specimen of philosophical acuteness and discrimination, in the author's own beautiful language.

"With respect to the phenomena of dreaming," says Mr Stewart, "three different questions may be proposed. First, what is the state of the *mind* in sleep? or, in other words, what faculties then continue to operate, and what faculties are then suspended? Secondly, how far do our dreams appear to be influenced by our bodily sensations; and in what respects do they vary, according to the different conditions of the body in health and in sickness? Thirdly, what is the change which sleep produces on those parts of the *body* with which our mental operations are more immediately connected; and how does this change operate, in diversifying, so remarkably, the phenomena which our minds then exhibit, from those of which we are conscious in our waking hours? Of these three questions, the first belongs to the philosophy of the human mind; and it is to this question that the following inquiry is almost entirely confined. The second is more particularly interesting to the medical inquirer, and does not properly fall under the plan of this work. The third seems to me to relate to a subject which is placed beyond the reach of the human faculties.

"It will be granted, that, if we could ascertain the state of the mind in sleep, so as to be able to resolve the various phenomena of dreaming into a smaller number of general principles; and still more, if we could resolve them into one general fact; we should be advanced a very important step in our inquiries upon this subject; even although we should find it impossible to show in what manner this change in the state of the mind results from the change which sleep produces in the state of the body. Such a step would at least gratify, to a certain extent, that disposition of our nature which prompts us to ascend from particular facts to general laws, and which is the foundation of all our philosophical researches; and, in the present instance, I am inclined to think that it carries us as far as our imperfect faculties enable us to proceed.

"In conducting this inquiry with respect to the state of the mind in sleep, it seems reasonable to expect, that some light may be obtained from an examination of the circumstances which accelerate or retard its approach; for when we are disposed to rest, it is natural to imagine that the state of the mind approaches to its state in sleep more nearly than when we feel ourselves alive and active, and capable of applying all our various faculties to their proper purposes.

"In general, it may be remarked, that the approach of sleep is accelerated by every circumstance which diminishes or suspends the exercise of the mental powers, and is retarded by every thing which has a contrary tendency. When we wish for sleep, we naturally endeavour to withhold, as much as possible, all the active exertions of the mind, by disengaging our attention from every interesting subject of thought. When we are disposed to keep awake, we naturally fix our attention on some subject which is calculated to afford employment to our intellectual powers, or to rouse and exercise the active principles of our nature.

"It is well known that there is a particular class of sounds which compose us to sleep. The hum of bees, the murmur of a fountain, the reading of an uninteresting discourse, have this tendency in a remarkable degree. If we examine this class of sounds, we shall find that it consists wholly of such as are fitted to withdraw the attention of the mind from its own thoughts; and are, at the same time, not sufficiently interesting to engage its attention to themselves.

"It is also matter of common observation, that children, and persons of little reflexion, who are chiefly occupied about sensible objects, and whose mental activity is in a great measure suspended as soon as their perceptive powers are unemployed, find it extremely difficult to continue awake when they are deprived of their usual engagements. The same thing has been remarked of savages, whose time, like that of the lower animals, is almost completely divided between sleep and their bodily exertions.

"From a consideration of these facts, it seems reasonable to conclude, that in sleep those operations of the mind are suspended which depend on our volition; for if it be certain, that before we fall asleep, we must withhold, as much as we are able, the exercise of all our different powers, it is scarcely to be imagined that, as soon as sleep commences, these powers should again begin to be exerted. The more probable conclusion is, that when we are desirous to procure sleep, we bring both mind and body as nearly as we can into that state in which they are to continue after sleep commences. The difference, therefore, between the state of mind when we are inviting sleep, and when we are actually asleep, is this, that in the former case, although its active exertions be suspended, we can renew them if we please. In the other case, the will loses its influence over all our powers both of mind and body, in consequence of some physical alteration in the system, which we shall never probably be able to explain.

"In order to illustrate this conclusion a little farther, it may be proper to remark, that if the suspension of our voluntary operations in sleep be admitted as a fact, there are only two suppositions which can be formed concerning its cause. The one is, that the power of volition is suspended; the other, that the will loses its influence over those faculties of the mind, and those members of the body, which, during our waking hours, are subjected to its authority. If it can be shown then that the former supposition is not agreeable to fact, the truth of the latter seems to follow as a necessary consequence.

"1. That the power of volition is not suspended during sleep, appears from the efforts which we are conscious of making while in that situation. We dream, for example, that we are in danger, and we attempt to call out for assistance. The attempt indeed is in general unsuccessful, and the sounds which we emit are feeble and indistinct; but this only confirms, or rather is a necessary consequence of the supposition that, in sleep, the connexion between the will and our voluntary operations is disturbed or interrupted. The continuance of the power of volition is demonstrated by the effort, however ineffectual.

"In like manner, in the course of an alarming dream, we are sometimes conscious of making an exertion to save ourselves, by flight, from an apprehended danger; but in spite of all our efforts we continue in bed. In such cases we commonly dream that we are attempting to escape, and are prevented by some external obstacle; but the fact seems to be, that the body is at that time not subject to the will. During the disturbed rest which we sometimes have when the body is indisposed, the mind appears to retain some power over it; but as, even in these cases, the motions which are made consist rather of a general agitation of the whole system, than of the regular exertion of a particular member of it, with a view to produce a certain effect, it is reasonable to conclude that, in perfectly sound sleep, the mind, although it retains the power of volition, retains no influence whatever over the bodily organs.

"In that particular condition of the system which is known by the name of *incubus*, we are conscious of a total want of power over the body; and I believe the common opinion is, that it is this want of power which distinguishes the *incubus* from all the other modifications of sleep. But the more probable supposition seems to be, that every species of sleep is accompanied with a suspension of the faculty of voluntary motion; and that the *incubus* has nothing peculiar in it but this, that the uneasy sensations which are produced by the accidental posture of the body, and which we find it impossible to remove by our own efforts, render us distinctly conscious of our incapacity to move. One thing is certain, that the instant of our awaking, and of our recovering the command of our bodily organs, is one and the same.

"2. The same conclusion is confirmed by a different view of the subject. It is probable, as was already observed, that when we are anxious to procure sleep, the state into which we naturally bring the mind approaches to its state after sleep commences. Now it is manifest that the means which nature directs us to employ on such occasions, is not to suspend the power of volition, but to suspend the exertion of those powers whose exercise depends on volition. If it were necessary that volition should be suspended before we fall asleep, it would be impossible for us by our own efforts to hasten the moment of rest. The very supposition of such efforts is absurd, for it implies a continued will to suspend the acts of the will.

"According to the foregoing doctrine with respect to the state of the mind in sleep, the effect which is produced on our mental operations is strikingly analogous to that which is produced on our bodily powers. From the observations which have been already made, it is manifest that in sleep the body is, in a very inconsiderable degree, if at all, subject to our command. The vital and involuntary motions, however, suffer no interruption, but go on as when we are awake, in consequence of the operation of some cause unknown to us. In like manner, it would appear that those operations of the mind which depend on our volition are suspended, while certain other operations are at least occasionally carried on. This analogy naturally suggests the idea that *all* our mental operations which are independent of our will may continue during sleep, and that the phenomena of dreaming may perhaps be produced by these, diversified in their apparent effects, in consequence of the suspension of our voluntary powers.

"If the appearances which the mind exhibits during sleep are found to be explicable on this general principle, it will possess all the evidence which the nature of the subject admits of.

"It was formerly shown that the train of thought in the mind does not depend *immediately* on our will, but is regulated by certain general laws of association. At the same time it appeared, that among the various subjects which thus spontaneously present themselves to our notice, we have the power of singling out any one that we chuse to consider, and of making it a particular object of attention; and that by doing so we not only can stop the train that would otherwise have succeeded, but frequently can divert the current of our thoughts into a new channel. It also appeared that we have a power (which may be much improved by exercise) of recalling past occurrences to the memory by a voluntary effort of recollection.

"The *indirect* influence which the mind thus possesses over the train of its thoughts is so great, that during the whole time we are awake, excepting in those cases in which we fall into what is called a reverie, and suffer our thoughts to follow their natural course, the order of their succession is always regulated more or less by the will. The will, indeed, in regulating the train of thought, can operate only (as I already showed) by availing itself of the established laws of association; but still it has the power of rendering this train very different from what it would have been if these laws had taken place without its interference.

"From these principles, combined with the general fact which I have endeavoured to establish with respect to the state of the mind in sleep, two obvious consequences follow. First, that when we are in this situation, the succession of our thoughts, in so far as it depends on the laws of association, may be carried on by the operation of the same unknown causes by which it is produced while we are awake; and, secondly, that the order of our thoughts in these two states of the mind must be very different; inasmuch as in the one it depends solely on the laws of association; and in the other, on these laws combined with our own voluntary exertions.

"In order to ascertain how far these conclusions are agreeable to truth, it is necessary to compare them with the known phenomena of dreaming; for which purpose I shall endeavour to show, first, that the succession of our thoughts in sleep is regulated by the same general laws of association to which it is subjected while we are awake; and, secondly, that the circumstances which discriminate dreaming from our waking thoughts are such as must necessarily arise from the suspension of the influence of the will.

"I. That the succession of our thoughts in sleep is regulated by the same general laws of association which influence the mind while we are awake, appears from the following considerations.

"1. Our dreams are frequently suggested to us by bodily sensations; and with these it is well known, from what we experience while awake, that particular ideas are frequently very strongly associated. I have been told by a friend, that having occasion, in consequence of an indisposition, to apply a bottle of hot water to his feet when he went to bed, he dreamed that he was making a journey to the top of Mount Ætna, and that he found the heat of the ground almost insupportable. Another person, having a blister applied to his head, dreamed that he was scalped by a party of Indians. I believe every one who is in the habit of dreaming will recollect instances, in his own case, of a similar nature.

"2. Our dreams are influenced by the prevailing temper of the mind, and vary in their complexion according as our habitual disposition at the time inclines us to cheerfulness or to melancholy. Not that this observation holds without exception; but it holds so generally, as must convince us that the state of our spirits has some effect on our dreams as well as on our waking thoughts. Indeed, in the latter case, no less than in the former, this effect may be counteracted or modified by various other circumstances.

"After having made a narrow escape from any alarming danger, we are apt to awake in the course of our sleep with startings, imagining that we are drowning, or on the brink of a precipice. A severe misfortune, which has affected the mind deeply, influences our dreams in a similar way, and suggests to us a variety of adventures analogous in some measure to that event from which our distress arises. Such, according to Virgil, were the dreams of the forsaken Dido.

"3. Our dreams are influenced by our prevailing habits of association while awake.

"In a former part of this work I considered the extent of that power which the mind may acquire over the train of its thoughts; and I observed that those intellectual diversities among men, which we commonly refer to peculiarities of genius, are at least in a great measure resolvable into differences in their habits of association. One man possesses a rich and beautiful fancy, which is at all times obedient to his will. Another possesses a quickness of recollection, which enables him at a moment's warning to bring together all the results of his past experience, and of his past reflections, which can be of use for illustrating any proposed subject. A third can without effort collect his attention to the most abstract questions in philosophy; can perceive at a glance the shortest and the most effectual process for arriving at the truth; and can banish from his mind every extraneous idea which fancy or casual association may suggest to distract his thoughts or to mislead his judgment. A fourth unites all these powers in a capacity of perceiving truth with an almost intuitive rapidity, and in an eloquence which enables him to command at pleasure whatever his memory and fancy can supply to illustrate and to adorn it. The occasional exercise which such men make of their powers may undoubtedly be said, in one sense, to be unpremeditated or unstudied; but they all indicate previous *habits* of meditation or study, as unquestionably as the dexterity of the expert accountant, or the rapid execution of the professional musician.

"From what has been said, it is evident that a train of thought which in one man would require a painful effort of study, may in another be almost spontaneous; nor is it to be doubted that the reveries of studious men, even when they allow, as much as they can, their thoughts to follow their own course, are more or less connected together by those principles of association which their favourite pursuits tend more particularly to strengthen.

"The influence of the same habits may be traced distinctly in sleep. There are probably few mathematicians who have not dreamed of an interesting problem, and who have not even fancied that they were prosecuting the investigation of it with much success. They whose ambition leads them to the study of eloquence are frequently conscious, during sleep, of a renewal of their daily occupations; and sometimes feel themselves possessed of a fluency of speech which they never experienced before. The poet in his dreams is transported into Elysium, and leaves the vulgar and unsatisfactory enjoyments of humanity, to dwell in those regions of enchantment and rapture which have been created by the divine imaginations of Virgil and of Tasso.

"As a farther proof that the succession of our thoughts in dreaming is influenced by our prevailing habits of association, it may be remarked, that the scenes and occurrences which most frequently present themselves to the mind while we are asleep are the scenes and occurrences of childhood and early youth. The facility of association is then much greater than in more advanced years; and although during the day the memory of the events thus associated may be banished by the objects and pursuits which press upon our senses, it retains a more permanent hold of the mind than any of our subsequent acquisitions; and, like the knowledge which we possess of our mother tongue, is, as it were, interwoven and incorporated with all its most essential habits. Accordingly, in old men, whose thoughts are in a great measure disengaged from the world, the transactions of their middle age, which once seemed so important, are often obliterated; while the mind dwells, as in a dream, on the sports and the companions of their infancy.

"I shall only observe farther, on this head, that in our dreams, as well as when awake, we occasionally make use of words as an instrument of thought. Such dreams, however, do not affect the mind with such emotions of pleasure and of pain, as those in which the imagination is occupied with particular objects of sense. The effect of philosophical studies, in habituating the mind to the almost constant employment of this instrument, and, of consequence, its effect in weakening the imagination, was formerly remarked. If I am not mistaken, the influence of these circumstances may also be traced in the history of our dreams, which in youth commonly involve in a much greater degree the exercise of imagination, and affect the mind with much more powerful emotions, than when we begin to employ our maturer faculties in more general and abstract speculations.

"II. From these different observations we are authorized to conclude, that the same laws of association which regulate the train of our thoughts while we are awake, continue to operate during sleep. I now proceed to consider how far the circumstances which discriminate dreaming from our waking thoughts, correspond with those which might be expected to result from the suspension of the influence of the will.

"1. If the influence of the will be suspended during sleep, all our voluntary operations, such as recollection, reasoning, &c. must also be suspended.

"That this really is the case, the extravagance and inconsistency of our dreams are sufficient proofs. We frequently confound together times and places the most remote from each other; and, in the course of the same dream, conceive the same person as existing in different parts of the world. Sometimes we imagine ourselves conversing with a dead friend, without remembering the circumstance of his death, although perhaps it happened but a few days before, and affected us deeply. All this proves clearly that the subjects which then occupy our thoughts are such as present themselves to the mind spontaneously, and that we have no power of employing our reason in comparing together the different parts of our dreams, or even of exerting an act of recollection, in order to ascertain how far they are consistent and possible.

"The processes of reasoning in which we sometimes fancy ourselves to be engaged during sleep, furnish no exception to the foregoing observation; for although every process, the first time we form it, implies volition, and, in particular, implies a recollection of the premises till we arrive at the conclusion, yet when a number of truths have been often presented to us as necessarily connected with each other, this series may afterwards pass through the mind according to the laws of association, without any more activity on our part than in those trains of thought which are the most loose and incoherent. Nor is this mere theory. I may venture to appeal to the consciousness of every man accustomed to dream, whether his reasonings during sleep do not seem to be carried on without any exertion of his will, and with a degree of facility of which he was never conscious while awake. Mr Addison, in one of his Spectators, has made this observation; and his testimony, in the present instance, is of the greater weight, that he had no particular theory on the subject to support. 'There is not,' says he, 'a more painful action of the mind than invention, yet in dreams it works with that ease and activity that we are not sensible when the faculty is employed. For instance, I believe every one, some time or other, dreams that he is reading papers, books, or letters; in which case the invention prompts so readily, that the mind is imposed on, and mistakes its own suggestions for the composition of another.' No. 487.

"2. If the influence of the will during sleep be suspended, the mind will remain as passive, while its thoughts change from one subject to another, as it does during our waking hours, while different perceptible objects are presented to our senses.

"Of this passive state of the mind in our dreams it is unnecessary to multiply proofs, as it has always been considered as one of the most extraordinary circumstances with which they are accompanied. If our dreams as well as our waking thoughts were subject to the will, is it not natural to conclude, that in the one case, as well as in the other, we would endeavour to banish, as much as we could, every idea which had a tendency to disturb us, and detain those only which we found to be agreeable? So far, however, is this power over our thoughts from being exercised, that we are frequently oppressed, in spite of all our efforts to the contrary, with dreams which affect us with the most painful emotions. And, indeed, it is matter of vulgar remark, that our dreams are, in every case, involuntary on our part, and that they appear to be obtruded on us by some external cause. This fact appeared so unaccountable to the late Mr Baxter, that it gave rise to his very whimsical theory, in which he ascribes dreams to the immediate influence of separate spirits on the mind.

"3. If the influence of the will be suspended during sleep, the *conceptions* which we then form of sensible objects will be attended with a belief of their real existence, as much as the *perception* of the same objects is while we are awake.

"In treating of the power of Conception, I formerly observed, that our belief of the separate and independent existence of the objects of our perceptions, is the result of experience; which teaches us, that these perceptions do not depend on our will. If I open my eyes, I cannot prevent myself from seeing the prospect before me. The case is different with respect to our conceptions. While they occupy the mind, to the exclusion of every thing else, I endeavoured to shew that they are always accompanied with belief; but as we can banish them from the mind, during our waking hours, at pleasure, and as the momentary belief which they produce is continually checked by the surrounding objects of our perceptions, we learn to consider them as fictions of our own creation, and, excepting in some accidental cases, pay no regard to them in the conduct of life. If the doctrine, however, formerly stated with respect to conception be just, and if, at the same time, it be allowed that sleep suspends the influence of the will over the train of our thoughts, we should naturally be led to expect, that the same belief which accompanies perception while we are awake, should accompany the conceptions which occur to us in our dreams. It is scarcely necessary for me to remark, how strikingly this conclusion coincides with acknowledged facts.

" May it not be considered as some confirmation of the foregoing doctrine, that when opium fails in producing complete sleep, it commonly produces *one* of the effects of sleep, by suspending the activity of the mind, and throwing it into a reverie; and that while we are in this state, our conceptions frequently affect us nearly in the same manner as if the objects conceived were present to our senses?

" Another circumstance with respect to our conceptions during sleep deserves our notice. As the subjects which we then think upon occupy the mind exclusively, and as the attention is not diverted by the objects of our external senses, our conceptions must be proportionably lively and steady. Every person knows how faint the conception is which we form of any thing with our eyes open, in comparison of what we can form with our eyes shut; and that in proportion as we can suspend the exercise of all our other senses, the liveliness of our conception increases. To this cause is to be ascribed, in part, the effect which the dread of spirits in the dark has on some persons who are fully convinced in speculation that their apprehensions are groundless; and to this also is owing the effect of any accidental perception in giving them a momentary relief from their terrors. Hence the remedy which nature points out to us when we find ourselves overpowered by imagination. If every thing around us be silent, we endeavour to create a noise by speaking aloud or beating with our feet; that is, we strive to divert the attention from the subjects of our imagination by presenting an object to our powers of perception. The conclusion which I draw from these observations is, that as there is no state of the body in which our perceptive powers are so totally unemployed as in sleep, it is natural to think that the objects which we conceive or imagine must then make an impression on the mind beyond comparison greater than any thing of which we can have experience while awake.

" From these principles may be derived a simple, and, I think, a satisfactory explanation of what some writers have represented as the most mysterious of all the circumstances connected with dreaming; the inaccurate estimates we are apt to form of time while we are thus employed—an inaccuracy which sometimes extends so far as to give to a single instant the appearance of hours, or perhaps of days. A sudden noise, for example, suggests a dream connected with that perception; and the moment afterwards this noise has the effect of awaking us; and yet during that momentary interval a long series of circumstances has passed before the imagination. The story quoted by Mr Addison (*Spectator*, No. 94) from the Turkish Tales, of the miracle wrought by a Mahometan doctor to convince an infidel sultan, is in such cases nearly verified.

" The facts I allude to at present are generally explained by supposing that, in our dreams, the rapidity of thought is greater than while we are awake; but there is no necessity for having recourse to such a supposition. The rapidity of thought is at all times such, that in the twinkling of an eye, a crowd of ideas may pass before us to which it would require a long discourse to give utterance; and transactions may be conceived which it would require days to realize. But in sleep the conceptions of the mind are mistaken for realities; and therefore our estimates of time will be formed, not according to our experience of the rapidity of thought, but according to our experience of the time requisite for realizing what we conceive. Something perfectly analogous to this may be remarked in the perceptions we obtain by the sense of sight. When I look into a show-box, where the deception is imperfect, I see only a set of paltry daubings of a few inches diameter; but if the representation be executed with so much skill as to convey to me the idea of a distant prospect, every object before me swells in its dimensions, in proportion to the extent of space which I conceive it to occupy; and what seemed before to be shut up within the limits of a small wooden frame, is magnified, in my apprehension, to an immense landscape of woods, rivers, and mountains.

" The phenomena which we have hitherto explained take place when sleep seems to be complete; that is, when the mind loses its influence over *all* those powers whose exercise depends on its will. There are, however, many cases in which sleep seems to be partial; that is, when the mind loses its influence over *some* powers, and retains it over others. In the case of the *somnambuli*, it retains its power over the limbs, but it possesses no influence over its own thoughts, and scarcely any over the body, excepting those particular members of it which are employed in walking. In madness, the power of the will over the body remains undiminished, while its influence in regulating the train of thought is in a great measure suspended, either in consequence of a particular idea, which engrosses the attention, to the exclusion of every thing else, and which we find it impossible to banish by our efforts, or in consequence of our thoughts succeeding each other with such rapidity that we are unable to stop the train. In both of these kinds of madness, it is worthy of remark, that the conceptions or imaginations of the mind becoming independent of our will, they are apt to be mistaken for actual perceptions, and to affect us in the same manner."

Some very beautiful fables have been written both by ancients and moderns in the form of dreams. The *Somnium Scipionis*, for instance, is perhaps one of the finest of Cicero's compositions. He who shall carefully peruse this piece, with Macrobius's commentary thereupon, will undoubtedly acquire a considerable knowledge of ancient philosophy. In the periodical publications which early diffused so much elegant and useful knowledge throughout Britain, the Tatlers, Spectators, Guardians, and the like, we find a number of excellent dreams. Addison excelled in this line of writing; his Vision of Mirza is a masterpiece of its kind. But the public are now less partial to this species of composition than they formerly were: writings purely imaginative, having ceased to be relished, are no longer produced.

DREDGING,

Is a term used to express the important operation in the practice of the engineer, of removing deposited matters from the beds of navigable rivers, harbours, canals, and basins.

The process of silting.

In describing the several methods by which dredging has been successfully employed, it is not our intention to enter into geological discussions regarding the ultimate tendency of the process of deposition; but we cannot allow it to pass without at least hinting at its original cause, a knowledge of which may lead the inexperienced practitioner more readily to the proper means of removing an evil so generally complained of in our most secure and sheltered harbours. If the universal tendency to waste and decay in the higher lands, from the agency of moisture, heat, and frost, be considered, we shall find that every rill of water must carry along with it a portion of separated matter. These rivulets being so many tributary streams to the great rivers which form the drainage of vast tracts of country, we need not be surprised to find that the beds and embouchures of the Scheldt, the Meuse, the Rhine, and the Elbe, or of the Thames, the Humber, the Tay, and other great tributaries to the German Ocean, should be variously silted up; and that even this great basin itself should be much encumbered by numerous banks of deposited matters. To the agency of these, combined with the effects of cross-running tides, we ascribe the existence of the Dogger Banks, the Yarmouth Sands, the Flemish Banks, and even the great platforms of Holland, and the opposite planes of the Fens of Lincoln.

There is also a marked difference to be noticed in the separation and distribution of these matters of deposition. In those rivers which flow with a very gentle current toward the sea, fine silt, or what is sometimes termed ouse, is produced; while rivers of greater fall, and consequently of more velocity, carry forward the grosser particles proportionally farther from their embouchures. Another circumstance which deserves our notice is the greater specific gravity of salt water than fresh, which (as has been ascertained by the writer of this article, on the Dee at Aberdeen, and other rivers where he has made observations) preserve their course in distinct films, the salt water under the fresh. The salt water thus flows up the courses of the respective rivers to an extent corresponding to the fall of their beds and the rise of the tide. A considerable portion of the heavier matters, as gravel and sand, are arrested in their progress sea-ward, where the current is languid; while the lighter particles floating at or near the surface are either borne along with the stream into the expanse of the ocean, or settle in the eddy-waters. In this way the projecting obstacles along the margin are formed, and thus accumulate in the form of sand banks and small islets; the creeks and sinuosities are also silted up, and too often render the connecting harbours and shipping places so shallow, as to be unfit for the purposes of floating ships of burden. To such a degree has this been experienced in some situations, as, for example, Sandwich in Kent, that this ancient sea-port is left almost in the state of an *inland town;* while other ports have been more or less deteriorated. Importance is therefore justly attached to such means as may be instrumental in counteracting or preventing the tendency of this process of silting. We shall accordingly direct the attention of our readers to some of those means, both natural and artificial.

Natural means of dredging.

Where recourse can be had to natural means in keeping a navigable channel clear, they will always be found preferable to those which are artificial. The great agent laid to our hand by nature for this purpose is the judicious use and application of the drainage waters of the connecting district, and the preservation of the full and ample flow of the tide waters. But in many instances these means are tampered with, and rendered ineffectual, by the reckless thirst of acquiring land at the expense or by the exclusion of the back-waters arising from the flow of the tide. Notwithstanding all that can be said by professional men upon the subject, this practice prevails in many parts of the united kingdom to a frightful extent. With a view to put a stop to this, an act (in which the late eminent engineer Mr Rennie, and the writer of this article, had some connection) which originated with the admiralty, was passed in 1806, entitled "An act for the preservation of public harbours of the united kingdom," Geo. III. cap. 153. But this act wants amendment, and has been rarely acted upon, especially to the extent contemplated by Earl Grey, then Lord Harwich, and first lord of the admiralty.

Montrose basin.

In noticing the natural means of cleaning harbours, we cannot perhaps better illustrate the subject than by reference to Montrose, in Forfarshire, where some of the conterminous proprietors have from time to time proposed to make firm ground of part of the great natural basin connected with the harbour of that port. This basin is flooded every tide to the extent of about five square miles, and is estimated, especially in spring-tides, to contain about fifty-five millions of cubic yards of the back-waters of the tide, which passing four times in the twenty-four hours through this harbour, produces so powerful a current that the shifting sand-bank at the entrance, called the Annet, is prevented from being thrown across the mouth of it in gales of easterly wind. In this state of the weather the Annet-bank has a continual tendency westward, while the back-waters of this great natural basin check its progress, and not only keep the navigation open, but are sufficient to preserve a considerable depth in it during the lowest tides.

Lake Lothing.

In the course of forming the bold design of opening a harbour near Lowestoffe, and carrying an inland navigation to the mercantile city of Norwich, Mr Cubit the engineer projected an entrance to this harbour, with a pair of gates measuring fifty feet in width, and of a depth so considerable that their ground-sill is sunk about twelve feet under low water of spring-tides, the rise of which upon this coast is very limited: the gates are laid at this depth, so as to be capable of receiving the largest class of mercantile ships. They are also ingeniously contrived for letting off the head-waters of Lake Lothing. This extensive sheet of water, which pervades a great portion of the lower district of Suffolk, is to be used as back-water to scour and keep the entrance of the harbour open against the effects of storms from the east sea acting upon the sand banks which so much encumber this part of the coast. This great work is only in the progress of being executed, but very sanguine expectations are entertained of its success.

The river Clyde.

In the improvement of the navigation of the river Clyde, the means resorted to have been those of narrowing the channel and confining the current; and these have been so successful that a depth of about ten feet has been obtained, instead of only five feet as formerly, by which the trade and commerce of the city of Glasgow derive the most decided advantages. Formerly only barges came up to the city, now sea-borne ships from all quarters of the globe are seen at its quays. But in forming a design upon the principle of narrowing the channel of a river, and thereby shutting out a portion of the tide waters, several elements connected with the local circumstances of the place require to be carefully weighed before attempting to lessen the capacity or water-way of a river. Much depends on the level or rise of the bed of the river, the perpendicular rise of the tide on the coast, the situation of its embouchure, and other circumstances which favourably and fortunately present themselves upon the Clyde. The application of the steam tug-boat, in towing vessels through narrow channels, has removed objections of the most serious nature upon this navigation.

Ballyshannon harbour.

Many other circumstances might be adduced to show the advantages of supplying the natural means in our power to the scouring of navigable tracks. The writer of this article has now (1833) under consideration the improvement of the harbour of Ballyshannon, in the county of Donegal, which possesses the natural means to an immense extent of clearing its embouchure, having almost the entire drainage waters of the county of Fermanagh collected in Lough Erne, which extend to about fifty miles in length, and in some places three miles in breadth, the entire overflow of which passes over the bar of Ballyshannon harbour.

Artificial means of dredging.

Ramsgate.

The most eminent engineers, both of our own country and of France, have introduced scouring basins into their designs of tide harbours. Mr Smeaton constructed a tide-basin of this kind at Ramsgate in Kent, where the silt of the outer harbour is loosened by artificial means, and dredged into the tracks or courses of water issuing from the sluices of an artificial tide-basin. By this means a considerable portion of the deposited stuff is carried out of the harbour into deep water. It is, however, to be regretted that there is not a more extensive collection of back-waters here, as, from its very circumscribed position, that eminent engineer was prevented from enlarging his scouring basin to a sufficient extent to ensure the best effects of his design.

Dover.

At Dover there is a good example of artificial scouring upon a small scale. This harbour is often choked up in a single tide. with the debris of the heights of Dover, and with the flinty gravel which surrounds this coast. Upon these occasions, the back-waters of an adjoining basin are conducted in great cast-iron pipes of about three feet in diameter. The water issuing from these pipes is made to act upon a system of temporary weirs, consisting of deal-boards set on edge, which are shifted about at pleasure in different directions, so as to bring the water from the sluices to bear upon the gravel; and it is astonishing with what facility the entrance to this harbour is by these means cleaned and rendered accessible to the packets, from a state of being quite shut up.

Liverpool docks.

In extensive plans of docks for floating ships much use is or may be made of a system of soughs or sluices for scouring or floating away mud. By opening these sluices from one dock into another, as is done by Mr Hartley, engineer for the Liverpool docks, the advantages of such a command of *head-water* is attended with the most beneficial effects, both for clearing the several docks, and also the outer harbours or receiving basins of this great port.

Dredging implements, &c.

The common plough and harrow, differing very little from their ordinary construction, and also a kind of frame of timber shod with plate iron, and provided with stilts or handles somewhat like a great shovel, are often used for loosening and dredging stuff within reach of removal by a stream of back-water, with which it is afterwards floated out of the respective harbours or navigable tracks. These and various other simple implements, suited to local circumstances, are sometimes employed by manual labour, and also with horse power, where the bottom is sufficiently firm to admit of the necessary trackage. Nor must we omit to mention the use of the common wheelbarrow and spade so much used in operations of this kind.

The spoon dredging apparatus, with its boat, as represented in Plate CCV., fig. 13, is of long standing, and was probably first used by the Dutch, who still apply it extensively. It is also much employed upon the river Thames, for lifting ballast and deepening the navigation of that greatest of all commercial rivers. Referring to fig. 13, the reader will at once comprehend the construction and application of this simple apparatus. The boats for this purpose vary in size according to the situation in which they are to be worked, say from twenty to sixty tons burden. They are built to float upon an easy draught of water, and are sometimes flush-decked, carrying their cargo wholly upon deck; but for the greater part, and especially those of the larger size, they are in the state of open boats, with a kind of inner sole or floor. When the excavated matters are not to be employed in banking on the sides of the river, or ballasting ships, the boat is formed with a kind of hopper-hold, somewhat upon the principle of the fishing smacks with wells, being convenient for getting quit of the stuff in deep water. In this case a hold of two compartments, one fore and one aft, are formed, as represented by the dark shading and dotted lines in fig. 13. Each of these hoppers has an aperture or opening in the bottom, through which the stuff is dropped by the flap-door, marked letter A, as represented in the figure. In some circumstances, also, the stuff is received into a system of sheet-iron boxes, and lifted out of the boat by a tackle, to be emptied. The spoon or shovel, marked letter B, which accompanies these boats, consists of a strong ring or hoop of malleable iron, the cutting part of which is of steel, and is about six or seven feet in circumference, properly formed for dredging upon soft mud or gravelly ground. To this ring a large bag made of bullocks' hide, but more generally of tanned leather, is strongly attached with thongs. The bag is perforated with a number of small holes for allowing the water to drain off, and its capacity may be about four or five cubic feet. A pole of from thirty to forty feet in length is fixed to the spoon, or rather two poles are so laid together with hoops and rings as to be lengthened or shortened at pleasure, to suit the depth of water in which the apparatus is required to work. A rope is also attached to the bottom of the bag, for directing its position at the commencement of each operation. This apparatus is generally worked with a chain or rope, brought from the spoon to a winch, worked with wheel and pinion, through a block suspended from a small crane used for hauling the bag and its contents along with the progress of the boat, and in lifting the spoon over the gunwale to be emptied into the hopper of the boat. The purchase-rope is led along the deck to the winch, by a snatch-block placed in a proper direction for this purpose. The boat is moored at the head and stern, and its berth may be shifted at pleasure. These boats are generally managed and worked with from two to four men, who with this simple apparatus can lift in a tide from twenty to sixty tons of stuff from the bottom, at the depth of two and a half or three fathoms, when the ground is somewhat loose, and favourable for the operation. In Holland this apparatus, and all these simple modes of dredging, are much practised upon the extensive flats at the entrance of their great navigable rivers, in connection with the sluices and natural currents issuing from their extensive basins and canals. On the British coast, dredging, when carried on to any extent, is now confined chiefly to the spoon and bucket machines; and here steam, wherever it can be applied, is the great moving power. In Holland the excavated matter is very generally of a mossy description, which, after being strongly compressed in moulds by that industrious people, is in a state to be speedily used as turf fuel. On the Thames the spoon dredging machine is conducted upon a large scale, and in the most systematic manner, under the immediate direction of the Trinity Board. The stuff brought from the bottom consists chiefly of mud and gravel. This is not only a useful operation for deepening and preserving the navigation, but the stuff itself is sold to good advantage as ballast for shipping. To such an extent is this carried, that the colliers, or shipping from London to Newcastle, have raised ballast hills in the neighbourhood of Shields, which from their vast extent have become objects of no small curiosity.

B ket d lging m hine.

In proportion as the commerce of a country extends, its ships increase in their dimensions, and a greater depth of water is consequently required to float them; and hence greater difficulty and expense attends the construction and preservation of harbours for their accommodation. To effect these objects, and especially to obtain a greater depth of water, recourse has been had to various means, such as the extension of piers, the formation of breakwaters, and deepening by means of the process of dredging now described. These simple modes have, however, been succeeded by a still more powerful engine termed the bucket dredging machine.

Since the date of the last edition of this work, very considerable improvements have been effected in the system of dredging, both by the application of the power of steam, and the form and construction of the apparatus itself, as well as that of the vessel containing it. The machine is said to have been first worked by men only: when the principles upon which it acts were more fully ascertained, horses were employed, and worked round a covered gin-track or circular path within the boat. A machine of this description, worked by horse power, was used for some years at the port of Greenock, though it was there ultimately found more suitable and expedient to resort to manual labour, applied by crane-work with wheel and pinion. Perhaps, in all situations where fuel is very expensive, and where the work is not of sufficient extent for the full employment of steam, it will be found better, in a process of this kind, to employ manual labour than horses, which, from the circumscribed and hampered nature of the track on board of the vessel, must be very disadvantageous, as experience has shown on the Clyde. Indeed, the only question seems to be, in such cases where steam cannot be profitably employed, whether it were not better to use the spoon apparatus, as upon the Thames, where manual labour is at the highest rate.

In this article we shall give a minute detail of one of the best and latest constructed dredging machines, employed by Messrs Gibb upon the harbour works of Aberdeen. This machine was entirely constructed by Messrs John Duffus and Company of that port, both as regards the vessel and the machinery. In describing it we refer to Plates CCIV. and CCV. Fig. 1, Plate CCIV., represents a longitudinal section of the vessel, exposing to view an elevation of the steam-engine and bucket apparatus, with its framework. The ground to be dredged is also shown, with the buckets in contact, and the attendant barge astern. Fig. 2 is a plan of the vessel and machinery. Her extreme length as taken by measurement is ninety feet, and the extreme breadth twenty-two feet; the length of the ark or well which contains the bucket-frame is fifty-four feet, and its width four feet one inch in the clear. The after-part of the vessel being thus formed into two compartments, these are connected at the stern by four strong timbers, placed across the well, and immediately above the keel. Upon these, timbers are placed in sloping directions for supporting the planking. This vessel draws only four feet of water, but the bucket frame can be lowered so as to dredge in a depth of fifteen feet. The steam engine is of the usual form of marine condensing engines; the diameter of the cylinder is twenty-four inches, and the length of the stroke thirty-one inches, being equal to the power of about sixteen horses. From the nature of the process of dredging, the resistance is extremely irregular, causing violent shocks; and therefore malleable instead of cast iron is used as much as possible in the construction of the moving parts. For the same reason a heavy fly-wheel becomes necessary, to regulate the motion. As a vessel of this description, in a tide harbour, must frequently get aground in places where it is unequal, the whole machinery is liable to be strained. On this account it is necessary that all pipes connected with the engine should be of copper, and for the same reason every facility is given for disengaging the parts of the machinery, to prevent fracture or derangement. From the corrosive nature of the stagnant water in harbours, which must be used for condensing, it is necessary to line or case the air-pump with copper or brass, and also to make the buckets, air-pump, valves, and rod, of the same metal. It has been observed that cast iron wastes more rapidly when exposed to the action of this harbour-water than in the open sea.

Subjoined are the dimensions of some of the principal parts of the engine. These, to the practical engineer, may hardly seem to be necessary; but as the Aberdeen machine has been found to answer every expectation, and as it appears to the writer to be similar to those so successfully employed on the river Clyde, it may be of consequence to the general reader to know, from such data, the proper strength and size for its different parts. This engine is set upon a cast-iron cistern, measuring three feet in width, and prolonged as far as to contain the air-pump, foot-valve, and condenser. The cistern and cylinder, set on the top, are strongly bolted down through the bottom of the vessel. On the top of the cistern the columns of support for the fly-wheel shaft are set at a sufficient height to connect with the dredge-gearing, which is stayed by a circular entablature, as represented in the plan of the engine at letter *a*. It has also a diagonal stay, securely bolted to a bracket, cast on the side of the cylinder. The side levers of the engine are seven feet eight and a fourth inches long; between centres one and three-fourth inches thick of plate, and three and three-fourth inches thick on the back; fifteen inches broad in the middle, with forked ends one and three-fourth inches thick, for laying hold of the cross-rail and cylinder side-rods. The cylinder cross-head is seven and a half inches deep at the middle, tapering to four inches where the side-rods are attached, and five and a fourth inches in diameter at the eye, and two inches in thickness. The cross-head of the air-pump is four and a half inches diameter at the eye, five and a half inches deep, and one and three-fourth inches thick. The cylinder side-rods are two and one-eighth inches diameter at each end, and two and two-eighth inches at the middle. The side-rods of the air-pump are finished with forked ends, for embracing the side-lever centre on each side, and fitted with straps and braces. The main centres are four and five-eighth inches diameter, keyed into the side levers. The parallel motion is constructed with radius and parallel boxes, as is usual in this description of engine. The connecting-rod is of malleable iron, three inches diameter at both ends, and three and three-fourth inches at the centre, fitted into the eye of the cross-tail with a gib and cutter. The fly-wheel is ten feet three inches in diameter, and eight inches deep by four inches broad in the rim, as represented in dotted lines upon the cross section of the vessel, fig. 3, Plate CCV., and at fig. 1, Plate CCIV. The shaft is of cast iron, seven and three-fourth inches diameter. The engine is also provided with a governor and its necessary connections, and is driven from the fly-wheel shaft by means of a pulley and belt.

The boiler, marked *c*, fig. 1, Plate CCIV., is of iron, measuring ten feet four inches across the end, eight feet four inches long, and four feet eight inches in height in the middle, with two furnaces two feet three inches wide. The water-ways between the flues are four inches wide, and the flues fifteen and a half inches, making one and a half turns in the length of the boiler. The sides and tops of the furnaces, the bottoms and sides of the flues, are three eighths of an inch thick, and the top half an inch in thickness. The copper steam-pipes are of the thickness No. 10 on the wire-guage, the funnel *a* of the engine is two feet in diameter and twenty-five feet in height, made of plate-iron an eighth of an inch in thickness.

Fig. 3, Plate CCV., represents a cross section of the vessel accurately drawn to the scale, showing its outline, and the manner in which it is constructed. The machinery is supported upon the three keels ABC of the vessel by their respective keelsons, or beams placed immediately over them. The bottom of the vessel is further supported by the like means, DD. The central keel extends only to the fore part of the ark or well. This cross section also exhibits an elevation of the train of wheels for raising and lowering the bucket-frame. From the main spur-wheel on the lying shaft, marked E, fig. 3, Plate CCV., down to the lowest wheel on the same shaft, with the chain-barrel, marked L, the connection is in the following order. The main spur-wheel is of that description called a mortise-wheel: it is eight feet in diameter, constructed in a very ingenious manner, to revolve upon a friction nave as follows: The nave is three feet seven inches in diameter, smoothly turned on the circumference, and fixed to the lying shaft with keys. The wheel is also particularly turned in the eye to coincide with the nave, and is furnished with eight pincing plates and screws marked *f*, for tightening it at pleasure, and made to pass with sufficient force upon the nave, in order to carry the spur-wheel round in its fair work along with it; but if overstrained, it immediately slips, and thereby any injurious consequences to the apparatus are prevented. The cogs or teeth of this wheel are made of hard wood; all the teeth of the other wheels are made of cast iron. The spur-pinion *g*, the half of which only is shown, is on the same shaft with the fly, as is also the small spur-wheel *h*. The pinion *g* works in the main spur-wheel, and is three feet six inches in diameter. The small spur-wheel *h*, the half of which only is shown, connects the engine and the other wheels for working the chain-barrel: it is three feet seven and a half inches in diameter, and works in the wheel *i*, measuring four feet two and three fourth inches in diameter. On the shaft of the last-mentioned wheel, which is four and an eighth inches square, there is fixed a pinion *j*, of one foot three inches diameter, working in the wheel K, which is three feet eleven inches in diameter; and on the same shaft there is fixed a wheel *l*, two feet six inches in diameter, working in another wheel L, which is four feet ten inches in diameter: it is fixed upon the shaft that carries the purchase chain-barrel, and is the last wheel of the train. The barrel of cast iron, Plate CCIV., fig. 1 and 2, measures five feet ten inches in length within the flanges, two feet in diameter, and two feet eight inches over the flanges. It makes six and one tenth revolutions in one minute, being equal to thirty-eight strokes of the piston. This barrel is provided with an offset-clutch, for engaging and disengaging it from the engine, for the purpose of raising and lowering the bucket-frame; and as a precaution against accident, this clutch is provided with a friction-nave similar to that already described for the main spur-wheel. This becomes indispensably necessary in situations like that of Aberdeen, where tree-roots, stones, or the like, obstruct the buckets. The machinery would otherwise run great risk of being torn in pieces and destroyed. This barrel is also provided with a brake-wheel and friction-hoop, for lowering or fixing the bucket-frame to any required depth. This is effected by means of a weight constantly acting over a pulley at the extremity of the lever *s*, Plate CCIV. fig. 1, for pressing the friction-hoop upon the circumference of the brake-wheel with force sufficient to hold the bucket-frame in any position. But when this weight is partially removed, which is done by the hand, the bucket-frame is lowered to the intended depth at the discretion of the master of the vessel, or person who has charge of the work. The upper tumbler is square, as shown in fig. 1, Plate CCV. and in the vertical section, fig. 2, showing the flange and part of the body of the tumbler. In the original form it is cast in one piece, the body being an octagonal prism, and is afterwards brought to the square form by bolting the triangular bars *a* on the alternate sides. Fig. 12 represents the upper end of the bucket-frame, the shaft M which carries the tumbler N, and the great bevelled-wheel O, which is shown in section; also a view of one of the buckets P attached to the links QQ of the bucket-chain. RR are the plumber-blocks, and SS the brackets for supporting the shaft. Fig. 4 is a cross section of the under tumbler of the bucket-frame, which is five sided: *a* is the flange, *b* the strong studs to which the tumbler bars are bolted, *c* the tumbler bars, and *d* the bolts by which they are secured. Fig. 5 is a vertical section of the flange, with the same letters of reference, showing the method of fixing the tumbler bars. The lying shaft is of cast iron, in five lengths, as represented in the longitudinal section, Plate CCIV. fig. 1. It is six and a half inches in diameter; the second length of the shaft is furnished with an offset clutch at *m*, for disengaging the bucket-frame without stopping the engine. This clutch is put into and out of gear by the lever *n*; but the clutch is more particularly shown in Plate CCV. fig. 6 and 7. The coupling-boxes for the lying shaft are fifteen inches long by one and three fourth inches thick, fastened together by four screwed bolts of one and a fourth inch square.

The bucket-frame, with its train of buckets, as represented in Plate CCIV. fig. 1, is fifty-two feet in length between the centres of the lower and upper tumbler shafts. The frame is of the best oak timber, each side being of one entire piece. The buckets, one of which is represented in Plate CCV., fig. 8, are perforated in the back and bottom with small holes for draining off the water. They measure one foot nine inches in depth, one foot two inches in width from back to breast at the bottom, and one foot five inches at the mouth; the breadth from side to side is two feet two inches. The mouth-piece or cutting edge *a* is of tempered steel; *b* is a side view of the double link connected with the bucket. Fig. 9 is an edge view of this link, fig. 10 a side view of the single link, and fig. 11 an edge view of it. These links are twenty-one inches long from centre to centre, three inches in breadth by two in thickness, with a ring of steel one fourth of an inch in thickness welded into the eye of each. The bolts for the chain are two inches in diameter, coated with steel. The weight of each double link is about 84 lbs. and of each single link about 44 lbs. The trussing rod for the bucket-frame, marked *tt*, Plate CCIV. fig 1, is three inches in breadth by one and a fourth inch in thickness, meeting in the centre, and forming a breadth of seven inches. The friction rollers along the upper side of the bucket-frame are ten in number, as shown in the longitudinal section; they are seven inches in diameter, with a flange measuring twelve inches in diameter. The bucket-frame is lowered and regulated upon the ground to be dredged by a tackle formed by two three-sheaved iron blocks, with 185 feet of three-fourth inch chain run through them for a tackle-fold. This tackle is suspended from a frame of cast iron, as shown at O, Plate CCIV., fig. 1, and is represented in dotted lines at P. It is attached to the bucket-frame by a malleable iron cross-bar and two side rods, the other end being attached to the cast-iron barrel already described. The iron ties marked *xx,* Plate CCIV., fig. 1, of which there are four, are used, along with the vertical beam, for supporting the extremity of the bucket-frame: they are of malleable iron, measuring five eighths of an inch in diameter.

The dredging vessel is moored with anchors of two and a half cwt. each, and is moved in any required direction when dredging, by means of four winches of cast iron, viz. one of double power on each bow of the vessel, having a five-eighth inch chain of 300 feet in length, with couplings, and one single-power crab on each quarter, with two iron leading-locks, having also 300 feet of half-inch chain. This vessel and its apparatus requires nine men to work it; when dredging in clean gravel it will discharge into the receiving-barges at the rate of 120 tons per hour; the period for working is regulated by the tides, but generally about four hours is obtained each tide, or eight hours per day, which is equal to 960 tons. But when the machine works upon a clayey bottom, about sixty tons per hour may be taken as the average quantity lifted; and when the stuff is mixed with gravel and stones, the quantity is still less. It is not uncommon with the buckets to take up stones of upwards of one hundredweight, and occasionally the roots of large trees.

In some instances the receiving barges are built with a hold for carrying their load, especially where the mud or sleek is thin. It is received into plate-iron tanks, fitted so as to fill the hold. (Tanks of this description, which contain about one ton each, are used at the harbour works of Dundee.) They are fitted with ears or handles, and are lifted out of the boat by a tackle, and emptied into ships as ballast, or they are landed on the quay to be otherwise disposed of. But where these excavated matters are not found necessary for the purposes of the port, they are thrown into deep water, for accomplishing which the barges are furnished with a copper-hold and flap-doors in the bottom, for letting off the stuff, as shown in Plate CCIV., fig. 13.

Though we have not been able to trace the invention of the bucket-dredging machine to any particular person, yet we believe it is strictly of British origin, and, so far as our information goes, was first used at the port of Hull in the Humber. It may here be curious to remark, that Jonathan Hulls was of that place; he obtained a British patent for working vessels by steam in 1735, although, strange to say, it was not introduced into practice till 1812, when the late Mr Henry Bell fitted out the canal steam-boat upon the Clyde. Since that period the steam dredging machine has come into very general use. On the Clyde there are now no fewer than three such vessels as we have described employed, besides a diving bell for the removal of large boulder stones, which in various parts obstruct that navigation. The engines and apparatus used on the Clyde are chiefly of the manufacture of Messrs Girdwood and Berry of Glasgow.

The dredging machine delineated in Plates CCIV. and CCV. was constructed by Messrs John Duffus and Company, Aberdeen. As before noticed, it is simple in its form, and contains the latest improvements both in the build of the vessel and the position and arrangement of the machinery. The great object to be attended to in framing these vessels is, to obtain such a degree of strength as not only to withstand the tremulous motion of the engine and dredging buckets, but also to be capable of resisting the strains to which they are continually liable in taking the ground, or in the fair way of shipping.

The cost of the vessel, engine, and bucket apparatus, complete, with her twelve lighters, may be taken at L.5000. The expenditure of coal is at the rate of four cwt. per hour, and the daily expense of working her at L.3. 3s. But these items of course vary in amount, according to local circumstances and the situation of the port.

The strength of the vessel, the power of the engine, fitness of the machinery, and the security of the whole against accident by fire, are circumstances connected with the application of the dredging-machine which will always meet with the attentive consideration of the engineer, whose regulation in all the parts of this apparatus will be guided by the actual operation to be performed, as more or less suitable to the peculiar situation of the works in which this apparatus is to be employed. What we have been able to bring under the professional reader's notice in this article, we trust will be sufficient to give him an idea, not only of the construction of the apparatus, and the principles upon which it acts, but also to afford such details as cannot fail to be highly useful in the construction of such an apparatus. To the general reader, who may not take much interest in the details of complicated machinery, we presume our section, elevation, and plan of the bucket dredging-machine will be sufficiently obvious. To him it will also have been interesting to know how operations of this kind are performed, the quantity of work that may be done, and the rate of its expense. We shall also be happy if our observations upon the baneful consequences of shutting out tide water by embanking shall happen to come under the eye of those possessed of legislative power, and be the means of rendering more effective the act of 1800, for the preservation of the navigable rivers of the kingdom, as noticed at page 193. (T. T.)

DRELINCOURT, Charles, minister of the Calvinist church at Paris, was born in July 1595, at Sedan, where his father held a considerable office. He had all the qualifications which constitute a respectable clergyman; and though he defended the Protestant cause against the Roman Catholic religion, he was much esteemed even amongst the Catholics. He is best known in England by his *Catechism* and *Consolations against the Fears of Death,* works which have been translated, and frequently reprinted. His controversial works are numerous, and include the *Jubilee,* the *Roman Combat,* the *Jesuit's Owl,* an *Answer to Father Coussin, Disputes with the Bishop of Bellai,* an *Answer to Lamilletière, Dialogues against the Missionaries,* the *False Paster convicted,* the *False Face of Antiquity,* the *Pretended Nullities of the Reformation,* an *Answer to Prince Ernest of Hesse,* an *Answer to the Speech of the Archbishop of Sens,* and a *Defence of Calvin.* He married the daughter of a rich merchant at Paris, by whom he had sixteen children. His third son, professor of physic at Leyden, was physician to the prince and princess of Orange before their accession to the crown of England. Bayle has given him a high character. Mr Drelincourt died in November 1660.

DRENTHE, one of the provinces of the Netherlands, bounded on the north and east by Groningen, on the south-east by the kingdom of Hanover, on the south and south-west by Overyssel, and on the north-west by Friesland. It is 820 square miles in extent, and contains 46,470 inhabitants, in three towns and thirty-seven villages. The capital is Assen. It is generally a poor, cold, heathy district, depending chiefly on its breed of cattle, and on the sale of wool, honey, wax, and turf, and on the conveyance of the latter for fuel to other and larger towns that are within the province.

DRESDEN, a city of Germany, the capital of the former electorate, now the kingdom of Saxony. It is a beautiful spot, both as regards the position and the buildings. The river Elbe divides it into two unequal parts, over which is a fine bridge of sixteen arches, 1420 feet in length and thirty-six in breadth, which, though destroyed in the French revolutionary war, has again been restored. It was fortified, but the works now serve the purposes merely of police. There are seven market-places or squares, and about sixty broad streets, with others connecting them together; and the public buildings, which are numerous and beautiful, give to the whole a most magnificent appearance, but especially in the new town, which is of more recent erection.

There are seventeen Lutheran, two Catholic, and a small Calvinist church; the most remarkable are the Frauenkirk of the Protestants, and the elegant Catholic church connected with the royal palace. Over the altar of the latter is a painting of the ascension by Mengs, highly valued.

Dresden has obtained the name of the Athens of the north, from the various collections of the fine arts and of antiquities that are to be seen there. The palace is spacious and noble, and in the repository in the *Grünen Gewolbe* is arranged a collection of antiquities connected with the ancient history of the country, of very great value. The zwenger or barbican is a beautiful circular building. The garden serves the purposes of a promenade, and the apartments are used as the repository of a valuable cabinet of natural history. The picture gallery occupying the four sides of a square building is peculiarly rich in specimens of art of the best and oldest masters, and is said to be the best in Europe at the present time. The Japan palace, in a garden looking on the Elbe, contains the royal library, amounting to more than 150,000 volumes, a collection of porcelain, and many of the finest specimens both of ancient and modern statuary. The chancery house is a fine building, and, besides several paintings, contains some most valuable records of the historical kind. The other public and private houses deserving attention are numerous, and will reward the curious visitor who shall devote his time to their minute examination.

The institutions for benevolence and for instruction are numerous, appropriate, and well conducted. The surrounding country presents many objects which induce pleasing walks or rides, especially the Plauensche-grund, where a rapid stream runs between lofty rocks, the palace of Pilnitz on the banks of the Elbe, and the gardens which surround a part of the city.

There are many manufactures carried on of gold and silver articles, silk goods, cotton and woollen cloth, gloves, hosiery, and other minute commodities. A considerable quantity of wine is made from the vineyards on the sides of the hills overlooking the Elbe. Dresden has suffered in its population by war in 1745, 1756, 1811, and especially in 1813. The inhabitants amount to 49,000, of whom 5000 are Catholics, 200 Calvinists, 860 Jews, and forty Hussites.

DREVET, Peter, the younger, an eminent French engraver, was a member of the royal academy of painting and sculpture, and died at Paris in 1739, at the age of forty-two. His portraits are neat and elegant, but laboured to the last degree. He particularly excelled in representing lace, silk, fur, velvet, and other ornamental parts of dress. But the younger Drevet did not confine himself to portraits. We have several historical prints by him, which in point of neatness and exquisite workmanship are scarcely to be equalled. His most esteemed and best historical print is very valuable; but the first impressions of it are rarely to be met with. It is The Presentation of Christ in the Temple; a very large plate, lengthwise, from Luigi de Bologna. Among his portraits, the two held in the highest estimation are, that of Bossuet, bishop of Meaux, a whole length figure standing, a middling sized upright plate, from Rigaud; and that of Samuel Bernard, a whole length figure sitting in a chair, a large upright plate. The first impressions of the last are before the words *Conseiller d'Etat* were inserted upon the plate.

DREUX, an arrondissement in the department of the Eure and Loire, in France, extending over 620 square miles, and divided into seven cantons and 138 communes, with 71,506 inhabitants. The chief city, of the same name, is situated on the river Blaise, and contains 860 houses, with 6037 inhabitants. Long. 1. 16. 19. E. Lat. 48. 44. 17. N.

DRIESEN, a city of Prussia, in the province of Brandenburg, surrounded by the two rivers Netze. It contains 317 houses, and 2565 inhabitants, mostly weavers of linen and woollen cloth, or employed in distilleries.

DRIFFIELD, a market-town in the wapentake of Harthill, in the east riding of Yorkshire, 197 miles from London. There is a market which is held on Thursday. The inhabitants amounted in 1801 to 1411, in 1811 to 1857, and in 1821 to 2303.

DRIFT, in *Navigation*, the angle which the line of a ship's motion makes with the nearest meridian, when she drives with her side to the wind and waves, and is not governed by the power of the helm; it also implies the distance which the ship drives on that line. A ship's way is only called *drift* in a storm, and then when it blows so vehemently as to prevent her from carrying any sail, or at least restrains her to such a portion of sail as may be necessary to keep her sufficiently inclined to one side, that she may not be dismasted by her violent labouring produced by the turbulence of the sea.

Drift, in mining, a passage cut out under the earth betwixt shaft and shaft, or turn and turn; or a passage or way wrought under the earth to the end of a meer of ground, or part of a meer.

Drift-*Sail*, a sail used under water, veered out right a-head by sheets, as other sails are. It serves to keep the ship's head right upon the sea in a storm, and to hinder her from driving too fast in a current.

Drift-*Wood*, trees or timber carried out to sea by the rivers when in flood, and then drifted about in various directions, and to different parts, by the currents of the ocean.

DRILL, in *Mechanics*, a small instrument for making such holes as punches do not conveniently serve to form. Drills are of various sizes, and are chiefly used by smiths and turners.

DRILLING is popularly used for exercising soldiers. The word is derived from the French *drille*, which signifies a *raw soldier*.

DRINK, a part of our ordinary food in a liquid form. See Dietetics.

DRISSA, a circle in the Russian government of Witepsk. It is bounded on the north by Sebesk, on the east by Polozk, on the south by Minsk, and on the west by Resitza. It is watered by the Düna and its tributary streams, and is fertile in rye, flax, and black cattle. The inhabitants amounted in 1797 to 51,400, who have since that census rapidly increased. It contains four cities and 1055 villages. The capital, of the same name, is situated on the river Drissa, where it falls into the Düna. It is a small town, with a slight but growing population.

DRIVING, in *Metallurgy*, is said of silver, when, in the operation of refining, the lead being burnt away, the remaining copper rises upon its surface in red fiery bubbles.

Driving, in the sea language, is said of a ship when an anchor being let fall does not hold her fast, nor prevent her sailing away with the wind or tide. The best help in this case is to let fall more anchors, or to veer out more cable; for the more cable she has out, the safer she rides. When a ship is a-hull or a-try, they say she drives to leeward.

DROGHEDA, a town in the province of Leinster, in Ireland, situated in the middle of a small district called the county of the town of Drogheda, between the counties of Louth and Meath, is built on both sides of the river Boyne, about five miles from its mouth, and thirty miles north of the city of Dublin. The entire extent of the county is 5800 acres, or nine square miles. In the earliest notices of it by ancient writers it is called Inver-Colpa, or the Port of Colpa, and afterwards Tredagh. Drogheda, the name it is at present known by, signifies "the Bridge over the Ford." The portions on each side of the Boyne were formerly distinct towns, under separate jurisdictions, distinguished by the names of Drogheda on the side of Meath, and Drogheda on the side of Uriel, the ancient appellation given to the county of Louth and some adjoining districts. It is now divided into the parishes of St Peter, St Mary, and part of that of Ballymakenny; and in the year 1813 it contained a population of 16,000 souls, in 1821 of 18,118, and in 1831 of 17,365; being the only place in Ireland whose numbers did not increase in the interval between the two last-mentioned dates. It ranks in amount of inhabitants the eighth of the chief cities and towns in Ireland.

The municipal government of the town is vested in the mayor, two sheriffs, two justices of the peace, and a recorder, who hold under a charter granted under the following singular circumstances: Whilst the town was split into two independent jurisdictions, the inhabitants were incessantly in a state of mutual hostility, in consequence of trading vessels landing their cargoes in the southern town, to avoid the payment of pontage duty levied on all vessels discharging on the northern or Louth side. Much blood was frequently shed on these occasions. At length Philip Bennett, a monk residing in the town, took occasion, on the festival of Corpus Christi, to preach a sermon before the constituted authorities of both sides, in which he inculcated the blessings of union so emphatically, and followed up the subject so effectively at an entertainment to which he invited them in his convent the same day, that they all joined in sending a deputation to Henry IV. to obtain a new charter, by which both parts were embodied into a single corporation. This event took place in the year 1412. The charter was afterwards confirmed with alterations by James I. The mayor was honoured by Edward IV. with a sword of state, and L.20 a year for its maintenance, in reward of the services performed by the townsmen in an engagement at Malpas Bridge, where this magistrate, at the head of 500 archers and 200 pole-axemen, contributed to the defeat of O'Reilly and his confederates. Previously to the union Drogheda returned two members to parliament. The number has since been reduced to one, who is elected by a constituency consisting of 531 freemen and 407 freeholders and leaseholders, the total number of electors being 560.

The town has always been considered by the English as a place of much importance. In the reign of Edward III. it was classed, along with Dublin, Waterford, and Kilkenny, as one of the four staple towns of Ireland. Richard II. received in it the submissions of O'Neal, O'Donnel, and other chieftains of Ulster and Leinster. The right of coining money was granted to it. Parliaments were several times assembled in it, in one of which the value of money was raised, by altering the silver groat or fourpenny piece to sixpence. In another parliament, also held here, in the beginning of the reign of Edward IV., the town was granted the right of having a university, with the same privileges as that of Oxford. The plan however failed, owing to the poverty of the town and the unsettled state of the country; and an attempt lately made by the corporation to re-assert the right was also unsuccessful. One of the Earls of Desmond was beheaded here on a charge of high treason, brought against him in parliament by the Earl of Worcester when lord lieutenant. Here also the celebrated statutes known by the name of Poyning's laws, which made such a change in the political relations between England and Ireland, were enacted. In the civil wars of 1641 the town was besieged by O'Neal and the northern Irish forces; but was gallantly defended by Sir Henry Tichbourne, and after a long blockade relieved by the Marquis of Ormond. The same nobleman relieved it a second time, when invested by the parliamentary army under Colonel Jones. In 1649 Cromwell appeared before it at the head of a numerous and well-appointed army. The town was taken after a short though spirited defence; and every individual in it, without distinction of age or sex, was put to the sword, after promise of quarter given. Thirty only escaped the butchery, who were afterwards transported as slaves to Barbadoes. In 1690 it was garrisoned by King James's army; but after the decisive battle of the Boyne it surrendered to the conqueror without a struggle, in consequence of a threat that quarter would not be granted if it were taken by storm. Its subsequent history is not marked by any circumstance of striking political notoriety.

Of the ancient fortifications very few relics remain. The only one of its four gates still in existence is that of St Laurence, which forms a very picturesque object. The modern town, built chiefly on the northern bank of the Boyne, is divided into four principal parts or quarters, by the two main streets that intersect each other at the Tholsel. The bridge which connects this portion with the southern is narrow, and by no means well suited to the great and increasing current of passengers and vehicles that take advantage of it. The principal public buildings are, the mayoralty-house, to which a suite of assembly-rooms is attached; the Tholsel, a square building of cut stone, with a cupola; the corn-market, the linen-hall, two parish churches, and several Roman Catholic chapels, the largest of which is that of St Peter. There are also several religious houses, in one of which, the abbey of Dominican nuns, without St Laurence's gate, is still preserved the head of Oliver Plunket, Roman Catholic archbishop of Armagh, who was executed at Tyburn in the year 1681, on an unfounded charge of treason. His body, having been interred in St Giles', London, was afterwards removed to the Continent. A classical school, under the endowment of Erasmus Smith, is maintained here. There are also several free schools, the principal of which, called the Patrician school, accommodates 150 pupils. Among the charitable institutions is one for the reception of thirty-six clergymen's widows, who are each provided with a house and an annuity of L.26 during life, arising from bequests made by two archbishops of Armagh. Here is also an alms-house for twenty-four aged widows, an infirmary, and a mendicity association for the suppression of street-begging, in which the inmates are provided with food and employment, but are not lodged.

The former importance of Drogheda may also be inferred from the numerous remains of its monastic institutions. The principal were, the hospital of St Mary, for the sick and infirm; the priory of St Laurence, which was granted to the corporation on the dissolution of the monasteries; the Dominican friary, of which a tower of stately proportions still exists; the Grey friary and the Augustinian friary; all in the northern part of the town. On the southern side were the hospital of the Knights of St John of Jerusalem, and the Carmelite friary. The archbishops of Armagh had a palace in the town, built by Archbishop Hampton about the year 1620.

Drogheda was until lately the seat of an extensive manufacture of coarse linens, on the decline of which the cotton manufacture supplied its place. Brewing and tanning are carried on largely. Four fairs are held annually on May 12, June 22, August 26, and October 29. It is also a great place of export for grain, hides, and butter. Vessels of two hundred tons can lie at the quay. The communication with the country is facilitated by means of the Boyne navigation, which is carried on for nine miles, chiefly in the bed of the river, to Slane; six miles of still water navigation continue it thence to Navan, and seven more to Trim. The chief articles conveyed by it are coal, slate, timber, iron, and salt upwards; grain, yarn, and linen downwards. The salmon fishery on the Boyne was once very valuable; the fish is highly esteemed for its flavour.

About four miles west of the town is the village of Old Bridgetoun, memorable for the celebrated and decisive victory gained by King William over King James, his unfortunate competitor for the crown of Great Britain. The battle, which marks one of the great epochs in Irish history, is fully detailed in every general account of the country. The precise point where the main body of the British army crossed the Boyne during the action, and where the aged Duke Schomberg was killed whilst leading on his men, is marked by an elegant obelisk 150 feet high, having on each side of its pedestal an appropriate inscription.

DROHICYN, a circle in the Russian government of Bialystock, on the southernmost division of it. It is about 1100 square miles, or 704,000 acres in extent, and contains six cities, one market-town, and 112 villages, with, in 1797, 49,651 inhabitants, who are estimated to have increased in 1827 to 68,000. The chief place, of the same name, is situated on the river Bug, and contains a college, in which are 250 noble students, a Franciscan and a Benedictine monastery, and four churches. Long. 22. 38. E. Lat. 51. 4. N.

DROHOBICZ, a city of the circle of Sambor, in the Austrian kingdom of Galicia. It stands on the river Tesmenica, which empties itself into the Dniester. It is a place of considerable trade, especially in corn, cattle, and salt. It contains several churches, monasteries, and public schools, with 1200 houses, and about 8000 inhabitants, among whom are a great number of Jews. The salt mines produce annually about 3700 tons of refined salt.

DROITWICH, a town of the hundred of Halfshire, in the county of Worcester, 118 miles from London. It is situated in a valley filled with salt springs, which, when reached, rise nearly to the surface; a circumstance supposed to proceed from a subterranean river passing through the masses of rock-salt which are excavated in Cheshire. The water from the springs is fully saturated, so that common salt will not dissolve in it. The salt is procured by evaporating the water, which yields about seven times as much salt as an equal quantity of sea water. The cheapness of coal causes an extensive making of salt, which supplies the neighbourhood. There is a canal joining the Severn, by which much salt is conveyed to Worcester, Gloucester, and Bristol, from which last city much is exported to distant markets. It is an ancient borough, lately sending two members to parliament, but now only one. The market is held on Friday. The inhabitants amounted in 1801 to 1845, in 1811 to 2079, in 1821 to 2176, and in 1831 to 2487.

DROME, a department of France, formed out of the districts Valentenois and Divis, of the ancient principality of Dauphiné. It is bounded on the north by the department of the Isère, on the east by that and the Upper Alps, on the south by the Lower Alps and Vaucluse, and on the west by the Ardèche, from which the Rhone separates it. The extent is 2722 square miles, or 692,750 hectares. The whole department consists of mountains, with valleys between, the entrances to which are commonly very narrow. The mountains increase in height on removing from the Rhone. At first they are sandy, then calcareous, and the highest of all are granite. Cultivation is in a languid state; the produce of corn is insufficient for the consumption, and 200,000 bushels are annually required from the surrounding districts to feed the population. They are enabled to obtain this in exchange for olives, almonds, nuts, silk, and hermitage wine, which the great heat of the summers brings to perfection under the shelter of the mountains. Much fuel also is collected, as one sixth of the land is covered with wood. Many sheep too are bred, but of an inferior race, producing a coarse wool. The manufacturing industry is confined to making some coarse woollen cloths, a few silk goods, and some domestic utensils for the supply of the inhabitants. The population amounts to 252,847 persons, of whom 34,500 are of the reformed church. None of them are rich or poor, but in moderate and nearly equal circumstances. It is divided into four arrondissements, twenty-eight cantons, and 360 communes. The capital is the city of Valence.

DROMEDARY. See MAMMALIA.

DROMORE, a town of Ireland, in the county of Down, situated on the river Lagan. It is a very ancient town, and the seat of a bishopric. The see was founded by St Colman in the sixth century. Besides the cathedral, which is small, there are two meeting houses. The population amounts to 1942. Dromore is situated fifteen miles southwest of Belfast.

DRONE, the male of the honey bee. Sometimes other flies also are so named. See BEE.

DRONERO, a city of Italy, in the province of Coni, and kingdom of Sardinia. It stands on the river Maria, is surrounded with walls, and contains six parish churches, one capuchin monastery, and 6440 inhabitants. There is a very considerable linen manufactory in the city.

DRONFIELD, a town of the hundred of Scarsdale, in the county of Derby, 157 miles from London. It has a well-endowed free school, founded in the reign of Elizabeth. The inhabitants amounted in 1801 to 1182, in 1811 to 1343, in 1821 to 1522, and in 1831 to 1653.

DRONTHEIM, the northernmost province of the kingdom of Norway, extending from 61. 41. to 71. 11. north latitude. It extends over 64,284 square miles, but the population amounts to no more than 239,712 individuals, who inhabit six cities or towns and 115 parishes, which contain 262 churches and 110 chapels.

DRONTHEIM, the capital of the province of the same name in Norway, and the see of a bishop, is situated at the mouth of the river Nidelf, in a deep bay or fiord, in a most pleasing situation. It is walled, and was formerly defended by two forts, which are now in a dilapidated state. The streets are spacious, and the houses of respectable appearance, though all built of wood. The cathedral was once the most celebrated in the north, though now only the choir, in which the kings were formerly crowned, is entire. It has, besides, two churches, and 1400 houses, with 9000 inhabitants. The haven is secure, and causes some export trade in copper, planks, stockfish, herrings, and train oil. There are a few manufactures of linen cloth, and also refineries for sugar and saltpetre, besides tanneries and glove-making. Long. 10. 18. 47. E. Lat. 63. 25. 47. N.

DROPSY, in *Medicine*, an unnatural collection of water in any part of the body. See MEDICINE.

DROSSEN, a city of Prussia, in a marshy situation, on the river Lenze, in the province of Brandenburg, containing 476 houses, and 2883 inhabitants.

DROWNING. This term usually signifies the extinction of life by total submersion; but it ought also to be applied to that species of suffocation which is produced by the exclusion of atmospheric air from the lungs by any liquid; for the effects produced in all such cases are similar. Drowning, therefore, may be considered as having taken place when the animal perishes from immersion of its head, or even from the obstruction to the air passages by a fluid.

The ordinary phenomena of drowning may be witnessed by submerging a small animal in a glass vessel filled with water. The animal at first struggles violently, and is soon observed to make a forcible *expiration*, as is indicated by the escape of bubbles of air from its mouth and nose. It next attempts to inspire; an effort marked by the strong heaving of its thorax, and convulsive efforts of its abdominal muscles. This effort is vain, and is speedily followed by the extrication of a few more air bubbles from its lungs. These convulsive motions are repeated at shorter intervals, while smaller portions of air are forced from the lungs at each succeeding expiration, until the air cells are deprived of a considerable portion of the air they contained at the moment of submersion. Insensibility soon comes on; but convulsive movements of the limbs mark the progress of cerebral congestion, and the influence of unoxygenated blood on the centre of the nervous system.

After these struggles, the animal is apparently dead; but a feeble motion may still be perceived in the chest; and before it ceases altogether, the muscles of the thorax are once more thrown into action by an ineffectual effort to breathe. Brodie has remarked, that in drowning, the action of the heart and diaphragm cease almost at the same instant. Unless the animal be removed from the water before the movements of the heart and diaphragm have entirely ceased, it perishes, and a minute or two more are sufficient to destroy it. If the animal be removed from the water while the heart and diaphragm are yet in action, it may escape from the immediate risk of suffocation, but yet may die from injury to the brain produced by congestion of dark blood on that organ. Bichat, Cruickshank, and Brodie, have proved, that dark unoxygenated blood acts as a poison on the brain, causing diminished nervous energy, laborious respiration, feeble pulse, dilated pupils, stupor, and convulsive twitches of the voluntary muscles.

Signs of death from drowning.—The signs of death from drowning are *external* and *internal*. 1. The external signs most usually perceived are either a very pale countenance, or the face bloated and livid; the lips, and not unfrequently the whole head, swelled; the eyes half open, and the pupils much dilated; the tongue swelled, and protruded between the teeth, so as to be in contact with the inner surface of the lips; the lips and nose often lined with a whitish froth; the chest and epigastrium tumid, and much arched; the ends of the fingers usually excoriated; and the spaces under the nails often filled with sand or mud. 2. The most usual internal signs are more or less cerebral congestion; but in some cases no morbid change appears in the brain. We usually find the blood in the vessels of the head, and indeed in the whole body, of a blackish colour. There is generally frothy mucus in the trachæa, which is sometimes tinged with blood; the lungs are dilated and gorged with blood; the diaphragm descends low into the abdomen, and has lost more or less of its concave surface towards that cavity. The right cavities of the heart, and the great vessels connected with it, are gorged with black blood, whilst the left side and its vessels are usually found empty. The blood in the body always remains fluid, and readily flows wherever an incision is made. Water is sometimes found in the bronchial tubes and cells of the lungs; and not unfrequently some water has been swallowed in the act of drowning. These symptoms will generally enable us to detect a death from drowning, if we examine the body before putrefaction is advanced.

The immediate cause of death from drowning has given rise to much controversy; and physiologists have appealed to contradictory experiments and observations in support of their different hypotheses. But this difference of opinion has orginated in physiologists supposing that the suspension of the vital functions on submersion always depended on the same proximate cause. It is singular that the very dissimilar appearances which the face presents in different cases did not suggest some difference in the cause of death. In some drowned persons, the face is remarkably pale, and rather pinched; in others, the countenance is livid, and the whole head swelled; the first indicating the deficiency of blood in the head, the latter its redundancy. This led Dr Desgranges to the conclusion that there were two different modes in which drowning proved fatal.

The first, which he terms *nervous or syncópal asphyxia*, occurs when the person, either from the terror of impending fate, the effect of surprise, or from the sudden immersion in extremely cold water, faints at the instant of immersion. The instantaneous arrestation of the movements of the heart in such cases prevents the transmission of unoxygenated blood to the brain; the principle of life is merely suspended; the resources of the animal machine are not destroyed, but are capable of being again called into action by suitable means. The second Desgranges terms *asphyxia by suffocation.* In this species the heart continues to act for some time after respiration is impossible. The brain thus becomes loaded with black or unoxygenated blood, which is known to act as a direct sedative or a poison on that delicate organ. When this has gone on for a short time, its functions are annihilated, and cannot be restored when the body is again exposed to asmospheric air. In this second species water often finds its way into the air tubes, and even into the cells of the lungs, during the vain efforts of the individual to breathe.

These distinctions are important, will serve to explain most of the anomalies which have been observed as effects of submersion, and render probable the very extraordinary instances of resuscitation after long-continued submersion, which have been related by men worthy of credit, but which have appeared marvellous to those whose ideas of drowning are founded on a few experiments made on the lower animals forcibly submerged.

Amongst individuals who have recovered from insensibility induced by long submersion, by far the majority are those who have been affected by *syncopal asphyxia*, in whom there has been instantaneous arrestation of the motion of the heart, and suspension of consciousness. This distinction will enable us also to explain why, when several persons are submerged together, some will be found quite irrecoverable; whilst others, who have been considerably longer under water, may be capable of resuscitation.

The recovery from *syncopal asphyxia* is well illustrated by a case given by Plater. A female, condemned for infanticide, was inclosed in a sack, according to the provisions of the *Caroline Code* of Germany, and thrown into a lake. She fainted at the moment of immersion; and, after having been under water for a quarter of an hour, was drawn out and restored to life.

Pouteau relates the history of a man at Lyons, who suddenly fell into a river covered with ice, and remained submerged for three hours, yet was restored to life by the long-continued assiduity of his medical attendant. Morgagni mentions the case of a man who was resuscitated after having been under water for half a day; and Pecklin relates the instance of a Swedish gardener, who was submerged in a frozen pond for sixteen hours, and yet was recovered by similar means.

In all such cases, Desgranges conceives that the capability of recovery is to be attributed to the sudden arrestation of the vital motions at the moment of immersion. The action of the heart and of the lungs ceasing simultaneously, no vitiated blood could be transmitted to the brain. A stop would at the same time be put to all secretions and excretions, so that there could be no expenditure of vital power. How long this suspension might continue without extinction of vitality, is unknown; but something resembling it occurs in some long-continued paroxysms of hysteria, and in persons who have for several days lain apparently dead, but have been resuscitated.

Drowning has been ascribed to water finding its way into the stomach and air passages; but this opinion was proved to be fallacious by Senac and Cullen. The former denied that water ever entered the lungs; but Morgagni showed that it actually does sometimes enter the air cells; and he ascribes the frothy mucus found in the fauces and air tubes to the intermixture of air with that water. The opinion of Morgagni on this last point is, however, incorrect; for the froth is found in many cases of asphyxia from noxious gases in epilepsy and apoplexy; and in the recent experiments of Dr M. Hall, it was observed in dogs that had been bled to death. It appears to be produced by the escape of air from the lungs mixing with the natural mucus lining the air passages, and indeed is common to all cases of laborious respiration. Goodwyn and Cullen showed the insufficiency of the water which finds its way into the lungs in drowning to cause speedy death.

The excoriation of the ends of the fingers is produced by the person endeavouring to save himself by catching at the bottom, or the first solid which meets his hands; and the sand and mud under the nails have the same origin. In fact, we are, by these marks, often able to discover whether a person has been drowned, or thrown into the water after death. The tumid state of the chest, and descent of the diaphragm into the abdomen, are caused by the violent efforts made to dilate the chest, for the relief of the sense of suffocation. The fluidity of the blood is remarkable, and seems almost universal in drowning. This appearance takes place wherever death is caused by the exclusion of oxygen, or when the blood does not undergo the usual changes in the lungs.

Treatment of drowned persons.—Various directions have been given for the treatment of persons who have been found in a state of asphyxia from submersion. The subject claimed the especial attention of De Haen, of John Hunter, and Cullen, each of whom have made many judicious remarks on the best means of restoring animation; and the Humane Society of London have published twelve general rules for the recovery of drowned persons, which are, on the whole, useful, although some of them are now obsolete, and require emendation.

The principal objects in such cases should be,

1st, *To restore or keep up the animal heat.*

2d, *To induce a renewal of respiration.*

3d, *To rouse latent animation by the exhibition of stimuli.*

1. As soon as the body is removed from the water, the wet clothes should be taken off, and the body rolled in warm blankets or dry clothing, while it is transporting to the nearest house. The body should be carried in the arms of men, or on a bier, with celerity, but without jolting, to a room which, in hot weather, should have the windows open, but in winter should have a fire. The head, during the transporting, should not be suffered to hang down, but be laid in an easy position. When brought into the apartment in cold or damp weather, the body should be laid on a mattress before a fire, when the surface is to be diligently rubbed with dry warm flannel, both to dry the surface, and to rouse the excitability of the capillaries. Whilst this is going on, it is important to permit the free access of warm air. No more persons should be present than are useful about the patient; and the Humane Society limit the number to six. Sometimes the body has been placed in warm water; but this practice is objectionable. Some recent experiments have rendered it more than probable that the influence of the free application of air to the general surface of the body is not unimportant in restoring animation in cases of asphyxia; and the cutaneous circulation is more readily induced by dry and diligent frictions of the surface than by immersion in warm water. Applications of bags of hot sand, bran, or the like, to different parts of the body, as the arm-pits, scrobiculus cordis, and extremities, are obvious means of restoring animal heat not to be neglected; and in some instances much benefit seems to have been derived from switching the soles and palms with twigs, or striking them with the open hand. Whilst these means are being employed, we must not neglect the important object, viz.

2. The restoration of respiration, by *insufflation* of the lungs. The best and simplest mode of effecting this object is, to introduce the nozzle of a pair of common bellows into one nostril, whilst the operator closes the other nostril and the mouth with his left hand, and applies his right to the thyroid cartilage, pressing it gently backward, in order to shut up the *œsophagus*, and prevent the air entering the stomach instead of the lungs. The bellows should be wrought by an assistant, so as moderately to inflate the chest. A third person is to press the chest with his hands, to expel the air. These motions are to be alternated, so as to imitate natural breathing as much as possible. This mode of insufflation is much preferable to the proposal of introducing a tube into the *glottis*, and still more so to the hazardous operation of tracheotomy, which never can be necessary in a case of simple drowning, and which, even in the hands of the celebrated surgeon Mr Justamond, proved fatal, by permitting the infiltration of blood into the air passages.

When a sufficient supply of oxygen gas can be obtained, it would probably expedite recovery; but perhaps it should not in general be employed undiluted. Where a pair of bellows cannot be obtained, the life of a person may be saved by introducing any sort of pipe into the nostril, as above directed, and blowing air from the mouth of the operator into the lungs of the drowned person. In this case, care should be taken not to use the air from the lungs of the operator, but merely that which his mouth contains, thrown forward by the compression of his cheeks, in the manner used with the common blow-pipe. But a pair of bellows should always be preferred.

In the directions of the Humane Society, we read (art. 10) that the body, especially if the subject be a child, "is to be well shaken every ten minutes, in order to render the process of animation more certain." This practice is justly condemned by most modern authors, as either useless or dangerous. All the benefit of "shaking" may be obtained by frictions and switchings, without the risk of extinguishing the feeble remains of animation by rude concussions, "pullings, and pushings," which have been generally employed in cases of asphyxia. It is scarcely necessary to caution the practitioner against the exploded practice of hanging the drowned person by the heels, or laying him across a barrel with his head hanging downwards; a practice of which even Fothergill approves, on the principle of making him disgorge the water that might have found its way into the stomach and lungs, which was erroneously imagined to be the chief cause of suspended animation.

3. The application of various stimulants internally and externally, to facilitate resuscitation, is limited, but not unimportant. The vapour of ammonia, to irritate the Schneiderian membrane of the nose, has been generally adopted, and is useful in rousing the dormant excitability. When a tube can be introduced into the stomach, a portion of warm spirit and water, with or without ammonia, will generally be useful. The introduction of warm stimulants by the arms is likewise desirable, both to rouse the latent powers of life by their stimulant effect, and to restore the animal heat.

The eighth rule of the Humane Society recommends the injection of tobacco smoke into the fundament. This practice was borrowed from the savage Indians of North America; but it is of very questionable utility. The excessive faintness produced by this strong narcotic is a great objection to its employment in cases where the powers of life are already too low; and we have abundant means of exciting the peristaltic motion of the alimentary canal, by aloetic and other warm purgatives, without running the risk of extinguishing the feeble remains of vitality by the introduction of a narcotic. The objection is still stronger to infusions of the plant, which have also been recommended.

The application of Voltaic electricity bids fair to aid resuscitation, especially if not used too strong. It has a powerful effect in rousing the voluntary muscles, but its influence on the heart is doubtful. Yet there can be no doubt of its capability of stimulating the diaphragm and abdominal muscles, to cause the dilatation of the chest; and its application to the parts of the body most suitable for this end, as about the lower ribs and the pit of the stomach, should be tried. Common electricity is less suited to this purpose; but neither should be passed through the head, lest the excitability of the nervous system should be exhausted by so powerful and general a stimulant.

Blood-letting was reprobated by John Hunter; and in cases of drowning, when there are marks of *syncopal asphyxia*, it will probably prove injurious; but when there are decided marks of cerebral congestion, venesection under the direction of a medical practitioner will facilitate recovery.

These methods of resuscitation should be diligently employed for four or five hours at least, before the case is given up as hopeless. It is a vulgar and a dangerous error to suppose that because our efforts do not seem successful for one or two hours, that the patient is irrecoverably dead. There are instances of persons submerged, in whom no symptoms of returning animation have been obvious until after four, or even six hours of unremitted efforts. (I. I. I.)

DRUGGET, in commerce, a stuff sometimes all wool, and sometimes half wool half thread; sometimes corded, but usually plain. Those which have the woof of wool and the warp of thread are called *threaded druggets;* and those wrought with the shuttle on a loom of four marches are called *corded druggets.* As to the plain, they are wrought on a loom of two marches, with the shuttle, in the same manner as cloth, camblets, and other like stuffs not corded.

DRUIDÆ, or DROIUM, in *Ancient Geography,* a very ancient town, the principal place of the Druides or Druidæ in Gaul, as they are called; now *Dreux* in the Orleannois. Here, according to Cæsar, they met every year in a consecrated grove. The town was also called *Durocases.* Long. 1. 21. W. Lat. 48. 45. N.

DRUIDS, DRUIDES, or DRUIDÆ, the priests or ministers of religion amongst the ancient Celtæ or Gauls, the Britons, and the Germans.

Some authors derive the word from the Hebrew דרושים, *derussim,* or *drussim,* which they translate *contemplatores.* Picard (*Celtopæd.* lib. ii. p. 58) believes the druids to have been thus called from *Druis* or *Dryius,* their leader, the fourth or fifth king of the Gauls, and father of Saron or Naumes. Pliny, Salmasius, Vigenère, and others, derive the name from δρυς, *quercus, oak,* on account of their inhabiting, or at least frequenting and teaching, in forests; or perhaps because, as Pliny says, they never sacrificed except under the oak. But it is hard to imagine how the druids should have come to speak Greek, even although Cæsar assures us that they had the Greek letters. Ménage derived the word from the old British *drus,* a dæmon or magician; and Borel, from the Saxon *dry,* a magician, or rather from the old British *dru* or *derw,* an oak; whence he supposes δρυς to be derived, which indeed is not an improbable supposition. Becanus (lib. i.) takes *druis* to be an old Celtic and German word, formed from *trowis* or *truwis,* a doctor of the truth and the faith; and in this etymology Vossius is disposed to acquiesce.

General account of the druids.

The druids were the first and most distinguished order among the Gauls and Britons. They were chosen out of the best families; and the honours of their birth, joined with those of their function, procured them the highest veneration among the people. They were conversant in astrology, geometry, natural philosophy, politics, and geography: they were the interpreters of religion, and the judges in secular affairs: whoever refused obedience to them was declared impious and accursed. We know but little as to their peculiar doctrines, only that they believed the immortality of the soul, and, as is generally supposed, in the metempsychosis; though it appears highly probable that they did not believe in this last doctrine, at least not in the sense of the Pythagoreans.

The chief settlement of the druids in Britain was in the isle of Anglesey, the ancient *Mona,* which they chose for this purpose, as it was well stored with spacious groves of their favourite oak. They were divided into several classes or branches, namely, the *vacerri, bardi, eubages, symnothii* or *semnothei,* and *saronidæ.* The *vacerri* are held to have been the priests; the *bardi* were the poets; the *eubages* were the augurs; and the *saronidæ* were the civil judges and instructors of youth. As to the *semnothei,* who are said to have been immediately devoted to the service of religion, it is probable that they were the same with the *vacerri.* Strabo, however, and Picard after him in his *Celtopædia,* do not comprehend all these different orders under the denomination of Druids, as species under their genus, or parts under the whole, but make them quite different conditions or orders. Strabo in effect only distinguishes three kinds, *bardi*, *vates*, and *druids*. The *bardi* were the poets; the *vates*, *ουατεις*, apparently the same with the *vacerri*, were the priests and naturalists; and the *druids* were those who, besides the study of nature, applied themselves to that of morality.

Diogenes Laertius assures us in his prologue, that the druids were the same among the ancient Britons with the sophoi or philosophers among the Greeks, the magi among the Persians, the gymnosophists among the Indians, and the Chaldeans among the Assyrians.

Their garments were remarkably long; and, when employed in religious ceremonies, they always wore a white surplice. They generally carried a wand in their hands; and wore a kind of ornament enchased in gold about their necks, called the *druid's egg*. Their necks were likewise decorated with gold chains, and their hands and arms ornamented with bracelets. They wore their hair very short, and their beards remarkably long.

The druids had one chief or arch-druid in every nation, who acted as high priest, or *pontifex maximus*. He possessed absolute authority over the rest, and commanded, decreed, or punished, at pleasure. At his death he was succeeded by the most considerable amongst the survivors; and if there were several pretenders, the matter was ended by an election, or else put to the decision of arms.

The druids, we have observed, were in the highest esteem. They presided at sacrifices and other ceremonies, and had the direction of every thing relating to religion. The British and Gallic youth flocked to them in crowds to be instructed by them. With the children of the nobility, Mela tells us, they retired into caves, or the most desolate parts of forests, and kept them there sometimes for twenty years under their discipline. Besides the immortality and metempsychosis, their disciples were here instructed in the motion of the heavens and the course of the stars, the magnitude of the heavens and the earth, the nature of things, the power and wisdom of the gods, and a variety of other doctrines. They preserved the memory and actions of great men in their verses, which they never allowed to be written down, but made their pupils get by heart. In their common course of learning, they are said to have taught them twenty-four thousand such verses. By this means their doctrines appeared more mysterious by being unknown to all but themselves; and having no books to recur to, they were the more careful to fix these doctrines in their memory.

They worshipped the Supreme Being under the name of *Esus* or *Hesus*, and the symbol of the oak; and had no other temple than a wood or a grove, where all their religious rites were performed. Nor was any person admitted to enter that sacred recess, unless he carried with him a chain, in token of his absolute dependence on the Deity. Indeed their whole religion originally consisted in acknowledging that the Supreme Being, who made his abode in these sacred groves, governed the universe, and that every creature ought to obey his laws and pay him divine homage.

They considered the oak as the emblem, or rather the peculiar residence, of the Almighty; and accordingly chaplets of it were worn both by the druids and the people in their religious ceremonies, whilst the altars were strewed with its leaves and encircled with its branches. The fruit of it, especially the misletoe, was thought to contain a divine virtue, and to be the peculiar gift of heaven. It was therefore sought for on the sixth day of the moon with the greatest earnestness and anxiety, and when found it was hailed with raptures of joy. As soon as the druids were informed of this fortunate discovery, they prepared every thing for the sacrifice under the oak, to which they fastened two white bulls by the horns; then the arch-druid, attended by a prodigious number of people, ascended the tree, dressed in white, and, with a consecrated golden knife or pruning-hook, cropped the misletoe, which he received in his *sagum* or robe, amidst the rapturous exclamations of the people. Having secured this sacred plant, he descended the tree; the bulls were sacrificed; and the Deity invoked to bless his own gift, and render it efficacious in those distempers in which it should be administered.

The consecrated groves, in which they performed their religious rites, were fenced round with stones, to prevent any person's entering between the trees, except through the passages left open for that purpose, and which were guarded by some inferior druids, to prevent any stranger from intruding into their mysteries. These groves were of different forms; some quite circular, others oblong, and more or less capacious as the votaries in the districts to which they belonged were more or less numerous. The area in the centre of the grove was encompassed with several rows of large oaks set very close together. Within this large circle were several smaller ones surrounded with large stones; and near the centre of these smaller circles were stones of a prodigious size and convenient height, on which the victims were slain and offered. Each of these being a kind of altar, was surrounded with another row of stones, the use of which cannot now be known, unless they were intended as cinctures to keep the people at a convenient distance from the officiating priest.

Suetonius, in his life of Claudius, assures us that the druids sacrificed men; and Mercury is said to have been the god to whom they offered these victims. Diodorus Siculus observes, that it was only upon extraordinary occasions they made such offerings; as, to consult what measures to take, or to learn what should happen to them, by the fall of the victim, the tearing of his members, and the manner in which his blood gushed out. Augustus condemned the custom, and Tiberius and Claudius punished and abolished it.

We learn from Cæsar that the druids were the judges and arbiters of all differences and disputes, both public and private; they took cognizance of murders, inheritances, boundaries, and limits, and decreed rewards and punishments. Such as disobeyed their decisions they excommunicated, which was their principal punishment; the criminal being thereby excluded from all public assemblies, and avoided by all the world, so that nobody durst speak to him, for fear of being polluted.[1] Strabo observes they had sometimes interest and authority enough to stop armies upon the point of engaging, and accommodate their differences.

It has been disputed whether the druids were themselves the inventors of their opinions and systems of religion and philosophy, or received them from others. Some have imagined that the colony of Phocians which left Greece and built Marseilles in Gaul about the 57th olympiad, imported the first principles of learning and philosophy, and communicated them to the Gauls and other nations in the west of Europe. It appears indeed that this famous colony contributed not a little to the improvement of that part of Gaul where it settled, and to the civilization of its inhabitants. "The Greek colony of Marseilles," says Justin, "civilized the Gauls, and taught them to live under laws; to build cities, and enclose them with walls; to raise corn; to cultivate the vine and olive; and, in a word, made so great a change both in the face of the country and the manners of its inhabitants, that Gaul seemed to be translated into Greece, rather than a few Greeks transplanted into Gaul." But though we may allow that the druids of Gaul and Britain borrowed some hints and embellishments of their philosophy from this Greek colony, and perhaps from other quarters, there is some reason to believe that the substance of it was their own. Others have suggested that the druids derived their philosophy from Pythagoras, who published his doctrines at Crotona in Italy, where he lived above twenty years, in the highest reputation for his virtue, wisdom, and learning. This conjecture seems to be confirmed by the remarkable expression of Ammianus Marcellinus, "That the druids were formed into fraternities, as the authority of Pythagoras decreed." It has also been observed, that the philosophy of the druids bore a much greater resemblance to that of Pythagoras than to that of any of the other sages of antiquity. But it seems probable that Ammianus meant no more by the above expression than to illustrate the nature of the druidical fraternities, by comparing them to those of the Pythagoreans, which were well known to the Romans; and the resemblance between the Pythagorean and druidical philosophy may perhaps be best accounted for, by supposing that Pythagoras learned and adopted some of the opinions of the druids, as well as imparted to them some of his discoveries, or that both were derived from a common source. It is well known that this philosopher, animated by the most ardent love of knowledge, travelled into many countries in pursuit of it, and got himself admitted into every society that was famous for its learning. It is therefore highly probable in itself, as well as directly asserted by several authors, that Pythagoras heard the druids of Gaul, and was initiated into their philosophy.

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[1] The *aquæ et ignis interdictio* of the Roman law was probably borrowed from and founded on the druidical excommunication, just as the "letters of intercommuning" in the reigns of Charles II. and James II. were a reproduction of the Roman penalty.

Lening of e drs.

From the concurring testimonies of several authors, it appears that physiology or natural philosophy was the favourite study of the druids of Gaul and Britain. Cicero tells us that he was personally acquainted with one of the Gaulish druids, Divitiacus the Æduan, a man of quality in his own country, who professed to have a thorough knowledge of the laws of nature, or of that science which the Greeks called *physics* or *physiology*. According to Diodorus Siculus, Strabo, Cæsar, Mela, Ammianus Marcellinus, and others, they entered into many disquisitions and disputations in their schools, concerning the form and magnitude of the universe in general, and of this earth in particular, and even concerning the most sublime and hidden secrets of nature. On these and similar subjects they formed a variety of systems and hypotheses, which they delivered to their disciples in verse, that the latter might the more easily retain them in their memories, since they were not allowed to commit them to writing. Strabo has preserved one of the physiological opinions of the druids concerning the universe, viz. that it was never to be entirely destroyed or annihilated, but was to undergo a succession of great changes and revolutions, which were to be produced sometimes by the power and predominacy of water, and sometimes by that of fire. This opinion, he intimates, was not peculiar to them, but was entertained also by the philosophers of other nations; and Cicero speaks of it as a truth universally acknowledged and undeniable. "It is impossible for us," says he, "to attain a glory that is eternal, or even of very long duration, on account of those deluges and conflagrations of the earth, which must necessarily happen at certain periods." This opinion, which was entertained by the most ancient philosophers of many different and very distant nations, was probably neither the result of rational inquiry in all these nations, nor communicated from one of them to others, but descended to them all from their common ancestors of the family of Noah by tradition, though corrupted and misunderstood through length of time. The agreement of the druids with the philosophers of so many other nations in this opinion about the alternate dissolution and renovation of the world, gives us reason to believe that they agreed with them also in their opinion of its origin from two distinct principles: the one intelligent and omnipotent, which was God; the other inanimate and inactive, which was matter. We are told by Cæsar that they had many disquisitions about the power of God; and, no doubt, amongst other particulars, about his creative power. But whether they believed with some that matter was eternal, or with others that it was created, and in what manner they endeavoured to account for the disposition of it into the present form of the universe, we are entirely ignorant, though they certainly had their speculations on these subjects. We are only informed that they did not express their sentiments on these and similar heads in a plain and natural, but in a dark, figurative, and enigmatical manner. This might incline us to suspect that Pythagoras had borrowed from them his doctrines about numbers, to the mystical energy of which he ascribes the formation of all things; for nothing can be more dark and enigmatical than that doctrine. The druids disputed likewise about the magnitude and form of the world in general, and of the earth in particular, of which things they pretended to have a perfect knowledge. We know not what their opinions were about the dimensions of the universe or of the earth, but there is reason to think that they believed both to be of a spherical form. This is visibly the shape and form of the sun, moon, and stars, the most conspicuous parts of the universe; and hence it was natural and easy to infer that such was also the form of the world and of the earth. Accordingly this seems to have been the opinion of the philosophers of all nations; and the circle was the favourite figure of the druids, as appears from the form both of their houses and places of worship. Besides these general speculations about the origin, dissolution, magnitude, and form of the world and of the earth, the druids engaged in particular inquiries into the natures and properties of the different kinds of substances. But all their discoveries in this most useful and extensive branch of natural philosophy, whatever they were, have been entirely lost.

Phics.

Astronomy.

Astronomy also appears to have been one of the chief studies of the druids of Gaul and Britain. "The druids," says Cæsar, "have many disquisitions concerning the heavenly bodies and their motions, in which they instruct their disciples." Mela, speaking of the same philosophers, observes, "that they profess to have great knowledge of the motions of the heavens and of the stars." Some knowledge of this science indeed was not only necessary for measuring time in general, marking the duration of the different seasons, regulating the operations of the husbandman, directing the course of the mariner, and for many other purposes in civil life; but it was especially necessary for fixing the times and regular returns of their religious solemnities, of which the druids had the sole direction. Some of these solemnities were monthly, and others annual. It was therefore necessary for them to know, with some tolerable degree of exactness, the number of days in which the sun and moon performed their revolutions, that these solemnities might be observed at their proper seasons. This was the more essential, as some of these solemnities were attended by persons from different and very distant countries, who were all to meet at one place on one day, and who must have had some rule to discover the annual return of that day.

Their method of computing time.

The most perceptible division of time by means of the two great luminaries is into day and night; the former occasioned by the presence of the sun above the horizon, the latter by his absence, which is in some measure supplied by the moon and stars. The druids computed their time by nights, and not by days; a custom which they had received by tradition from their most remote ancestors, and in which they were confirmed by measuring their time very much by the motions of the moon, the mistress and the queen of night. As the changes in the aspect of that luminary are most conspicuous, they engaged the attention of the most ancient astronomers of all countries, and particularly of the druids, who regulated all their great solemnities, both sacred and civil, by the age and aspect of the moon. "When no unexpected accident prevents it, they assemble upon stated days, either at the time of the new or full moon; for they believe these to be the most auspicious times for transacting all affairs of importance." Their most august ceremony, that of cutting the misletoe from the oak by the archdruid, was always performed on the sixth day of the moon. Nay, they even regulated their military operations by this luminary, and avoided, as much as possible, to engage in battle whilst the moon was on the wane. As the attention of the druids was so much fixed on this planet, it could not be very long before they discovered that she passed through all her various aspects in about thirty days; and by more accurate observations, they would gradually find, that the real time of her performing an entire revolution was very nearly twenty-nine and a half days. This would furnish them with the division of their time into months, or revolutions of the moon; of which we know with certainty they were possessed. But this period, though of great use, was evidently too short for many purposes, and particularly for measuring the seasons; which, they could not fail to perceive, depended on the influences of the sun. By continued observation they discovered that about twelve revolutions of the moon included all the variety of seasons, which began again and revolved every twelve months. This suggested to them that larger division of time called a year, consisting of twelve lunations or three hundred and fifty-four days, which was the most ancient measure of the year in almost all nations. That this was for some time at least the length of the druidical year, is both probable in itself, and apparent from the expression of Pliny, that "they began both their months and years, not from the change, but from the sixth day of the moon;" which is a demonstration that their years consisted of a certain number of lunar revolutions, as they always commenced on the same day of the moon. But as this year of twelve lunar months falls eleven days and nearly one fourth of a day short of a real revolution of the sun, this error would soon be perceived, and call for reformation; though we are not informed of the particular manner in which it was rectified. Various arguments might be collected to render it very probable that the Britons were acquainted with a year exact enough for every purpose of life when they were first invaded by the Romans; but it will be sufficient to mention one, which is taken from the time and circumstances of that invasion. The learned Dr Halley has demonstrated that Cæsar arrived in Britain, in his first year's expedition, on the 26th day of August; and Cæsar himself informs us, that at his arrival the harvest was finished, except in one field, which by some means or other was more backward than the rest of the country. This is a proof that the British husbandmen knew and used the most proper seasons for ploughing, sowing, and reaping. The druids, as we are told by Pliny, had also a cycle or period of thirty years, which they called an age, and which likewise commenced on the sixth day of the moon; but that author has not acquainted us on what principle this cycle was formed, nor to what purpose it was applied. We can hardly suppose that this was the cycle of the sun, which consists of twenty-eight years, and regulates the dominical letters. It is more probable, that whilst the druids made use of the year of twelve lunar months, and had not invented a method of adjusting it to the real revolution of the sun, they observed that the beginning of this year had passed through all the seasons, and returned to the point whence it set out, in a course of about thirty-three years; which they might therefore denominate an age. Others may perhaps be of opinion that this thirty years cycle of the druids is the same with the great year of the Pythagoreans, or a revolution of Saturn. Some have imagined that the druids were also acquainted with the cycle of nineteen years, which is commonly called the cycle of the moon. But the evidence of this depends entirely on the truth of that supposition, that the Hyperborean island, which is described by Diodorus Siculus, was Britain, or some of the British isles. Amongst many surprising things, that author states, concerning the Hyperborean island, that "its inhabitants believed that Apollo descended into their island at the end of every nineteen years; in which period of time the sun and moon, having performed their various revolutions, return to the same point, and begin to repeat the same revolutions. This is called by the Greeks the great year, or the cycle of Meton."

We are told both by Cæsar and Mela, that the druids studied the stars as well as the sun and moon; and that they professed to know, and taught their disciples, many things concerning the motions of these heavenly bodies. From these testimonies we may conclude that the druids were acquainted with the planets, distinguished them from the fixed stars, and carefully observed their motions and revolutions. If this discovery was the result of their own observations, it would be gradual, and it would be a long time before they found out all the planets. They might perhaps have received assistance and information from Pythagoras, or from some other quarter. But whether this discovery of the planets was their own, or communicated to them by others, it is highly probable that they were acquainted with the precise number of these wandering stars. Dio Cassius says, that the custom of giving the name of one of the planets to each of the seven days of the week was an invention of the Egyptians, and from them was gradually communicated to all the other nations of the world; and that in his time this custom was so firmly established, not only among the Romans, but among all the rest of mankind, that in every country it appeared to be a native institution. The knowledge of the planets, and perhaps the custom of giving their names to the days of the week, was brought out of Egypt into Italy by Pythagoras, more than five hundred years before the beginning of the Christian era; and from thence it could not be very long before it reached Gaul and Britain. But though we have little or no reason to doubt that the druids knew the number and observed the motion of the planets, yet it may be questioned whether they had discovered the times in which these bodies performed their several revolutions. Some of the planets, as Jupiter and Saturn, take so great a number of years in revolving, that it required a very extraordinary degree of patience and attention to discover the precise periods of their revolutions. If we could be certain that the island in which the ancients imagined Saturn lay asleep was one of the British isles, as Plutarch intimates it was, we might be inclined to think that the British druids were not ignorant of the length of the period in which the planet Saturn performs a revolution; for that same author, in another treatise, tells us, that "the inhabitants of that island kept every thirtieth year a solemn festival in honour of Saturn, when his star entered into the sign of Taurus." If we could depend upon this testimony, we should have one positive proof that the druids of the British isles were acquainted with the constellations, and even with the signs of the zodiac; and that they measured the revolutions of the sun and planets, by observing the length of time between their departure from and return to one of these signs. But history supplies no direct evidence that this was really the case. The druids of Gaul and Britain, indeed, as well as the ancient philosophers of other countries, had a general plan or system of the universe, and of the disposition and arrangement of its various parts, in which they instructed their disciples. This is both probable in itself, and is plainly intimated by several authors of the greatest authority. But we cannot be certain whether this druidical system of the world was of their own invention, or was borrowed from others. If it was borrowed, it was most probably from the Pythagoreans, to whom they were the nearest neighbours, and with whom they had the greatest intercourse; or at all events from some oriental sect, order, or caste, of which many are of opinion that they originally sprung.

It has been imagined that the druids had instruments of some kind or other, which answered the same purposes as our telescopes, in making observations on the heavenly bodies. The only foundation of this very improbable conjecture is an expression of Diodorus Siculus, in his description of the famous Hyperborean island. "They say further, that the moon is seen from that island, as if she were but at a little distance from the earth, and having hills or mountains like ours on the surface." But no such inference can be reasonably drawn from this expression, which in reality merits little more regard than that which, according to Strabo, was said of some of the inhabitants of Spain, that "they heard the hissing noise of the sun every evening when he fell into the western ocean."

The application of the druids to the study of philosophy and astronomy amounts almost to a demonstration that they applied also to the study of arithmetic and geometry; for some knowledge of both these sciences is indispensably necessary to the natural philosopher and astronomer, as well as of great and daily use in the common affairs of life. If we were certain that Abaris, the famous Hyperborean philosopher, the friend and scholar of Pythagoras, was really a British druid, as some have imagined, we should be able to produce direct historical evidence of their arithmetical knowledge. For Iamblicus, in the life of Pythagoras, says, that "he taught Abaris to find out all truth by the science of arithmetic." It may be thought improbable that the druids had made any considerable progress in arithmetic, as this may seem to have been impossible by the mere strength of memory, without the assistance of figures and of written rules. But it is very difficult to ascertain what may be done by memory alone, when it has been long exercised in this way. We have had examples of persons who could perform some of the most tedious and difficult operations in arithmetic by the mere strength of memory. The want of written rules could be no great disadvantage to the druids, as the precepts of this, as well as of the other sciences, were couched in verse, which would be easily got by heart and long remembered. Though the druids were unacquainted with the Arabic numeral characters, which are now in use, we have no reason to suppose that they were destitute of marks or characters of another kind, which, in some measure, answered the same purposes, both in making and recording their calculations. In particular, it is believed that they made use of the letters of the Greek alphabet for both these purposes. This seems to be pretty distinctly intimated by Cæsar, who, in speaking of the druids of Gaul, observes, that "in almost all other public transactions and private accounts or computations, they make use of the Greek letters." And this is further confirmed by what he says of the Helvetii, a people of the same origin, language, and manners, with the Gauls and Britons. "Tables were found in the camp of the Helvetii written in Greek letters, containing an account of all the men capable of bearing arms who had left their native country, and also separate accounts of the boys, old men, and women." There is historical evidence of the druids being also well acquainted with geometry. "When any disputes arise," says Cæsar, "about their inheritances, or any controversies about the limits of their fields, they are entirely referred to the decision of their druids." But besides the knowledge of mensuration which this implies, both Cæsar and Mela plainly intimate that the druids were conversant in the most sublime speculations of geometry; "in measuring the magnitude of the earth, and even of the world."

Skill in mechanics.

There are still many monuments remaining in Britain and the adjacent isles, which cannot so reasonably be ascribed to any race as to that of the ancient Britons, and which lead us to think that they had made great progress in this department of knowledge, and could apply the mechanical powers so as to produce very astonishing effects. As these monuments appear to have been designed for religious purposes, we may be certain that they were erected under the direction of the druids. Many obelisks or pillars, of one rough unpolished stone each, are still to be seen in Britain and its isles. Some of these pillars are both very thick and lofty, erected on the summits of barrows and of mountains; and some of them, as at Stonehenge, have ponderous blocks of stone raised aloft, and resting on the tops of the upright pillars. We can hardly suppose that it was possible to cut these prodigious masses of stone, some of them above forty tons in weight, without wedges, or to raise them out of the quarry without levers. But it certainly required still greater knowledge of the mechanical powers, and of the method of applying them, to transport those huge stones from the quarry to the places of their destination; to erect the perpendicular pillars, and to elevate the imposts to the tops of these pillars. If the prodigious stone in the parish of Constantine, Cornwall, was really removed by art from its original place, and fixed where it now stands, it is a demonstration that the druids could perform the most astonishing feats by their skill in mechanics. That the British druids were acquainted with the principles and use of the balance, we have reason to believe, not only from the great antiquity of that discovery in other parts of the world, but also from some druidical monuments which are still remaining in this island. These monuments are called *logan stones*, or rocking stones, and each of them consists of one prodigious block of stone, resting upon an upright stone or rock, and so equally balanced, that a very small force, sometimes even that of a child, can move it up and down, though hardly any force is sufficient to remove it from its station. Some of these stones may have fallen into this position by accident, but others of them evidently appear to have been placed in it by art. That the ancient Britons understood the construction and use of wheels, the great number of their war-chariots and other wheel carriages is a sufficient proof; and that they knew how to combine them together and with the other mechanical powers, so as to form machines capable of raising and transporting very heavy weights, we have good reason to believe. In a word, if the British druids were wholly ignorant of the principles and the use of any of the mechanical powers, it was most probably of the screw, though even of this we cannot be certain.

Medicine.

In Germany and in the northern nations of Europe the healing art was chiefly committed to the old women of every state; but in Gaul and Britain it was entrusted to the druids, who were the physicians as well as the priests of these countries. Pliny says expressly, that "Tiberius Cæsar destroyed the druids of the Gauls, who were the poets and physicians of that nation;" and he might have added, of the Britons. The people of Gaul and Britain were probably induced to devolve the care of their health on the druids, and to apply to these priests for the cure of their diseases, not only by the high esteem they had of their wisdom and learning, but also by the opinion which they entertained, that a very intimate connection subsisted between the arts of healing and the rites of religion, and that the former were most effectual when they were accompanied by the latter. It appears indeed to have been the prevailing opinion of the nations of antiquity, that all internal diseases proceeded immediately from the anger of the gods; and that the only way of obtaining relief from these diseases was by applying to the priests to appease their anger by religious rites and sacrifices. This was evidently the opinion and practice of the Gauls and Britons, who in some dangerous cases sacrificed one man as the most effectual means of curing another. "They are much addicted," says Cæsar, "to superstition, and hence those who are afflicted with a dangerous disease sacrifice a man, or promise that they will sacrifice one, for their recovery. For this purpose they make use of the ministry of the druids, because the latter have declared that the anger of the immortal gods cannot be appeased, so as to spare the life of one man, but by the life of another." This way of thinking also gave rise to that great number of magical rites and incantations with which the medical practices of the druids, and indeed of all the physicians of antiquity, were attended. "Nobody doubts," says Pliny, "that magic derived its origin from medicine, and that, by its flattering but delusive promises, it came to be esteemed the most sublime and sacred part of the art of healing."

Botany.

That the druids made great use of herbs for medicinal purposes, there is sufficient evidence. They not only had a most superstitious veneration for the misletoe of the oak, on a religious account, but they also entertained a very high opinion of its medicinal virtues, and esteemed it as a kind of panacea, or remedy for all diseases. "They call it," says Pliny, "by a name which in their language signifies *All-heal*, because they have an opinion that it cures all diseases." They believed it to be in particular a specific against barrenness, and a sovereign antidote against the fatal effects of poisons of all kinds. It was also esteemed an excellent emollient and discutient for softening and discussing hard tumours, and good for drying up scrofulous sores, and curing ulcers and wounds; and, provided it was not suffered to touch the earth after it was cut, it was thought to be a very efficacious medicine in epilepsy. It has been thought useful in this last calamitous disease by some modern physicians. The pompous ceremonies with which the misletoe was gathered by the druids have been already described. The selago, a kind of hedge hyssop resembling savin, was another plant much admired by the druids of Gaul and Britain for its supposed medicinal virtues, particularly in all diseases of the eyes. But its efficacy, according to them, depended very much upon its being gathered exactly in the following manner: The person who gathered it was to be clothed in a white robe; to have his feet bare, and washed in pure water; to offer a sacrifice of bread and wine before he proceeded to cut it, which he was to do with his right hand covered with the skirt of his garment, and with a hook of some more precious metal than iron. When it was cut, it was to be received and kept in a new and very clean cloth. Gathered exactly according to this whimsical ritual, it was affirmed to be not only an excellent medicine, but also a powerful charm and preservative against misfortunes and unhappy accidents of all kinds. The druids also entertained a high opinion of the herb samolus or mashwort, from its sanative qualities, and gave directions for gathering it, not less fanciful than those which have already been mentioned. The person who was to perform that office was to do it fasting, and with his left hand; he was on no account to look behind him, nor to turn his face from the herbs he was gathering. It would be tedious to relate the extravagant notions they entertained of the many virtues of the vervain, and to recount the ridiculous mummeries which they practised in gathering and preparing it, both for the purposes of divination and physic. It is easy to see that Pliny's information was very imperfect; and that, like many of the other Greek and Roman writers, he designedly represented the philosophers of Gaul and Britain in an unfavourable light. The herb called *Britannica* by the ancients, which some think was the great water-dock, and others the *cochlearia* or scurvy-grass, was probably much used in this island for medicinal purposes, as it derived its name from Britain, and was thence exported to Rome and other parts. Though these few imperfect hints are all that we can now collect of the botany of the British druids, yet there is some reason to think that they were not contemptible botanists. Their circumstances were peculiarly favourable for the acquisition of this kind of knowledge. For as they spent most of their time in the recesses of mountains, groves, and woods, the spontaneous vegetable productions of the earth constantly presented themselves to their view, and courted their attention.

The opinions which, it is said, the druids of Gaul and Britain entertained of the anguinum or serpent's egg, both as a charm and as a medicine, are romantic and extravagant in a very high degree. This extraordinary egg was formed, as they pretended, by a great number of serpents, interwoven and twined together; and when it had been formed, it was raised up in the air by the hissing of these serpents, and was then to be caught in a clean white cloth before it fell to the ground. The person who caught it was obliged to mount a swift horse, and to ride away at full speed to escape from the serpents, who pursued him with great rage, until they were stopped by some river. The way of making trial of the genuineness of the egg was no less extraordinary. It was to be encased in gold, and thrown into a river, and if it was genuine it would swim against the stream. "I have seen," says Pliny, "that egg; it is about the bigness of a moderate apple, its shell is a cartilaginous incrustation, full of little cavities, such as are on the legs of the polypus; it is the insignia or badge of distinction of the druids." The virtues which they ascribed to this egg were many and wonderful. It was particularly efficacious in rendering those who carried it about with them superior to their adversaries in all disputes, and in procuring them the favour and friendship of great men. Some have thought that this whole affair of the serpent's egg was a mere fraud, contrived by the druids to excite the admiration and pick the pockets of a credulous people, who purchased these wonder-working eggs from them at a high price. Others have imagined that this story of the anguinum, of which there is an ancient monument in the cathedral at Paris, was an emblematical representation of the doctrine of the druids concerning the creation of the world. The serpents, say they, represent the divine wisdom forming the universe, and the egg is the emblem of the world formed by that wisdom. It may be added, that the virtue ascribed to the anguinum, of giving those who possessed it a superiority over others, and endearing them to great men, may perhaps be intended to represent the natural effects of learning and philosophy. But in so doubtful a matter every one is of course at liberty to form what judgment he thinks proper.

Rhetoric.

As the influence and authority of the druids in their country depended very much upon the reputation of their superior wisdom and learning, they wisely applied to the study of those sciences which most directly contributed to the support and advancement of that reputation. In this number, besides those already mentioned, we may justly reckon rhetoric, which was diligently studied and taught by the druids of Gaul and Britain, who to the charms of their eloquence were indebted for much of the admiration and authority which they enjoyed. They had indeed many calls and opportunities to display their eloquence, and to discover its great power and efficacy; as, when they were teaching their pupils in their schools; when they discoursed in public to the people on religious and moral subjects; when they pleaded causes in the courts of justice; and when they harangued in great councils of the nation, and at the heads of armies ready to engage in battle, sometimes with a view to inflame their courage, and at other times with a design to allay their fury, and dispose them to make peace. Though this last was certainly a difficult task amongst fierce and warlike nations, yet such was the authority and eloquence of the druids, that they frequently succeeded in it. "They pay a great regard," says Diodorus Siculus, "to their exhortations, not only in the affairs of peace, but even of war; and these are respected both by their friends and enemies. They sometimes step in between two hostile armies, who are standing with their swords drawn and their spears extended, ready to engage; and by their eloquence, as by an irresistible enchantment, they prevent the effusion of blood, and prevail upon them to sheath their swords. So great are the charms of eloquence and the power of wisdom even amongst the most fierce barbarians." The British kings and chieftains, who were educated by the druids, were famous for their eloquence. This is evident from the many noble speeches which are ascribed to them by the Greek and Roman writers. For though these speeches may not be genuine, yet they are a proof that it was a well-known fact that these princes were accustomed to make harangues on such occasions. This we are expressly told by Tacitus: "The British chieftains, before a battle, fly from rank to rank, and address their men with animating speeches, tending to inflame their courage, increase their hopes, and dispel their fears." These harangues were called, in the ancient language of Britain, *brosnichty kah*, which is literally translated by Tacitus, *incitamenta belli*, incentives to war. The genuine posterity of the ancient Britons long retained their taste for eloquence, and their high esteem for those who excelled in that art. "Orators," says Mr Martin, "were in high esteem, both in these islands (the Hebrides) and the continent, until within these forty years. They sat always among the nobles or chiefs of families in the streah or circle. Their houses and little villages were sanctuaries, as well as churches, and they took place before doctors of physic. The orators, after the druids were extinct, were brought in to preserve the genealogy of families, and to repeat the same at every succession of a chief; and upon the occasion of marriages and births, they made epithalamiums and panegyrics, which the poet or bard pronounced. The orators, by the force of their eloquence, had a powerful ascendant over the greatest men in their time. For if any orator did but ask the habit, arms, horse, or any other thing belonging to the greatest man in these islands, it was readily granted him; sometimes out of respect, and sometimes for fear of being exclaimed against by a satire, which in those days was reckoned a great dishonour."

Magic and divination.

If the British druids, considering the times in which they lived, had made no contemptible proficiency in several parts of real and useful learning, it cannot be denied that they were also great pretenders to superior knowledge in certain vain and fallacious sciences, by which they excited the admiration, and took advantage of the ignorance and credulity, of mankind. These were the sciences, if they may be so called, of magic and divination, by means of which they pretended to work a kind of miracles, and exhibit astonishing appearances in nature; to penetrate into the counsels of heaven; to foretel future events, and to discover the success or miscarriage of public or private undertakings. Their own countrymen not only believed that the druids of Gaul and Britain were possessed of these powers, but they were celebrated on this account by the philosophers of Greece and Rome. "In Britain," says Pliny, "the magic arts are cultivated with such astonishing success, and so many ceremonies, at this day, that the Britons seem to be capable of instructing even the Persians themselves in these arts. They pretend to discover the designs and purposes of the gods. The Eubates or Vates in particular investigate and display the most sublime secrets of nature; and by auspices and sacrifices they foretel future events." They were so famous for the supposed veracity of their predictions, that they were not only consulted on all important occasions by their own princes and great men, but even sometimes by the Roman emperors. Nor is it very difficult to account for all this. The druids finding that the reputation of their magical and prophetical powers contributed not a little to the advancement of their wealth and influence, naturally endeavoured to strengthen and establish it by all their art and cunning. Their knowledge of natural philosophy and mechanics enabled them to execute such works, and to exhibit such appearances, or to make the world believe that they did exhibit them, as were sufficient to gain them the character of great magicians. The truth is, that nothing is more easy than to acquire this character in a dark age, and among an unenlightened people. When the minds of men are haunted with dreams of charms and enchantments, they are apt to fancy that the most common occurrences in nature are the effects of magical arts. The following strange story, which we meet with in Plutarch's Treatise of the Cessation of Oracles, was probably occasioned by something of this kind. "There are many islands which lie scattered about the isle of Britain, after the manner of our Sporades. They are generally unpeopled, and some of them are called the *Islands of the Heroes*. One Demetrius was sent by the emperor [probably Claudius] to discover these parts. He arrived at one of these islands [supposed by some to be Anglesey, but more probably one of the Hebrides] next adjoining to the isle of Britain before mentioned, which was inhabited by a few Britons, who were esteemed sacred and inviolable by their countrymen. Immediately after his arrival the air grew black and troubled, and strange apparitions were seen; the winds rose to a tempest, and fiery spouts and whirlwinds appeared dancing towards the earth." This was probably no more than a storm of wind, accompanied with rain and lightning, a thing neither unnatural nor uncommon; but Demetrius and his companions having heard that the British druids, by whom this isle was chiefly inhabited, were great magicians, imagined that it was raised by them, and fancied that they saw many strange and unnatural sights.

The druids did not think proper to undeceive them; for when they inquired about the cause of this storm, they were told that it was occasioned by the death of one of those invisible beings or genii who frequented their isle; a wonderful and artful tale, very well calculated to increase the superstitious terrors of Demetrius and his crew, and to determine them to abandon this enchanted isle, with a resolution never to return. Stonehenge, and several other works of the druids, were, for many ages after the destruction of their whole order, believed to have been executed by the arts of magic and enchantment; nor is it improbable that they persuaded the vulgar in their own times to entertain the same opinion of these works, by concealing from them the real arts by which they had been erected. The natural and acquired sagacity of the druids, with their long experience and great concern in the conduct of affairs, enabled them to form very probable conjectures about the event of enterprises. These conjectures they pronounced as oracles when they were consulted; and they pretended to derive them from the inspection of the entrails of victims, the observation of the flight and feeding of certain birds, and many other mummeries. By these and similar arts they obtained and preserved the reputation of prophetic foresight among an ignorant and credulous people. But these pretensions of the druids to magic and divination, which contributed so much to the advancement of their fame and fortune in their own times, have brought very heavy reproaches upon their memory, and have made some learned moderns declare that they ought to be expunged out of the catalogue of philosophers, and esteemed no better than mere cheats and jugglers. This censure is evidently too severe, and might have been pronounced with equal justice upon all the ancient philosophers of Egypt, Assyria, Persia, Greece, and Rome, who were great pretenders to magic and divination, as well as the druids. "I know of no nation in the world, " says Cicero, " either so polite and learned, or so savage and barbarous, as not to believe that future events are presignified to us, and may by some men be discovered and foretold." The only conclusion, therefore, that can be fairly drawn from the successful pretensions of the British druids to the arts of magic and of divination, is this: That they had more knowledge than their countrymen and contemporaries, but had not so much virtue as to resist the temptation of imposing upon their ignorance to their own advantage.

DRUM is a martial instrument in the form of a cylinder, hollow within, and covered at the two ends with vellum, which is stretched or slackened at pleasure by means of small cords or sliding knots. It is beat upon with sticks. Drums are sometimes made of brass, but most commonly of wood. The drum is said by Le Clerc to have been an oriental invention, and to have been brought into Spain by the Arabians, or perhaps rather the Moors.

Kettle Drums are two sorts of large basons of copper or brass, rounded in the bottom, and covered with vellum or goat skin, which is kept fast by a circle of iron round the body of the drum, with a number of screws to screw up and down. They are much used among the cavalry, as also in operas, oratorios, concerts, and the like.

DRUMMOND, William, was born at Hawthornden on the 13th of December 1585. His father was Sir John Drummond, descended from the family of Carnock, a branch of the more illustrious family of Stobhall, from which the king derives his remote lineage through Anabella Drummond, the mother of James the First. The poet's mother was Anne the daughter of William Fowler;[1] and she is described as " a woman of excellent breeding, and of a good and virtuous life." William was the eldest of four sons, and there were three daughters by the same marriage. The earlier part of his education he received at the High School of Edinburgh, where he began to distinguish himself by the superiority of his talents; and being afterwards removed to the university, which was then a very recent institution, he took the degree of A. M. in the year 1605. We are particularly informed that he did not confine his attention to the metaphysical learning commonly taught in the schools, but likewise applied himself to the study of mathematics and of ancient authors. During the following year, his father sent him to complete his education in France; and in the university of Bourges he is said to have devoted himself with great assiduity and success to the study of the civil law; a study necessary to a lawyer, and useful to a scholar. After an absence of four years, he returned to his native country in 1610; and his friends now expected that he would devote himself to the practice of a lucrative profession, for which he seemed eminently qualified by his talents and learning.[2] The bar must however have presented very few attractions to a youth of his elegant taste and delicate sensibility: the municipal law was then but a dreary path, beset with thorns which never blossomed; and, what was particularly discouraging, there was not a single elementary book, there were no institutions of our law, from which a young student could derive a comprehensive knowledge of those principles which were afterwards to direct his practice. His systematic doctrines were indeed to a great extent borrowed from the ancient civilians, and the study of the civil law was generally prosecuted in some foreign university; but, besides an indispensable attendance in the courts, his final preparation for the practice of his profession consisted in reading the statute law, and such collections of maxims and reports as were then circulated in manuscript. Nor was Drummond compelled by any domestic considerations to overcome his repugnance: he was beyond the reach of that original impulse which has directed many a lawyer to reputation and emolument; for, about the period of his return from the continent, the death of his father left him in possession of an estate sufficient to maintain him in the liberal style of a gentleman.

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[1] He is commonly described as Sir William Fowler, secretary to the queen, but this account of his quality is evidently erroneous. The secretary was his son, who bore the same name with himself; nor does it appear that either of them received the honour of knighthood. The son followed the queen to England; and a list of the officers of her council, dated in October 1603, describes him as " Secretarie, and Master of the Requests." (Lodge's Illustrations of British History, vol. iii. p. 209.) In 1587, we find him denominated parson of Hawick; and the records of the presbytery, 2 Sept. 1612, mention him as then dead. It is however more than probable that he continued a layman, and, at a period when such irregular proceedings were not uncommon, enjoyed the temporalities of that living without residence and without qualification. His poems are not unknown to those who are acquainted with the literary history of that age. Of some of his manuscripts, as well as those of his nephew, Mr Laing has given an account in the Transactions of the Society of Antiquaries of Scotland, vol. iv.

[2] President Lockhart is said to have averred, that if he had followed the legal profession, he might have made the best figure of any lawyer in his time. But the accuracy of this tradition, says Mr Maitland, " may reasonably be doubted. Drummond has left a record of the books read by him between 1606 and 1614, from which it is apparent that literature occupied a much larger portion of his attention than law. In the detail of his studies, which were in a great measure confined to the most popular poetry and romances of the time, he mentions no other work on law than the Institutes of Justinian." (Introduction to Drummond's Poems. Edinb. 1832, 4to.)

He now retired to his family residence at Hawthornden, six miles from Edinburgh, and resumed the study of the Greek and Latin classics. The immediate vicinity presents an air of such romantic beauty, that a poet could scarcely have found a more suitable habitation: his house is erected on the edge of a woody cliff which overhangs the river Esk; and at one extremity of the variegated and sequestered glen stand the ruins of the baronial castle and the collegiate church of Roslin. The ancient caves of Hawthornden, and the adjacent moor of Roslin, where Comyn and Fraser gained a signal victory over the English, have likewise their peculiar effect in impressing the imagination. Near the poet's house is a seat hewn in the solid rock, and still described by the name of the Cypress-grove; a name which it obtained from the circumstance of his having frequented this spot when engaged in the composition of a work which bears that title.

Here Damon ‘ sat’ whose songs did sometime grace
The murmuring Esk; may roses shade the place.

In this delightful seclusion he devoted himself to the general improvement of his mind, and to the occasional exercise of his fine talents; and many of his poems appear to have been composed about this period of his life.[1] He chiefly cultivated the familiarity of the university men, and other individuals of genius and learning: among his own countrymen, he enjoyed the particular friendship of the earl of Stirling, the earl of Ancram, Arthur Johnston, and John Adamson; and among the English poets, his greatest intimacy and correspondence was with Ben Jonson and Michael Drayton. The grandfather of Jonson was originally from Annandale, where Johnstone is still a very prevalent name. In the year 1619, when this celebrated poet had attained the age of forty-five, he travelled from London on foot, for the express purpose of paying Drummond a visit; and at Hawthornden he spent three or four weeks with every appearance of satisfaction.[2] The heads of some of Jonson's conversations on subjects of literature, together with his own impressions of Jonson's character, he committed to writing, with the manifest intention of occasionally referring to this as a private record: many years after his death, this paper was communicated to the public, apparently in a somewhat mutilated form; and as it does not represent his distinguished guest as altogether faultless, the amiable and esteemed writer has incurred the virulent and unmeasured censure of Mr Gifford, the late editor of Jonson's works.[3] If Drummond had resembled some more recent authors, who have violated all the decencies of private life by ministering to the gross appetite of the public with ridiculous or disparaging tales of their friends and acquaintance, the justice of this strong condemnation could not safely have been disputed; but what person of ordinary candour will thus censure an act which, to all human appearance, was entirely unconnected with malevolent or ungenerous motives?

The poet's tranquillity was exposed to a severe interruption from the unfortunate issue of his first love. He became deeply enamoured of a beautiful young lady, the daughter of Cunningham of Barns; he met with a suitable return, and a day was fixed for their nuptials, but before that day arrived, her life was terminated by a rapid fever. Such an event as this, which would have affected a lover of the most ordinary sensibility, could not but sink deeply into the heart of one who had assiduously cherished the softer feelings, and whose habits of seclusion were so directly calculated to preserve a lasting impression of melancholy. He was so overwhelmed with grief that he found it necessary to try the effect of a change of objects; and he accordingly retired to the continent, where he spent about eight years. His longest residence was at Paris and Rome; but he travelled through France, Germany, and Italy, visited the most celebrated universities, and conversed with men of learning. In the course of his peregrinations, he is said to have formed an excellent collection, not only of the ancient classics, but likewise of the best writers in the French, Italian, and Spanish languages. He presented to the university of Edinburgh a collection of books and manuscripts, of which he printed a catalogue in the year 1627, prefixing to it an appropriate preface written in Latin. Of this well-known collection, the value, that is, the extrinsic or pecuniary value, which was far from being inconsiderable at first, has been immensely encreased by the lapse of two centuries. It contains many Scotish and English publications of singular rarity. When Drummond returned to Scotland, he found his countrymen divided by fears and animosities. He now spent some time at the residence of his brother-in-law Sir John Scot of Scotstarvet, a learned man, and an encourager of learning. Having continued in a state of celibacy till the age of forty-seven, he in 1632 married Elizabeth Logan; a lady in whom he traced a strong resemblance to his first mistress. She is commonly represented as the grand-daughter of Sir Robert Logan of Restalrig; but, according to Hay, her father, who was altogether unconnected with that family, was minister of Edleston in the county of Peebles, and her mother was the daughter of a shepherd.[4] Of this marriage there were five sons and four daughters. John, the eldest son, died in his youth; William was knighted by Charles the Second, and lived to an advanced age;[5] Robert was married, but died about the age of forty without children; the two youngest, Richard and James, died in their infancy. The eldest daughter Elizabeth was married to Dr Henryson, an eminent physician in Edinburgh;[6] but the other three, Margaret, Anabella, and Jane, died very young.[7] The father was a decided cavalier, and wielded his pen, though not his sword, in the king's service; and being reputed a malignant, he was exposed to some of the usual molestations of those unhappy times. The tragical fate of his sovereign is said to have hastened his own dissolution: we are informed by Bishop Sage that Drummond, being weakened by hard study and disease, was so overwhelmed with extreme grief and anguish that he died on the 4th of December 1649.[1] But as the king was executed on the 30th of January, an interval of more than ten months must have occurred between his death and that of his faithful subject; an interval so long as to render the biographer's inference somewhat questionable. He had nearly completed the sixty-fourth year of his age. His remains were interred in the church of Lasswade, which stands at the distance of about a mile from Hawthornden. He appears through life to have maintained a character of uniform respectability; uniting with his other qualities that of consistent piety, and blending morality with his devotion. His death was affectionately lamented by his friend Colonel Lauder of Hatton, who has left several other specimens of his poetical talents, and who was not the only Scotish soldier of this period that evinced his love of the Muses.

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[1] The first edition of his poems has the following title: “Poems, amorous, funerall, diuine, pastorall, in Sonnets, Songs, Sextains, Madrigals. By W. D. the author of the Teares on the Death of Mœliades.” Edinbvrgh, printed by Andro Hart, 1616, 4to. Another edition, or the same edition with a new title, bears “Poems, by William Drvmmond of Hawthorne-denne. The second impression.” Edinbvrgh, printed by Andro Hart, 1616, 4to.

[2] To this visit another poet of exquisite talents makes the following allusion:

Then will I dress once more the faded bower,
Where Jonson sat in Drummond's classic shade.
COLLINS's Ode to John Home.

[3] Gifford's Memoirs of Jonson, p. cxxx.—This charge has been sufficiently repelled by Sir Walter Scott in his Provincial Antiquities of Scotland, vol. ii. p. 133. See likewise Dr Drake's Mornings in Spring, vol. i. p. 286.

[4] Hay's Memoirs, vol. ii. p. 105. MS. Adv. Lib.

[5] Sir William Drummond is more celebrated for his jovialty than for his literature. See Dr Pennecuik's Poems, p. 49. 52. An honourable instance of his humanity is recorded in the Memoirs of George Brysson, p. 285.

[6] This was probably Henry Henryson, M. D. of Elvingston, whose Latin version of the hundred and fourth psalm occurs in the *Octupla*. Edinb. 1696, 8vo. He is more commonly called Henderson, which is a corruption of the other name. Elizabeth, the heiress of her father Dr Henry Henderson of Elvington, was married to John Clerk of Pennecuik. (Inquisitionum Abbreviatio, vol. i. Haddington, 341.)

[7] Douglas's Baronage of Scotland, p. 573, compared with Sage's Life of Drummond, p. vi.

Drummond was evidently a man of superior talents and accomplishments. We are informed that he was familiarly acquainted with the best Greek and Latin authors: his long residence on the continent afforded him an excellent opportunity of acquiring a knowledge of the living languages; and he is said to have spoken French, Italian, and Spanish, as fluently as his native tongue. To his graver qualifications he added no mean proficiency in music; and he occasionally sought a relaxation from his studies by playing on the lute, "which he did to admiration." He seems to have devoted a considerable portion of his time to the invention or improvement of various instruments and machines, applicable to various purposes of peace or war. They are curiously enumerated, to the extent of sixteen, in a patent which he obtained in the year 1627, and which secured to him the sole right and property within the kingdom of Scotland for the space of twenty-one years.[2]

His literary productions exhibit considerable variety. His compositions in prose chiefly consist of the Cypress Grove, some political tracts, and the History of the five Jameses; a work which embraces the history of Scotland from 1423 to 1542.[3] "The best of Drummond's prose works," says Mr Headley, "is his Cypress Grove, which, though quaint in its style, is worth reading for its vein of dignified morality." His history, which has alternately been the object of extravagant commendation and unsparing censure, cannot now be regarded as a work of much value or interest: the author's materials are not generally drawn from recondite sources, and his manner is too rhetorical. For the reputation which he still retains, Drummond is chiefly indebted, not to his historical, but to his poetical excellence; and, in the opinion of competent judges, he is entitled to a distinguished place among the English poets of that age. As few of his poems extend to a considerable length, his genius cannot be estimated by the success of any great and continued effort; but notwithstanding the shortness of his flights, he generally soars on bright and steady wings. He is conspicuous for his delicate sensibility and warmth of fancy; and with these qualities, so essential in an amatory poet, he unites uncommon skill in versification. His taste seems in a great measure to have been formed upon the Italian model, nor are his compositions entirely free from Italian conceits; but he commonly maintains a degree of elegant simplicity to which few English poets of that age have attained.

The reputation which Drummond enjoyed during his life, appears to have suffered some diminution after his death. He was a gentleman, says Edward Phillips, "who imitating the Italian manner of versifying, vented his amours in sonnets, canzonets, and madrigals, and, to my thinking, in a style sufficiently smooth and delightful; and therefore why so utterly disregarded and layd aside at present, I leave to the more curious palats in poetry."[4] After an interval of more than a century, the same complaint of unmerited neglect was repeated by Mr Headley. "Without ostentatious praise (which is always to be suspected), it is but truth to observe that many of his sonnets, those more especially which are divested of Italian conceits, resemble the best Greek epigrams in their best taste, in that exquisite delicacy of sentiment, and simplicity of expression, for which our language has no single term, but which is known to all classical readers by the word ἀφελεια. It is in vain we lament the fate of many of our poets, who have undeservedly fallen victims to a premature oblivion, when the finished productions of this man are little known and still less read."[5]

Drummond's sonnets form a very considerable proportion of his poetical works. The following four may be selected as a specimen of the entire collection; and they are here exhibited in modern orthography.

I know that all beneath the moon decays,
  And what by mortals in this world is brought,
  In Time's great periods shall return to nought;
That fairest states have fatal nights and days:
I know how all the Muse's heavenly lays,
  With toil of spright which are so dearly bought,
  As idle sounds, of few or none are sought,
And that nought lighter is than airy praise:
I know frail beauty like the purple flower,
  To which one morn oft birth and death affords;
  That love a jarring is of minds' accords,
When sense and will invassal reason's power.
Know what I list, this all cannot me move
But that, O me! I both must write and love.

With flaming horns the Bull now brings the year,
  Melt do the horrid mountains' helms of snow,
  The silver floods in pearly channels flow,
The late-bare woods green anadems do wear;
  The nightingale, forgetting winter's woe,
Calls up the lazy morn her notes to hear;
  Those flowers are spread which names of princes bear,
  Some red, some azure, white, and golden grow.
Here lows a heifer, there bewailing strays
  A harmless lamb, not far a stag rebounds;
The shepherds sing to grazing flocks sweet lays,
  And all about the echoing air resounds.

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[1] Sir Thomas Urquhart is said to have expired in a paroxysm of laughter, on hearing of the restoration of Charles the Second; a statement which is rendered sufficiently probable by the record of similar cases, and by the eccentric character of the individual. Aretæus, an ancient physician, specifies unextinguishable laughter as one of the causes of death: γελως ἀσβεστος μεχρι θανατου. (De Causis et Signis Morborum, lib. i. p. 35. edit. Boerhaave. Lugd. Bat. 1735, fol.) And other ancient writers have mentioned the names of different persons who died of excessive joy. (Valerius Maximus, lib. ix. cap. xii. Plinii Hist. Nat. lib. vii. cap. liii.) According to the common account, Sophocles was of this number.

[2] Drummond's Works, p. 235. Edinb. 1711, fol.

[3] Of his History of Scotland, the first edition is that of London, 1655, fol. The introduction was written by Mr Hall of Gray's Inn. There are other three editions.

[4] Phillips's Theatrum Poetarum, or compleat Collection of the Poets, part ii. p. 192. Lond. 1675, 12mo.

[5] Headley's Biographical Sketches (p. xlv.) prefixed to Select Beauties of Ancient English Poetry. Lond. 1787, 2 vols. 8vo.

Hills, dales, woods, floods, and every thing doth change,
But she in rigour, I in love am strange.

Trust not, sweet soul, those curled waves of gold,
With gentle tides which on your temples flow,
Nor temples spread with flakes of virgin snow,
Nor snow of cheeks with Tyrian grain enroll'd;
Trust not those shining lights which wrought my woe,
When first I did their burning rays behold,
Nor voice, whose sounds more strange effects do show
Than of the Thracian harper have been told.
Look to this dying lily, fading rose,
Dark hyacinth, of late whose blushing beams
Made all the neighbouring herbs and grass rejoice,
And think how little is 'twixt life's extremes.
The cruel tyrant that did kill those flowers,
Shall once, aye me! not spare that spring of yours.

What doth it serve to see sun's burning face,
And skies enamell'd with both the Indies' gold,
Or moon at night in jetty chariot rolled,
And all the glory of that starry place?
What doth it serve earth's beauties to behold,
The mountains' pride, the meadows' flowing grace,
The stately comeliness of forests old,
The sport of floods, which would themselves embrace?
What doth it serve to hear the Sylvans' songs,
The wanton merle, the nightingale's sad strains,
Which in dark shades seem to deplore my wrongs?
For what doth serve all that this world contains,
Sith she, for whom those once to me were dear,
No part of them can have now with me here?

To some of his compositions, which he has described as songs, this title is by no means applicable; it is neither applicable to the vein of poetry, nor to the measure of the verse. One striking poem, which he entitles a song, is written in heroic couplets, and contains such passages as this:

And tell me, thou who dost so much admire
This little vapour, smoke, this spark or fire,
Which life is call'd, what doth it thee bequeath
But some few years which birth draws out to death?
Which if thou paragon with lustres run,
And them whose career is but now begun,
In day's great vast they shall far less appear,
Than with the sea when matched is a tear.
But why would'st thou here longer wish to be?
One year doth serve all nature's pomp to see,
Nay, even one day and night: this moon, that sun,
Those lesser fires about this round which run,
Be but the same which, under Saturn's reign,
Did the serpenting seasons interchain.
How oft doth life grow less by living long,
And what excelleth but what dieth young?[1]

His collection of sacred verses, which he entitles Flowres of Sion,[2] contain much poetical imagery and expression. Some of the topics cannot be very safely approached by a poet, who must place his chief reliance on the exercise of his fancy; and the subsequent lines of this writer may sometimes occur to the recollection of his reader:

Who would this Eden force with wit or sense,
A cherubim shall find to bar him thence.

Drum-
mond.

One of the longest poems in this collection, entitled a Hymne on the fairest Faire, contains the following among many other striking passages:

Ah! as a pilgrim who the Alps doth pass,
Or Atlas' temples crown'd with winter's glass,
The airy Caucasus, the Apennine,
Pyrenes cliffs where sun doth never shine,
When he some heaps of hills hath over-went,
Begins to think on rest, his journey spent,
Till, mounting some tall mountain, he doth find
More heights before him than he left behind:
With halting pace so while I would me raise
To the unbounded circuits of thy praise,
Some part of way I thought to have o'er-run,
But now I see how scarce I have begun,
With wonders new my spirits range possest,
And wand'ring wayless in a maze them rest.

It has been suggested by Mr Headley that one would be induced to suppose Pope must have remembered these lines when he wrote a well-known passage in his Essay on Criticism. The subsequent couplet, which occurs in the same hymn, is remarkable for its energetic simplicity:

Uncomprehensible by reachless height,
And unperceived by excessive light.

Another poem of considerable length he entitles the Shadow of the Judgment. It is left in an unfinished state, and is not included in the collection published under the direction of Sir John Scot;[3] but it nevertheless contains many passages worthy of the author's reputation. An elegant critic has remarked that the following verses, describing God moved to wrath, are in Milton's manner:

So seeing earth, of angels once the inn,
Mansion of saints, defloured all by sin,
And quite confus'd by wretches here beneath,
The world's great sovereign moved was to wrath.
Thrice did he rouse himself, thrice from his face
Flames sparkle did throughout the heavenly place:
The stars, though fixed, in their rounds did quake,
The earth, and earth-embracing sea did shake:
Carmel and Hæmus felt it, Athos' tops
Affrighted shrunk, and near the Ethiops
Atlas, the Pyrenees, the Apennine,
And lofty Grampius, which with snow doth shine.
Then to the synod of the sprights he swore,
Man's care should end, and time should be no more.

Drummond's poem in commemoration of Prince Henry[4] commences in a strain somewhat bombastic, but it contains some elegant and striking passages. The subsequent lines exhibit a very favourable specimen of his versification; and it is proper to recollect that the poem was printed so early as the year 1613. He describes the lamented youth as rejoicing to look down to the azure bars of heaven,

And in their turning temples to behold,
In silver robe the moon, the sun in gold,
Like young eye-speaking lovers in a dance,
With majesty by turns retire, advance.
Thou wonderest earth to see hang like a ball,
Clos'd in the ghastly cloister of this all;

Ὁν οἱ θεοι φιλουσιν ἀποθνησκει νεος.
MENANDRI Fragmenta, p. 48. edit. Meineke.

[2] Flowres of Sion. By William Drvmmond of Hawthorne-denne. To which is adjoyned his Cypresse Groue. 1623, 4to. Edenbovrgh, printed by Iohn Hart, 1630, 4to.

[3] Poems by that most famous wit Mr William Drummond of Hawthornden. Lond. 1656, 8vo. The editor was Edward Phillips, the nephew of Milton. The same edition was exhibited under a new and fantastic title, with the date of 1659. A more extensive collection of his poems is to be found in the Works of William Drummond of Hawthornden. Edinb. 1711, fol. Bishop Sage's life of the author is prefixed to this publication. But the most complete, as well as the most elegant edition was printed under the superintendence of Mr Maitland: "The Poems of William Drummond of Hawthornden." Edinb. 1832, 4to. The book however is not published: it was the splendid contribution of William Macdowall, Esq. of Garthland to the Maitland Club.

[4] Teares on the Death of Mœliades. Edinbvrgh, printed by Andro Hart, 1613, 4to. His two sonnets and epitaph, which appear in this publication, are likewise inserted in the "Mavsolevm, or choisest Flowres of the Epitaphs, written on the Death of the neuer-too-much lamented Prince Henrie." Edinb. 1613, 4to. A third edition of the "Teares on the Death of Mœliades" soon followed. Edinb. 1614, 4to. The second we have not seen.

Drummond.

And that poor men should prove so madly fond
To toss themselves for a small foot of ground;
Nay, that they even dare brave the powers above,
From this base stage of chance that cannot move.
All worldly pomp and pride thou seest arise
Like smoke, that scatt'reth in the empty skies.
Other hills and forests, other sumptuous tow'rs,
Amaz'd thou find'st excelling our poor bow'rs;
Courts void of flattery, of malice minds,
Pleasure which lasts, not such as reason blinds.

Forth Feasting, a poem written in the year 1617 on the king's visit to his native country,[1] may be considered as his best performance; it abounds with poetical imagery, and the versification possesses uncommon terseness and harmony. In all poems of the same age and denomination, the reader must necessarily expect a certain sprinkling of mythology; this is a prevailing vice, an endemic disease, among the poets of that period; but Forth Feasting is enlivened by an elegant vein of fancy, and contains various passages of distinguished felicity. In the following nervous lines, he pays a warm and not unmerited compliment to the monarch's love of peace:

Now, where the wounded knight his life did bleed,
The wanton swain sits piping on a reed,
And where the cannon did Jove's thunder scorn,
The gaudy huntsman winds his shrill-tun'd horn;
Her green locks Ceres without fear doth dye,
The pilgrim safely in the shade doth lie,
Both Pan and Pales careless keep their flocks,
Seas have no dangers save the winds and rocks:
Thou art this isle's Palladium, neither can,
While thou art kept, it be o'erthrown by man.
Let others boast of blood and spoils of foes,
Fierce rapines, murders, Iliads of woes,
Of hated pomp, and trophies reared fair,
Gore-spangled ensigns streaming in the air,
Count how they make the Scythian them adore,
The Gaditan, the soldier of Aurore;
Unhappy vauntry! to enlarge their bounds,
Which charge themselves with cares, their friends with wounds,
Which have no law to their ambitious will,
But, man plagues, born are human blood to spill:
Thou a true victor art, sent from above,
What others strain by force to gain by love;
World-wand'ring Fame this praise to thee imparts,
To be the only monarch of all hearts.

When the successor of this king visited his northern dominions in the year 1633, Drummond contributed the verses for the pageants which welcomed his arrival in Edinburgh.[2] These verses, although they do not exhibit passages equal to those which we have lately examined, are not destitute of merit. Of the frequent compression and harmony of his couplets, every reader must be sufficiently aware; and the excellence of his versification has been highly extolled by an English critic. Waller and Denham are often regarded as the great improvers of a mode of versification which was carried to greater perfection by Dryden; but the Tears on the Death of Mœliades, and Forth Feasting, were composed several years before either of those poets had reached the age of manhood.[3] (x.)

Drummond, *Sir William*, of Logie-Almond, a distinguished scholar, acute philosopher, and accomplished writer, died at Rome, of a lingering and painful disease, on the 29th of March 1828. The date of his birth we have not been able to ascertain, and consequently cannot pretend to determine his age at the time of his decease.

He seems to have been early ambitious of literary distinction, and in 1794 he published *A Review of the Government of Sparta and Athens*, large 8vo; a work which, though not destitute of merit, and exhibiting considerable traces of a vigorous mind, yet gave no promise of that bold spirit of speculation for which its author was afterwards so much distinguished. At the close of the year 1795, he was returned to parliament for the borough of St Mawes, in the representation of which a vacancy had occurred; and in the two following parliaments, which met respectively in 1796 and 1801, he sat for the town of Lostwithiel. At the time of his second election he had been appointed envoy-extraordinary to the court of Naples.

In the year 1798, he published *The Satires of Persius Translated*, 8vo, which happened to appear about the same time with the rival translation of the Roman satirist by Mr Gifford, author of the Baviad and Mæviad, and afterwards editor of the *Quarterly Review*. This translation alone would have been sufficient to fix his reputation as an accomplished classical scholar; and, in point of fact, it has been much admired by all who are competent to appreciate the difficulty of the task which he so successfully performed. It would not be easy, indeed, to overrate the skill with which the niceties of Persius have been discriminated, or the felicity with which the idiomatic peculiarities of that difficult author have been converted into equivalent forms of expression. Drummond's versification is easy, graceful, and precise; and though it wants the piquancy of allusion, the congenial bitterness of spirit, and the occasional point and concentration, which impart so strong a zest to the translation of Mr Gifford, it is yet distinguished for greater freedom and equal fidelity, two things which Drummond has shown that it is not impossible to reconcile.

In the year 1801, Mr Drummond being then ambassador to the Ottoman Porte, was honoured with the order of the Crescent, which was confirmed by license, in the London Gazette, dated the 8th of September 1803.

In 1805 Sir William published his *Academical Questions*, in 4to, and thereby greatly extended his fame as an author. Hitherto he had appeared only in the character of an elegant and accomplished scholar; but in this work he boldly entered the domain of philosophy, and in a free and fearless spirit attacked every species of dogmatism, whether consecrated by time, or sustained by authority, exposing the weakness of the human understanding, and mortifying the pride of pretended wisdom, by a collection of what appear to be insoluble cases and indeterminate problems. In this work, however, it is only the task of demolition which he proposes to accomplish; and it must be owned that he has spread abroad the rubbish and scattered the dust of philosophical systems in a somewhat appalling manner. "The author of *Academical Questions,*" says the able critic of the work in the *Edinburgh Review,* "is indubitably a person of great reading, and much natural acuteness; but he has taken too wide a range, and indulged somewhat too much in a vein of controversial declamation. He often seems to think more of demolishing his antagonist than of enlightening his reader; and sometimes appears to enlarge upon a topic as much for the display of his eloquence as for the support of his reasoning. By frequent reference to the Greek writers, and continual allusions to the usages of antiquity, he expected perhaps to seduce the scholars of the South into metaphysical investigations, and to engage the attention of polite readers by a certain vivacity and polish in the turn of his expression. If this was his view, however, he certainly ought not to have plunged at first into the great gulf of substance and entity." (*Edinburgh Review*, vol. vii. p. 185.) To these observations, however, it is proper to add, that the author avowedly reserved the full exposition of his own theory for a subsequent volume, though in point of fact it never appeared; and that in this preliminary publication he conceived himself to be only clearing out the foundation on which it was his intention afterwards to build.

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[1] Forth Feasting. A Panegyricke to the Kings most excellent Majestie. Edinbvrgh, printed by Andro Hart, 1617, 4to.—This poem occurs in the Muses Welcome, p. 25.

[2] Drummond's verses appeared in a publication entitled "The Entertainment of the high and mighty Monarch Charles, King of Great Britaine, France, and Ireland, into his auncient and royall Citie of Edinbvrgh, the fifteenth of Iune 1633." Printed at Edinbvrgh by Iohn Wreittoun, 1633, 4to. The last work which he himself is known to have published bears the following title: "To the Exequies of the Honovrable Sr Antonye Alexander, Knight, &c. A pastorall Elegie." Edinbvrgh, printed in King James his College, by George Anderson, 1638, 4to. Mr Maitland has reprinted the *Polemo-Middinia* from the earliest edition that has been traced. Edinb. 1684, 4to.

[3] Neve's Cursory Remarks on some of the Ancient English Poets, particularly Milton, p. 49. Lond. 1789, 8vo.—With respect to the supposed merit of Waller and Denham as improvers of English versification, the reader may consult Mr Crowe's Treatise on English Versification, p. 166. Lond. 1827, 8vo.

In the year 1810, Sir William Drummond, in conjunction with Robert Walpole, Esq. published *Herculanensia,* in 4to, containing archæological and philological dissertations, and a copy of a manuscript found amongst the ruins of Herculaneum; and in 1811 appeared an *Essay on a Punic Inscription found in the Isle of Malta,* royal 8vo; both works of great merit and erudition. Sir William was also an occasional, if not a frequent, contributor to the *Classical Journal;* in which his papers on subjects of antiquity, particularly the zodiac of Denderah, which occupied without exhausting his ingenuity, attracted the general admiration of the learned, if not always on account of their soundness, at least by reason of the acuteness and originality they display, and the resources of learning which the author had always at command for the illustration of his peculiar views. About this time, Sir William Drummond, whose residence at Constantinople had turned his attention to oriental literature, sacred as well as profane, consigned the fruits of his researches and investigations into the historical books of the Old Testament, in his *Œdipus Judaicus.* This singular work was never published, having been printed solely for distribution amongst the author's friends and acquaintance; but as he had caused a considerable impression to be struck off, copies of it soon found their way into the hands of persons connected with the periodical press, and those of others; and, as might have been expected, it was most fiercely attacked. The first onset was made by a churchman of the name of D'Oyly, in *Letters to the Right Hon. Sir William Drummond, in Defence of particular Passages of the Old Testament against his late work entitled "Œdipus Judaicus;"* and the attack was renewed in the *Quarterly Review,* with equal vigour and ability. Whether it was altogether fair thus openly to stigmatize a book which had never been published, we shall not stop to inquire; more especially as the principal cause of regret is, not that it was severely criticised, but that it was ever written, far less printed. In the controversy which thus arose, however, Sir William was overmatched, both in science and in Hebrew, with which D'Oyly and the Reviewer evinced a most intimate acquaintance; and although his reply displayed much ingenuity, no skill could evade, far less destroy, the force of some of the criticisms. The truth is, the allegorical theory which he undertook to establish was taken at second hand from the work of Dupuis; and although the author, notwithstanding all the errors charged against him, brought great stores of learning and erudition to bear upon it, yet the absurdities to which it leads are so glaring, and the consequences which follow from it are so pernicious, that it is surprising Sir William Drummond should not have foreseen the one, or been prudent enough not to hazard the other. The preface, too, though beautifully written, contains observations which nothing can excuse, and irreverences so gross as even to shock persons the least scrupulous about subjects of religion. The profane joke about veal cutlets is worthy only of Mr Thomas Paine, and fit to appear in no work where the ordinary humanities of taste and reason are duly observed.

In 1818 Sir William Drummond published, experimentally we believe, the first part of a poem entitled *Odin,* 4to, the object of which was to embody in verse some of the more striking features of the Scandinavian mythology. The poem, however, did not succeed in attracting public attention, which was then almost exclusively fixed on some of the great masters of song, whose deep voice of inspiration filled the land; and although it contained passages of very considerable power and beauty, it fell into almost immediate oblivion.

But the work on which the reputation of Sir William Drummond as a scholar and antiquary must chiefly rest, is his *Origines, or Remarks on the Origin of several Empires, States, and Cities,* in 3 vols. 8vo. The first volume, embracing the origin of the Babylonian, the Assyrian, and the Iranian empires, appeared in 1824; the second, which is wholly devoted to the subject of Egypt, including the modern discoveries in hieroglyphics, came out in 1825; and the third, which treats of the Phœnicians and Arabia, was published in 1826. It would be exceedingly difficult, by a general statement, or by critical observations apart from details, to convey an accurate idea of the real character and merits of this work; which, with much that is strained, exaggerated, or defective, to say nothing of errors into which the author is sometimes betrayed by the excessive refinements of an ever active ingenuity, is in several respects one of the most remarkable productions of modern times. A principal feature of the *Origines,* though certainly the least obtrusive, is, that here the author labours quietly to build up and fortify the authority of the historical books of the Old Testament, which, in the *Œdipus Judaicus,* he had (probably without intending it) contributed to impair, if not to pull down: whilst by concentrating, as it were, into one focus the various scattered lights of tradition, history, philosophy, science, etymology, and archæology, he has contrived to illuminate many of the darkest passages in the records of the ancient world; to dispel no inconsiderable portion of the obscurity which overshadowed the origin and annals of the great empires of antiquity; and, even in the merest archæological discussions, to interweave incidental illustrations, alike curious in themselves, and valuable to the scholar, the theologian, and the antiquary. Upon this work, therefore, as on a fixed and enduring pedestal, the fame of Drummond as a scholar must in a great measure rest. Besides its other great and singular merits, it has that which indeed is peculiar to almost all Drummond's works, of being written in a pure, chaste, classical style, full of vivacity and vigour, and sometimes even rising into a rich and lofty strain of eloquence. The dialogue between Neomathes and Philothoth, in the second volume, where the one impugns and the other defends the astronomical and mathematical skill of the ancient Egyptians, may be instanced as a specimen of the grace, elegance, and force of Drummond's style, when it flows in a continuous stream, unbroken by the projecting corners and edges of a hard and rugged erudition.

Sir William Drummond's appreciation of the modern discoveries in hieroglyphics (a subject to which three consecutive chapters of the second volume are devoted)

Drummond.

is, in general, sound and discriminating; and he foresaw sooner than almost any one else, that the powers of the phonetic alphabet, as an instrument of discovery, would be found to have been greatly over-rated. In a letter, dated Naples, 27th April 1827, and addressed to the author of this imperfect notice, he very distinctly shows how fully he had estimated the difficulty which M. Champollion had overlooked, and which now appears to be nearly, if not altogether insuperable. "That M. Champollion's system is accurate to a certain extent," says he, "I admit; and his discoveries do him great honour. Whether he be right in all the details of his system is another question. He establishes the existence of a very great number (I forget the precise number) of phonetic hieroglyphs;[1] and to these, he says, are to be traced all the characters of the running hand, which he reads with so much ease. Now I cannot help observing, that where there are so many signs to represent each alphabetical letter, and where consequently there must have been various contractions for each of these signs in the running hand, the task of learning all these contractions without the aid of a master, and of accurately referring them to their prototypes, must be immense. In Sanscrit there are fifty-two letters, and yet there are above eight hundred contractions. To refer these Sanscrit contractions to their original letters is not always very easy; but the difficulty in Egyptian must have been much greater, in which language the phonetic characters, and consequently the contractions, are far more numerous." Here we have the germ of those principles which, developed and applied by Klaproth to the values of characters as set down by M. Champollion, have made terrible havoc of his discoveries, and left him at last little more than what he took without acknowledgment from Dr Young.

Of Sir William Drummond in his public capacity we are not prepared to speak with any degree of confidence, having little knowledge of his services as a diplomatist, or of his capabilities for acting in that character. The habit of his mind was a cautious or rather tentative boldness, accompanied with perseverance, yet tempered with a conciliating blandness of disposition, and an amenity of manners, native to his character; and it is to be presumed that this prevailing tendency showed itself in the conduct of affairs, as well as in abstract or speculative pursuits. In 1808, we find him, whilst resident at the court of Palermo, ostensibly embarked in a scheme for securing the regency of Spain, which had then just risen in arms to throw off the yoke of France, to Prince Leopold of Sicily. As might have been expected, the project misgave at the very commencement, and Sir William Drummond has not escaped censure for the part he had in it. "Sir William Drummond, the British envoy at Palermo, Mr Viale, and the Duke of Orleans," says Colonel Napier," were the ostensible contrivers of this notable scheme, by which, if it had succeeded, a small party in a local junta (that of Seville) would have appointed a regency for Spain, paved the way for altering the laws of succession in that country, established their own sway over the other juntas, and created interminable jealousy between England, Portugal, and Spain; but with whom the plan originated does not very clearly appear. Sir William Drummond's representations induced Sir Alexander Ball to provide the ship of war, nominally for the conveyance of the Duke of Orleans [now king of the French, who had made no secret of his intention to negociate for the regency of Spain], but in reality for Prince Leopold, with whose intended voyage Sir Alexander does not appear to have been made acquainted. That the prince should have desired to be regent of Spain was natural; but that he should have been conveyed to Gibraltar in a British ship of the line, when the English government disapproved of his pretensions, was really curious. Sir William Drummond could scarcely have proceeded such lengths in an affair of so great consequence, without secret instructions from some member of his own government; yet Lord Castlereagh expressed unqualified approbation of Sir Hew Dalrymple's decisive conduct upon the occasion." (Napier's *History of the Peninsular War*, vol. i. p. 177.) In politics Sir William Drummond appears to have known his ground well, and to have given entire satisfaction to the governments which employed him, at periods of no ordinary difficulty, in transacting affairs of the greatest importance.

Such is an imperfect outline of the literary and political character of this distinguished person. In private life he was a man of modest, retiring, unobtrusive manners, perfectly unconscious that he differed from or had any claims to distinction superior to the most ordinary and commonplace person who fell in his way. Throughout his whole life he was a close and assiduous student, often preferring the company of his books to the promiscuous and frivolous intercourse of company; and hence he was sometimes considered as eccentric, if not cold, distant, and haughty, by those who neither knew nor could sympathise with the habits which are gradually formed by a studious and contemplative life; habits which continue unconsciously to grow upon men whose days and nights are devoted to the pursuit of knowledge. But he was, nevertheless, one of the kindest, mildest, and most generous and humane men that ever existed. To his tenants and dependents he was indulgent even to the injury of his own private fortune; to his friends he was most stedfastly and fervently devoted. In him rising merit was always sure to find a ready and active patron; and not a few individuals have owed their establishment and success in life to the circumstance of having attracted his notice, or of being pointed out to him as deserving of support or encouragement. Latterly, owing to the precarious state of his health, which made it necessary for him to resort to a warmer climate, he resided almost constantly abroad; chiefly, we believe, at Naples, where he continued to indulge in those learned pursuits which formed the main solace and delight of his life. (A.)

DRUNKENNESS, or INTOXICATION, a well-known vice, the consequence of an excessive use of spirituous liquors, wines, or drugs. Drunkenness is gradually produced, and several distinct stages may be traced in its progress. The sensations experienced in the earlier stages, or the state of incipient intoxication, are peculiarly pleasurable. The mind becomes unusually excited; a soft serenity steals over it, inducing a spirit of universal contentment; gaiety and warmth kindle at the heart, and images of beauty expand before the imagination. In this state, before consciousness is attacked, or the sensorium affected, some of the faculties of the soul act with greater liveliness and vigour, and the feelings of strength and courage are increased. In a short while the sense of propriety is lost, the soul begins to open itself and pour forth its secrets, displaying all the peculiarities of temper, good or bad. Gradually the scene thickens, and consciousness becomes still more weakened. Reason vacates her throne, and grotesque conceptions crowd upon the fancy. Dizziness attacks the brain, and surrounding objects, seeming to lose their balance,

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[1] About *a hundred and forty;* whilst, even by the lowest estimate, the total number of hieroglyphs on the monuments exceeds *eight hundred.*

Into strange vagaries fall,
As they would dance.

The drunkard begins to feel the earth unsteady beneath his feet, his sense of equilibrium gives way, and total insensibility succeeds, in which a state of stupor, wild dreams, and horror, strongly contrasts with that of previous excitement. Different individuals are differently affected by the inebriating liquid. The state of the passions at the period of indulging in strong liquors also operates powerfully in modifying its effects. Persons under sentence of death, and immediately before execution, have been known to swallow with impunity draughts of the strongest alcohol, which, under other circumstances, would have rendered them senseless. Hence the remarkable propriety of the language put into the mouth of Lady Macbeth previously to the contemplated murder, when, alluding to the manner in which she had "drugged the possets" of the grooms, she says, "that which hath made them drunk hath made me bold." In some persons constitutional moroseness and melancholy are dispelled; in others their habitual gloom is aggravated. Cases of the latter description, however, are by no means so numerous as those of the former, and the general effect of indulgence in "thick potations" is to dispel the clouds of care, at least for the time being. But the re-action which eventually follows over-excitement serves to deepen the darkness, and, by a dispensation of retributive justice, to inflict certain punishment for the previous delinquency. Drunkards who are of a sanguineous temperament are most intensely excited by the use of strong liquors.

It is unnecessary to enumerate the various inebriating agents, which, as well as temperament, influence the nature of the intoxication produced. Thus ebriety from ardent spirits differs from that generated by malt liquors. Besides alcohol, which is the intoxicating principle in all liquors, there are various substances taken, both in the solid and fluid state, which induce intoxication. The most common and remarkable are opium and nitrous oxide gas. The former, it is well known, is in extensive use for this purpose in the East, but the latter has not yet been employed out of the laboratory of the chemist. The effects produced by this gas are described by the discoverer, Sir Humphry Davy, and others who have experienced them, as very delightful, and similar to those felt during the earlier stages of intoxication from wine, but of a purer and more ethereal nature.

Amongst the physiological effects of drunkenness are vertigo, double vision, staggering and stammering, heat and flushing, ringing in the ears, and other analogous affections. Vertigo, though partly produced by the ocular delusions under which the drunkard labours, seems principally to arise from the close sympathy which subsists between the brain and the nerves of the stomach. Double vision is readily accounted for by the influence of increased circulation in the brain upon the nerves of sight. Staggering and stammering may likewise be explained by the disordered state of the nervous system. Heat and flushing result from the strong determination of blood to the surface of the body, and ringing in the ears particularly from the throbbing of the internal carotid arteries, which run in the immediate neighbourhood of the ear. The mental pleasure arising from intoxication is not so easily explained, though the primary cause no doubt is physical or rather nervous excitement gradually superinduced, and thus stimulating both the imagination and the passions. The evil consequences of drinking, both in a physical and moral point of view, are numerous and distressing. On the unhappy victim of this propensity a long train of bodily diseases and infirmities are entailed. The liver, stomach, brain, kidneys, indeed all the functions of the body, are seriously impaired by the practice; and in this state the frame is not only more liable to attacks of disease, but when they do come they are likely to exhibit tenfold inveteracy. Thus life is either suddenly shortened, or protracted into a long disease. Death itself is frequently an immediate consequence of over indulgence. We shall not attempt a classification of the bodily infirmities and pernicious effects which drunkenness produces; but we may mention madness, and spontaneous combustion of the body, as belonging to the number. The former is by no means a rare occurrence, and there are well authenticated cases of the latter. Drunkenness in a judicial point of view is not punishable by our laws; but acts of violence committed under its influence are held to be aggravated rather than otherwise; nor can the accused allege it as an extenuation of the crime of which he has been guilty. In proof of this it may be stated, that a bond signed in a fit of intoxication holds good in law, and is perfectly binding, unless it can be shown that the person who signed it was inebriated by the collusion or contrivance of those to whom the bond was given.

Drunkenness has been known from the earliest ages. Wherever the grape flourished inebriation soon made its appearance. It has greatly varied at different times and amongst different nations. There can be no doubt that in a rude, uncivilized state of society, it prevails to the greatest extent, and assumes the most revolting forms. It is also found to exist more extensively in northern than in southern latitudes, owing no doubt to the difference of climate. As society is refined, the vice certainly diminishes amongst the higher orders, although amongst those in the lower ranks it is still found to exist to a fearful extent. For checking this demoralizing practice various moral engines have been set to work, but without a success commensurate with the philanthropy of the design or the importance to society of the anticipated results.

Druses.

DRUSES, an independent people of Palestine, of warlike habits, who inhabit the mountains of Libanus, Anti-Libanus, and all the coast from Gibail to Saide, and east as far as Balbec. There are various conjectures concerning the origin of this singular race; the most rational of which is, that they were originally a persecuted sect of Mahommedans, who, flying from oppression, took refuge, about the commencement of the eleventh century, amongst the mountains of Lebanon, and there formed an independent society.

The unity of the Mahommedan faith was at a very early period broken by contending sectaries; and, according to the full and accurate details of Vólney, from whom the following account is chiefly compiled, Egypt, under the influence of these delusions, became, in the reign of the third caliph of the race of the Fatimites, and in the year of the Hegira 386 (A. D. 996), the theatre of the most extravagant enthusiasm and absurdity ever perhaps recorded in history. This prince, called Hakem-b'amr-ellah, was remarkable for his heresies and fanatical zeal. He caused the first caliphs, the companions of Mahommed, to be cursed in the mosques, and afterwards revoked the anathema; he compelled the Jews and Christians to abjure their religion, and then permitted them to resume it; he forbade the pilgrimage to Mecca, fasting, and the five prayers; and at length carried his madness so far as to desire to pass for God himself. This impious pretension was supported by a false prophet, who came from Persia into Egypt, and who, to ingratiate himself with Hakem, maintained that this caliph was God himself incarnate. But unluckily for the prophet, his new god had not the power to protect him from the fury of his enemies, who slew him in a tumult almost in the arms of the caliph, who was himself massacred soon afterwards on Mount

Mokhattam, where, as he said, he had held conversation with angels.

The death of these two chiefs did not stop the progress of their opinions. A disciple of Mohammed-ben-Ismael, named Hamzu-ben-Ahmud, propagated them with indefatigable zeal in Egypt, in Palestine, and along the coast of Syria, as far as Sidon and Berytus. But his proselytes being persecuted by the sect in power, took refuge in the mountains of Lebanon, where they were better able to defend themselves; and shortly after this era we find them established there, and forming an independent society.

The difference of their opinions naturally disposes them to be enemies, but the urgent interest of their common safety forces them to allow mutual toleration; and they have always appeared united, and have jointly opposed, at different times, the Crusaders, the sultans of Aleppo, the Mamelukes, and the Ottomans. The conquest of Syria by the latter made no change in their situation. Selim I. on his return from Egypt, meditating no less than the conquest of Europe, disdained to waste his time before the rocks of Lebanon. Soliman II. his successor, incessantly engaged in important wars, either with the knights of Rhodes, the Persians, the kingdom of Yemen, the Hungarians, the Germans, or the emperor Charles V. had no time to think of the Druses. Emboldened by this inattention, and not content with their own independence, they frequently descended from their mountains to pillage the Turks. The pashas in vain attempted to repel these inroads; for their troops were invariably routed or repulsed. But about the year 1588 they were at last subdued by Amurath III., to whom they became tributary, and under whose powerful sway the anarchy by which the country was distracted under its different chiefs was put an end to; and one head or chief was established, who was invested with the executive power, and who was made liable to the sultan for the stipulated tribute, which he was to collect as he best could from the people. The whole power and resources of the country being by this conquest or revolution concentrated under one head, the Druses were engaged in continual warfare and in marauding hostilities with the Turks; and towards the middle of the seventeenth century they had attained to the height of their power under the celebrated emir Fakir-el-din or Fakardin. This chief extended his conquests, and at length became so formidable that he excited the terror of the sultan, who resolved to make an effort for his destruction. To avert the threatening storm he embarked for Italy to solicit succours from the court of the Medici, at Florence, where he remained for nine years. On his return he found every thing prosperous under the wise government of his son Ali. But this prince was afterwards defeated in a battle with the Turks; and Fakir-el-din himself being compelled to take refuge in the mountains, was betrayed into the hands of the Turks by his companions, and by the orders of Amurath he was strangled at Constantinople in the year 1631.

After the death of Fakir-el-din, the posterity of that prince still continued in possession of the government, though at the pleasure, and as vassals, of the Porte. But as this family failed in the male line at the beginning of the last century, the authority devolved, by the election of the scheiks, on the house of Shelah. The only emir of that house whose name deserves to be preserved, is Melhem, who reigned from 1740 to 1759; in which interval he retrieved the losses of the Druses, and restored them to that consequence which they had lost by the defeat of Fakir-el-din. Towards the end of his life, about the year 1754, Melhem, wearied with the cares of government, abdicated his authority, to live in religious retirement, after the manner of the Okkals; but the troubles which succeeded forced him once more to resume the reins of government, which he held till 1759, when he died universally regretted.

He left three sons, minors, the eldest of whom ought, according to the custom of the country, to have succeeded him; but being only eleven years of age, the authority devolved on his uncle Mansour, agreeably to a law very general in Asia, which provides that the people shall be governed by a sovereign who has arrived at years of maturity. The young prince was but little fitted to maintain his pretensions; but a Maronite, named Sad-el-kouri, to whom Melhem had intrusted his education, took this upon himself. Aspiring to see his pupil a powerful prince, that he might himself become a powerful vizir, he made every exertion to advance his fortune; and accordingly entered into a great many plots and intrigues, in which he succeeded by means of an emir of the name of Yussuf in subverting his authority. We have no exact or accurate information of the internal state of this country, or of the domestic agitations and wars by which it has since been distracted. Nor would the detail of these petty wars, however ample or correct, possess any peculiar interest. The country is ruled by an emir, who is considered as the vassal of the Turks.

In their religion the Druses have very peculiar tenets and observances. They practise neither circumcision, nor prayers, nor fasting; they observe neither festivals nor prohibitions. They drink wine, eat pork, and allow marriage between brothers and sisters, though not between fathers and children. From this we may conclude, with reason, that the Druses have no religion; yet one class of them must be excepted, whose religious customs are very peculiar. Those who compose it are to the rest of the nation what the initiated were to the profane. They assume the name of *Okkals*, or spiritualists, and bestow on the vulgar the epithet of *Djahel*, or ignorant. They have various degrees of initiation, the highest orders of which require celibacy. These are distinguished by the white turban, which they affect to wear as a symbol of their purity; and so proud are they of this supposed purity, that they think themselves sullied by even touching a profane person. If you eat out of their plate, or drink out of their cup, they break them; and hence the custom, so general in this country, of using vases with a sort of cock, which may be drank out of without touching them with the lips. All their practices are enveloped in mysteries. Their oratories stand alone or detached, and are constantly situated on eminences; in these they hold their secret assemblies, to which women are admitted. It is believed that they perform ceremonies there in presence of a small statue resembling an ox or a calf; and hence some have pretended to prove that they are descended from the Samaritans. But besides that the fact is not well ascertained, the worship of the ox may be deduced from other sources.

The rest of the Druses, strangers to this spirit, are wholly indifferent about religious matters. The Christians who live in their country pretend that several of them believe in the metempsychosis, and that others worship the sun, moon, and stars. All this is possible; for every one, left to his own fancy, follows the opinion which pleases him most; and these opinions are those which present themselves most naturally to unenlightened minds. When among the Turks, they affect the exterior of Mahommedans, frequent the mosques, and perform their ablutions and prayers. Among the Maronites, they accompany them to church, and, like them, make use of holy water. Many of them, importuned by the missionaries, suffer themselves to be baptized; and if solicited by the

Turks, receive circumcision, and conclude by dying neither Christians nor Mahommedans. But they are not so indifferent in matters of civil policy.

The Druses may be divided into two classes: the common people; and the people of eminence and property, distinguished by the title of scheiks and emirs, or descendants of princes. The greater part are cultivators, either as farmers or proprietors; and every man lives on his inheritance, improving his mulberry trees and vineyards. In some districts they grow tobacco, cotton, and some grain; but the quantity of these is inconsiderable. It appears that at first all the lands were, as formerly in Europe, in the hands of a small number of families. But in order to render them productive, the great proprietors were forced to sell part of them, and let leases; which subdivision has become the chief source of the power of the state, by multiplying the number of persons interested in the public welfare. There still exist, however, some traces of the original inequality, which even at this day produces pernicious effects. The great property possessed by some families gives them too much influence in all the measures of the nation; and their private interests have too great weight in every public transaction. Their recent history affords sufficient proofs of this, since all the civil or foreign wars in which they have been engaged have originated in the ambition and personal views of some of the principal families, such as the Lesbeks, the Djambelats, and the Ismaels of Solyma. The scheiks of these houses, who alone possess one tenth part of the country, procured retainers by means of their money, and at last involved all the Druses in their dissensions. It must be owned, however, that possibly to this conflict between contending parties the whole nation owes the good fortune of never having been enslaved by its chief.

This chief, called *Hakem* or governor, and also *Emir* or prince, is a sort of king or general, who unites in his own person the civil and military powers. His dignity is sometimes transmitted from father to son, sometimes from one brother to another; and the succession is determined rather by force than by any certain laws. Females can in no case pretend to this inheritance. They are already excluded from succession in civil affairs, and consequently can still less expect it in political. In general the Asiatic governments are too turbulent, and their administration renders military talents too necessary, to admit of the sovereignty of women. Among the Druses, the male line of any family being extinguished, the government devolves to him who is in possession of the greatest number of suffrages and resources. But the first step used to be to obtain the approbation of the Porte, of whom he became the vassal and tributary. It even happens, that, not unfrequently, to assert its supremacy, it names the Hakem, contrary to the wishes of the nation, as in the case of Ismael Hasbeya, raised to that dignity by Djezzar; but this constraint lasts no longer than it is maintained by the violence which gave it birth. The office of the governor is to watch over the good order of the state, and to prevent the emirs, scheiks, and villages, from making war on each other; and in case of disobedience, he may employ force. He is also at the head of the civil power, and he names the cadis, reserving to himself the power of life and death. He collects the tribute, from which he annually pays to the pasha a stated sum. This tribute, which is called *miri*, is imposed on the mulberry trees, vineyards, cotton, and grain. All sown land pays in proportion to its extent; every foot of mulberries is taxed at three medins, or three sols nine deniers (not quite twopence). A hundred feet of vineyard pays a piastre, or forty medins; and fresh measurements are often made to preserve a just proportion. The scheiks and emirs have no exemption in this respect; and it may truly be said that they contribute to the public stock in proportion to their fortune. The collection is made almost without expense. Each man pays his contingent at Dair-el-kamar, if he pleases, or to the collectors of the prince, who make a circuit round the country after the crop of silks. The surplus of this tribute is for the prince; so that it is his interest to reduce the demands of the Turks, as it would likewise be to augment the impost. But this measure requires the sanction of the scheiks, who have the privilege of opposing it. Their consent is necessary, likewise, for peace and war. In these cases, the emir must convoke general assemblies, and lay before them the state of his affairs. There every scheik, and every peasant who has any reputation for courage or understanding, is entitled to give his suffrage; so that this government may be considered as a mixture of monarchy, aristocracy, and democracy. Every thing indeed depends on circumstances. If the governor be a man of ability, he is absolute; if he be weak, he is a cipher. This proceeds from the want of fixed laws; a want common to all Asia, and the radical cause of all the disorders in the governments of the Asiatic nations.

Neither the chief nor the individual emirs maintain troops; they have only persons attached to the domestic service of their houses, and a few black slaves. When the nation makes war, every man, whether scheik or peasant, able to bear arms, is called upon to march. He takes with him a little bag of flour, a musket, some bullets, a small quantity of powder made in his village, and repairs to the rendezvous appointed by the governor. If it be a civil war, as sometimes happens, the servants, the farmers, and their friends, take up arms for their patron, or the chief of their family, and repair to his standard. In such cases, the parties irritated frequently seem on the point of proceeding to the last extremities; but they seldom have recourse to acts of violence, or attempt the death of each other. Mediators always interpose, and the quarrel is appeased the more readily, as each patron is obliged to provide his followers with provisions and ammunition.

The Druses are noted for their hospitality. Whoever presents himself at their door in the quality of a suppliant or passenger, is sure of being entertained with lodging and food in the most generous and unaffected manner. Volney often saw the lowest peasants give the last morsel of bread they had in their houses to the hungry traveller; and when it was observed to them that they wanted prudence, their answer was, "God is liberal and great, and all men are brethren." There are, therefore, no inns in their country any more than in the rest of Turkey. When they have once contracted with their guest the sacred engagement of bread and salt, no subsequent event can make them violate it. Various instances of this are related which do honour to their character. A few years ago an aga of the janissaries having been engaged in a rebellion, fled from Damascus and retired among the Druses. The pasha was informed of this, and demanded him of the emir, threatening to make war on him in case of refusal. The emir demanded him of the scheik Talhouk, who had received him; but the indignant scheik replied, "When have you known the Druses deliver up their guests? Tell the emir, that as long as Talhouk shall preserve his beard, not a hair of the head of his suppliant shall fall."

In consequence, says Volney, of their prejudices, the Druses do not choose to make alliances out of their own families. They invariably prefer their relation, though poor, to a rich stranger; and poor peasants have been known to refuse their daughters to merchants of Saide and Bairout, who possessed from twelve to fifteen thousand piastres. They observe also, to a certain degree, the custom of the Hebrews, which directed that a brother should espouse his brother's widow.

In short, the proper and distinctive character of the Druses is a sort of republican spirit, which gives them more energy than any other subjects of the Turkish government, and an indifference for religion, which forms a striking contrast with the zeal of the Mahommedans and Christians. In other respects, their private life, their customs and prejudices, are the same with those of other orientals. They may marry several wives, and repudiate them when they choose; but, except by the emir and a few men of eminence, that is rarely practised. The women are all veiled, so that no man knows the face of any other woman than his wife, his mother, his sister, and sisters-in-law. Every man lives in the bosom of his own family, and goes little abroad. The women, those even of the scheiks, make the bread, roast the coffee, wash the linen, cook the victuals, and perform all domestic offices. The men cultivate their lands and vineyards, and dig canals for watering them. In the evening they sometimes assemble in the court, the area, or house of the chief of the village or family. There, seated in a circle, with legs crossed, pipes in their mouths, and poniards at their belts, they discourse of their various labours, the scarcity or plenty of their harvests, peace or war, the conduct of the emir, or the amount of the taxes; they relate past transactions, discuss present interests, and form conjectures on the future. Their children, tired with play, come frequently to listen. This is the only education of those who are termed the Ignorant.

This account of the character, manners, and religious tenets of the Druses has been corroborated by modern travellers. The reverend Mr Connor, a missionary and travelling agent of the British and Foreign Bible Society, mentions that there are many sects among them; but that they are divided into two great classes, that of the Okkals or the Intelligent, who to the number of 10,000 form the sacred order; and the Djahels or Ignorant. It is stated to be extremely difficult to learn any thing satisfactory respecting the religious creed of this people. It is generally agreed that they believe in the transmigration of souls; and according to the character of the individual in his journey through life, will be the nature of the body which his soul will animate in a future state of existence. If his conduct has been fair and honourable, his soul will vivify the body of some respectable character in life. But if his conduct has been evil, his soul will enter the body of a horse, a mule, or an ass. In like manner it is believed that persons of eminent and conspicuous virtue will, as the highest recompense of their merit, pass after death into the bodies of Chinese Druses. In the schools, which are frequent among the Druses, the Okkals are generally the masters, and are paid by the pupils. They teach reading and writing, and the book generally used is the Koran. In some villages where there are Christian schools, the Druses send their children thither, where they are taught to read the Psalms of David. There are no Christians among the Druses, though the emir with his family and some of the other nobles have their children baptized, have chapels in their houses, and hear mass on Sunday, not from any rational belief in the truths of Christianity, but for the same reason that, though they dislike the Mahommedans generally, and entertain no tenet in common with their faith, yet many of them, as we learn from Buckingham, are infected with their customs, and keep the feast of Ramadan with as much rigour as the most orthodox follower of the Arabian prophet; just as the Mussulmans of India, though they despise and hate the Hindus, have nevertheless adopted many of their superstitions and ceremonies.

The Djahels or the Ignorant, who form by far the most numerous class, perform no religious rites whatever, unless when they are obliged by circumstances to assume the appearance of Mahommedans. They cherish an equal dislike to the Christians and Turks; and believe that the deity was incarnated in the person of Hakem, caliph of Egypt, and that he will shortly appear again and utterly destroy all his enemies.

The Druses are a restless and enterprising people; they are formidable in irregular war, being brave even to temerity; excellent marksmen, and noted for sudden surprises. The passion of all classes for arms is remarked by every traveller; and Buckingham mentions a keen dispute at which he was present relative to the value of different weapons, in which the sabres of Ispahan and Damascus, and the muskets and pistols of England, were unanimously preferred. They are of industrious habits, devoting their attention to the cultivation of the soil; and the same traveller, who was over all this country, on quitting a Mahommedan village and entering one inhabited by Druses, was struck with the contrast of the superior order and neatness everywhere conspicuous, as well as in the more cultivated state of the land. No great distinction of ranks is preserved among them, scheiks and peasants treating each other with the greatest familiarity. They speak pure Arabic. Soeda, which is the capital of the Eastern Druses, and the residence of their emir or prince, is about two miles westward of the summit of that range of hills which forms the eastern boundary of the plains of the Hauran.

DRUSIUS, or VAN DEN DRIECHE, JOHN, a learned Protestant and eminent critic, was born at Oudenarde, in Flanders, on the 28th June 1550. Being designed for the church, he learned Greek and Latin at Ghent, and philosophy at Louvain; but his father having been outlawed for his religion, and deprived of his estate, they both retired to England, where the son became professor of oriental languages at Oxford. Upon the pacification of Ghent, however, they returned to their own country, and Drusius was appointed professor of the oriental languages at Leyden. From this place he removed to Friesland, and was admitted professor of Hebrew in the university of Franeker; an office which he discharged with great honour till his death, which happened in 1616. His works prove him to have been well skilled in Hebrew and in Jewish antiquities; and in 1600 the states-general employed him, at a salary of four hundred florins a year, to write notes on the most difficult passages in the Old Testament; but being frequently interrupted in prosecuting this undertaking, it was not published until after his death. He carried on an extensive correspondence with the learned in different countries; for, besides letters in Hebrew, Greek, and other languages, there were found amongst his papers upwards of two thousand written in Latin. He had a son, John, who died in England at the age of twenty-one, and was accounted a prodigy of learning.

Drusius, who was a man of real learning, and deserves the encomiums which Simon has bestowed on him, is also favourably mentioned by Bayle, Freher, Meursius, Foppens, Paquot, and others. Paquot states the number of the printed works and treatises of Drusius at forty-eight, and of the unprinted at upwards of twenty. Of the former more than two thirds were inserted in the collection entitled *Critici Sacri, sive Annotata doctissimorum Virorum in vetus et novum Testamentum*, Amsterdam, 1698, in 9 vols. folio, or London, 1660, in 10 vols. folio. Amongst the works of Drusius not to be found in this collection may be mentioned, 1. *Alphabetum Hebraicum vetus*, 1584, 4to; 2. *Tabulæ in Grammaticam Chaldaicam ad usum Juventutis*, 1602, 8vo; 3. An edition of *Sulpitius Severus*, Franeker, 1607, 12mo; 4. *Opuscula quæ ad Grammaticam spectant omnia*, 1609, 4to; 5. *Lacrymæ in obitum J. Scaligeri*, 1609, 4to; and 6. *Grammatica Linguæ Sanctæ nova*, 1612, 4to.

DRYADES, in the heathen theology, a sort of deities or nymphs, which, the ancients thought, inhabited groves and woods. They differed from the Hamadryades, the latter being attached to some particular tree, with which they were born, and with which also they died; whereas the former were goddesses of trees and woods in general.

DRYANDER, Jonas, a Swedish naturalist of eminent talents, and a distinguished pupil of the great Linnæus, was born in 1748. His father, a clergyman near Gottenburg, died during the minority, if not the infancy, of his son; in consequence of which the care of the education of the latter devolved on a maternal uncle. This was Dr Lars Montin, a member of the Stockholm Academy, known to the world by several botanical writings, and, amongst others, by an inaugural dissertation on the genus *Splachnum*, published under the presidency of Linnæus, 28th March 1750; and reprinted in the *Amœnitates Academicæ*, vol. ii. 263. The early education of young Dryander, as far as we can learn, was chiefly in the University of Gottenburg; but he afterwards removed to Lund, where he took his degree of master of arts, or doctor in philosophy, under the presidency of Lidbeck, in 1776; on which occasion he published a dissertation, *fungos regno vegetabili vindicans.* He combated the ideas of certain philosophers, who, led by analogy rather than observation and judgment, were disposed to believe that *fungi* might, like corals and corallines, be the production of animals. But though Mr Dryander thus asserted the vegetable nature of these bodies, he subsequently imbibed, from his friend and preceptor Linnæus, an insuperable dislike to their use as food; nor could the most delicate mushrooms of the most luxurious table ever tempt him to overcome this prejudice. We know not at what period he went to study at Upsal, nor how long he remained there. He became for some time domestic tutor to a young Swedish nobleman, after which he visited England, under the patronage of his countryman the well-known Dr Solander, who introduced him to the acquaintance of Sir Joseph Banks; and on the sudden death of Solander in 1782, he succeeded to the place of that eminent man, in the confidence and friendship of his distinguished patron. He was, in like manner, domesticated under the roof of Sir Joseph as his librarian, and continued in that situation as long as he lived. Mr Dryander also held the offices of librarian to the Royal and the Linnæan Societies. He was one of the first founders of the latter in 1788; and took a principal interest in all its concerns, especially in drawing up its laws and regulations, when this society was incorporated by royal charter in 1802. He, moreover, fulfilled the duties of a very active vice-president, till the time of his decease, which happened towards the end of October 1810, in the sixty-third year of his age. His remains were deposited in the vault of St Ann's Church, Soho, the funeral being attended by a number of his friends, principally members of the Linnæan Society.

The acknowledged publications of Mr Dryander on the subject of botany consist of the following dissertations: 1. *An Account of the Genus Albuca*, in the Stockholm *Transactions* for 1784, in Swedish; 2. *Observations on the Genus Begonia*, in the *Transactions of the Linnæan Society*, vol. i. In this essay twenty-one species are determined, with an indication of nine doubtful ones, though the genus was previously supposed to consist of a solitary species only. 3. *On Genera and Species of Plants* which occur twice or three times in Professor Gmelin's edition of Linnæus's *Systema Naturæ; Trans. of Linn. Soc.* vol. ii. These corrections unfortunately extend no farther than the class *Octandria.* Their author intended to have completed them, but other occupations intervened; and the book which was the object of his correction soon fell into absolute neglect, as far as regards botany; insomuch that its errors, however great and numerous, became harmless. 4. *Lindsea, a new Genus of Ferns; Trans. of Linn. Soc.* vol. iii. This genus is distinguished from *Pteris*, by the *involucrum* opening outward. 5. *Botanical Description of the Benjamin Tree of Sumatra*, in the *Phil. Trans.* vol. lxxvii. The tree in question, about which great mistakes had arisen, is here shown to be a species of *Styrax.* This paper has been republished and translated.

The principal works published under the superintendence and correction of the subject of this memoir, were, the *Hortus Kewensis* of Mr Aiton, printed in 1789, and about half the second edition of the same work, interrupted by his death; as well as Dr Roxburgh's *Plants of the Coast of Coromandel*, a splendid and highly valuable publication, for which the world is indebted to the munificence of the East India Company. To both these the critical learning and accuracy of Mr Dryander were most usefully applied, especially in the typographical department. It would be vain to seek for an error in the printing of any thing which had passed through his hands. We have only to regret that the same critical correctness was not extended as a principle to every other department of the works in which he took a part. Had this been the case, the erroneous essential character of *Oldenlandia*, copied in *Hortus Kewensis* from Linnæus and Willdenow, would not have been allowed to contradict the plate and description of Roxburgh, cited underneath. But, above all, various inaccuracies and faults in nomenclature are propagated and confirmed by an authority which Mr Dryander himself never intended to give. He has often assured the writer of this notice, that, had he published in his own name, he would not have adopted such inaccuracies; which is mentioned here to prevent the errors of others being laid to his charge. The popular *Species Plantarum* of Willdenow being the avowed guide, the author of that work must be responsible for matters which it did not come within the scope of the author or editor of the *Hortus Kewensis* to correct. Many subjects, however, are most skilfully elucidated in this publication, as well as in the sequel of its second edition by Mr Brown, and these cannot escape the discrimination of an intelligent reader. Practical botany was but a secondary or occasional pursuit of Mr Dryander, and he had a diffidence of his powers, and a consequent distaste for the technical and descriptive parts of the science. The descriptions he had prepared for Mr Bauer's splendid figures of *Ericæ*, published by Mr Aiton, were readily and even gladly thrown into the fire, on occasion of a difference of opinion respecting the intended title of the work.

The study in which this most acute and correct man found ample scope for the exercise of his talents was bibliography. His *Catalogus Bibliothecæ Historico-Naturalis Josephi Banks*, is a model for all future writers in this line; but a model rather calculated to check than to excite imitation. A work so ingenious in design, and so perfect in execution, can scarcely be produced in any science; so faultless a specimen of typography we have never elsewhere seen. The frank and unvarnished sincerity of Mr Dryander's character was secondary only to his universal and fastidious exactness upon every subject that came under his notice. He could not be a silent witness of the slightest injustice, misrepresentation, or misconception. His impatience of contradiction arose more from the quickness of his penetration into the confusion and inaccuracy of ordinary intellects and characters, than from any natural severity. All clearness, honesty, and precision himself, he had little indulgence for those who fell short of his standard, and these were the greater part of mankind. On being asked what share Dr Smith had in the composition of the *Flora Græca*, he replied, with a vehemence which startled the inquirer, "Every word!" When teazed, as was too often his lot, by the questions of the heedless and superficial, he never neglected the duties of the office he had undertaken, if he could not always conceal his impatience under their performance. But when the humblest cultivator of real science applied for his assistance, all his stores were laid open; the most condescending liberality graced his conversation; and he was careful that what he communicated should not only be heard but understood. The versatility of his genius and conversation was no less admirable than their exactness. Whether the subject were a question in science, or a point of history; the politics of Europe, or the tittle-tattle of an obscure German court; the literary talents and performances of any distinguished man, or his private transactions; the intrigues for a place at court, a professorship, or a domestic establishment; he was sure to throw some light upon it. Few men are more missed in the circle in which he moved, nor can his place in general society be readily supplied. (x. x.)

DRYDEN, John, an illustrious English poet, descended of a respectable family in Huntingdonshire, was born at Aldwincle, in that county, on the 9th August 1631. He was educated under Dr Bushby at Westminster school, whence he removed to Cambridge in 1650, having been elected scholar of Trinity College, of which he appears to have been afterwards a fellow. In his earlier days he gave no extraordinary indications of genius; for even the year before he quitted the university, he wrote a poem on the death of Lord Hastings, which by no means exhibits a presage of that perfection in poetical composition which he was afterwards destined to attain.

On the death of Oliver Cromwell he wrote some "heroic stanzas" to the memory of the Lord Protector; but after the Restoration, being desirous of ingratiating himself with the new monarch, he wrote, first, a poem entitled *Astræa Redux*, and afterwards a panegyric on the king upon the occasion of his coronation. In 1662, he addressed a poem to the lord chancellor Hyde, presented on new year's day; and in the same year he published a satire on the Dutch. In 1668 appeared his *Annus Mirabilis*, or the Year of Wonders, an historical poem, intended to celebrate the Duke of York's victory over the Dutch. These pieces at length obtained him the favour of the crown; and Sir William Davenant having died the same year, 1668, Mr Dryden was appointed to succeed him as poet-laureat and historiographer to Charles II.; and accordingly he entered upon the office, though his patent was not signed until the year 1670. The pension of the two offices was L.200 a year. About this time also his inclination to write for the stage seems first to have evinced itself. For besides his concern with Sir William Davenant in the alteration of Shakspeare's *Tempest*, he in 1669 produced his *Wild Gallants*, a comedy, which met with very indifferent success. Yet the author, not discouraged by its failure, soon published his *Indian Emperor*, which having experienced a more favourable reception, encouraged him to proceed. He did so, and that with so great rapidity, that in the key to the Duke of Buckingham's *Rehearsal* he is recorded to have engaged himself by contract to write four plays in the year; and, indeed, in the years 1679 and 1680 he appears to have fulfilled this obligation. To this unhappy necessity which he lay under are to be attributed all those irregular and bombastic flights, and sometimes even puerile exuberances, for which he has been so severely criticised, and which, in the unavoidable hurry he usually wrote in, it was impossible for him to find time either to lop off or to correct.

In 1675, the Earl of Rochester, whose envious disposition did not allow him patiently to see growing merit meet with its due reward, and who therefore felt chagrined at the just applause with which Dryden's dramatic pieces had been received, was determined if possible to shake his interest at court; and he succeeded so far as to recommend one Crowne, an obscure author, to write a mask for the court, a service which of course belonged to Mr Dryden as poet-laureat. Nor was this the only attack, or indeed the most formidable one, which Dryden's fame drew upon him; for, some years before this, the Duke of Buckingham, a man of licentious character, but of great wit, had severely ridiculed several of our author's plays in his piece called the *Rehearsal*. But though the intrinsic wit which runs through this performance cannot, even at the present day, fail to excite our laughter, yet, as ridicule is not always the test of truth, it ought not to form the standard by which to fix Dryden's poetical reputation, more especially when we consider that the pieces therein ridiculed are not the masterpieces of Dryden; that the very passages burlesqued are frequently, in their original places, much less ridiculous than when thus detached, like a rotten limb, from the body of the work, exposed to view with additional distortions, and divested of that connection with the other parts which gave it not only symmetry, but beauty; and, lastly, that the beauties, which the critic has kept in the back-ground, are infinitely more numerous than the deformities which he has thus industriously brought forth into immediate view.[1]

Dryden, however, did not suffer these attacks to pass with impunity; for in 1679 there appeared an *Essay on Satire*, said to have been written jointly by himself and the Earl of Mulgrave, containing some very severe reflections on the Earl of Rochester and the Duchess of Portsmouth, who, it is not improbable, might have been instrumental in the affront shown to Dryden; and in 1681 he published his *Absalom and Achitophel*, in which the well-known character of Zimri, drawn for the Duke of Buckingham, is certainly severe enough to repay all the ridicule thrown on him by that nobleman in the character of Bayes.[2] The resentment shown by these peers was, however, different and characteristic. Lord Rochester, who was a coward as well as a man of the most depraved morals, basely hired three ruffians to cudgel Dryden in a coffeehouse; whilst the Duke of Buckingham, in a more open manner, took the task upon himself, and at the same time presented the poet with a purse containing no very trifling sum of money; telling him that he inflicted the beating as a punishment for his impudence, but bestowed the gold as a reward for his wit.

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[1] Dryden affected to despise the satire of the *Rehearsal*, which, however, he must have felt acutely. In the dedication prefixed to his translation of Juvenal and Persius, he observes, speaking of the many lampoons and libels which had been written against him, "I answered not the *Rehearsal*, because I knew the author sat to himself when he drew the picture, and was the very Bayes of his own farce; because also I knew, that my betters were more concerned than I was in that satire; and, lastly, because Mr Smith and Mr Johnson, the main pillars of it, were two such languishing gentlemen in their conversation, that I could liken them to nothing but their own relations, those noble characters of men of wit and pleasure about town." But notwithstanding this affected insensibility, Dryden did not fail to take his revenge, as will be seen in the succeeding paragraph of the text.

[2] Dryden left the story unfinished; and the reason he assigns for doing so is, because he could not prevail upon himself to exhibit Absalom as unfortunate. "Were I the inventor," says he, "who am only the historian, I should certainly conclude the piece with the reconcilement of Absalom to David. And who knows but this may come to pass? Things were not brought to extremity where I left the story; there seems to be yet room left for a composure: hereafter there may be only for pity. I have not so much as an uncharitable wish against Achitophel; but am content to be accused of good-natured error, and to hope, with Origen, that the devil himself may at last be saved. For which reason, in this poem, he is neither brought to set his house in order, nor to dispose of his person afterwards." Nevertheless, a second part of *Absalom and Achitophel* was undertaken and written by Tate, at the request and under the direction of Dryden, who wrote nearly two hundred lines of it himself.

In 1680 was published a translation of Ovid's Epistles in English verse by several hands, two of which, together with the preface, were by Mr Dryden; and in 1682 appeared his *Religio Laici*, designed as a defence of revealed religion, against deists, infidels, *et hoc genus omne.* Soon after the accession of King James II. our author changed his religion for that of the church of Rome, and wrote two pieces in vindication of the Catholic tenets; namely, *A Defence of the Papers written by the late King*, found in his strong box; and the celebrated poem, afterwards answered by Lord Halifax, entitled *The Hind and the Panther.* By this extraordinary step he not only engaged himself in controversy, and incurred much censure and ridicule from the contemporary wits, but on the accomplishment of the revolution, being, by reason of his new religion, disqualified from bearing any office under the government, he was stripped of the laurel, which, to his still greater mortification, was bestowed on Richard Flecknoe, a man for whom he had a most settled aversion. This circumstance occasioned his writing the severely satirical poem called *MacFlecknoe.*

Dryden's circumstances had never been affluent; but being now deprived of this little support, he found himself reduced to the necessity of writing for bread. We consequently find him from this period engaged in tasks of labour as well as genius, namely, in translating the works of others; and to this necessity perhaps our nation stands indebted for some of the best translations extant. In the year when he lost the laurel, he published the life of St Francis Xavier from the French. In 1693 appeared a translation of Juvenal and Persius; in the first of which he had a considerable hand, and of the latter the entire execution. In 1695 was published his prose version of Fresnoy's *Art of Painting;* and in the year 1697 he gave to the world that translation of Virgil's works which still does, and perhaps ever will, hold the first place amongst all attempts of the kind. The smaller pieces of this eminent writer, such as prologues, epilogues, epitaphs, elegies, songs, and the like, are too numerous to be specified here, though now all happily collected in Sir Walter Scott's edition of his works. His last work is what is called his *Fables*, consisting of many of the most interesting stories in Homer, Ovid, Bocaccio, and Chaucer, translated or modernized in the most elegant and poetical manner; together with some original pieces, among which is the Ode to St Cecilia's Day. This last composition, though written in the very decline of the author's life, and at a period when old age and distress had conspired to damp his poetic ardour, and enfeeble the wings of fancy, possesses nevertheless as much of both as would have been sufficient to render him immortal had he never written a single line besides.

Dryden married Lady Elizabeth Howard, the daughter of the Earl of Berkshire, who survived him about eight years, though for the last four of them she was a lunatic, having been deprived of her senses by a nervous fever. By this lady he had three sons; Charles, John, and Henry. After a long life, harassed with the most laborious of all fatigues, that of the mind, and continually rendered anxious by distress and difficulty, he expired on the 1st of May 1701. Dryden had no monument erected to him for several years; a circumstance to which Mr Pope alludes in his epitaph intended for Mr Rowe. Upon this hint Sheffield duke of Buckingham erected a tomb, for which the following epitaph was originally intended:

> This Sheffield rais'd—the sacred dust below
> Was Dryden once; the rest, who does not know?

But this was afterwards changed into the plain inscription still to be seen on the monument, containing merely the dates of the poet's birth and death, together with the fact of the tomb having been erected by John Sheffield, duke of Buckingham.

Mr Dryden's character has been variously estimated by different writers, some of whom have exalted it by the highest commendation, and others debased it by the severest censure. The latter, however, we must charge to that strong spirit of party which prevailed during the greater part of Dryden's lifetime, and which ought therefore to be taken with great allowances. From some parts of his history, however, he appears to have been unsteady, and to have too readily temporized with the several revolutions in church and state. But this might in some measure have been owing to that natural timidity and diffidence of disposition, which almost all writers seem agreed that he possessed. Congreve, whose authority cannot be suspected, has given us such an account of him as must make him appear no less amiable in his private character as a man, than he was illustrious in his public capacity as a poet. In the former capacity, according to Congreve, he was humane, compassionate, forgiving, and sincerely friendly; of extensive reading, tenacious memory, and ready communication; gentle in the correction of the writings of others, and patient under the reprehension of his own deficiencies; easy of access himself, but slow and diffident in his advances to others; and of all men the most modest and the most easy to be discountenanced in his approaches either to his superiors or to his equals. In the latter the highest testimonies have been borne to his merits by some of the greatest men.

Pope had a very high opinion of Dryden. In a letter to Wycherly he says, "It was certainly a great satisfaction to me to see and converse with a man whom in his writings I had so long known with pleasure; but it was a very high addition to it, to hear you at our very first meeting doing justice to your dead friend Mr Dryden. I was not so happy as to know him; *Virgilium tantum vidi.* Had I been born early enough, I must have known and loved him; for I have been assured, not only by yourself, but by Mr Congreve and Sir William Trumball, that his personal qualities were as amiable as his poetical, notwithstanding the many libellous misrepresentations of them; against which the former of these gentlemen has told me he will one day vindicate him." But what Congreve and Pope have said of Dryden is rather in the way of panegyric than as an exact and impartial character. Other writers, however, have spoken of him with greater moderation, yet probably without doing him any injustice. Thus, according to Felton, "he at once gave the best rules, and broke them, in spite of his own knowledge, and the *Rehearsal.* His prefaces are many of them admirable upon dramatic writings: he had some peculiar notions, which he maintains with great address; but his judgment in disputed points is of less weight and value, because the inconstancy of his temper did run into his thoughts, and mixed with the conduct of his writings, as well as his life." Voltaire describes him as "a writer whose genius was too exuberant, and not accompanied with judgment enough;" and he adds, that "if he, Dryden, had written only a tenth part of the works he left behind him, his character would have been conspicuous in every part. But," says the philosopher of Ferney, "his great fault is his having endeavoured to be universal." "Perhaps no nation," says Dr Johnson, "ever produced a writer that enriched his language with such a variety of models. To him we owe the improvement, perhaps the completion, of our metre, the refinement of our language, and much of the correctness of our sentiments. By him we were taught 'sapere et fari,' to think naturally and express forcibly. Though Davies has reasoned in rhyme before him, it may be perhaps maintained that he was the first who joined argument with poetry. He showed us the true bounds of a translator's liberty. What was said of Rome adorned by Augustus, may be applied by an easy metaphor to English poetry embellished by Dryden, 'lateritiam invenit, marmoream reliquit;' he found it brick, and he left it marble." The public voice, indeed, has assigned to Dryden the first place in the second rank of our poets; no mean station in a table of intellectual precedency so rich in illustrious names: and it is allowed that, even of the few who were his superiors in genius, none has exercised a more extensive or permanent influence on the national habits of thought and expression. In the following noble passage from an article in the *Edinburgh Review* (vol. xlvii. p. 29), the great attributes of Dryden's character and genius are unfolded with striking vigour of diction and splendour of illustration.

"If Dryden had died before the expiration of the first of the periods into which we have divided his literary life, he would have left a reputation, at best, little higher than that of Lee or Davenant. He would have been known only to men of letters; and by them he would have been mentioned as a writer who threw away, on subjects which he was incompetent to treat, powers which, judiciously employed, might have raised him to eminence, whose diction and whose numbers had sometimes very high merit, but all whose works were blemished by a false taste, and by errors of gross negligence. A few of his prologues and epilogues might perhaps still have been remembered and quoted. In these little pieces, he early showed all the powers which afterwards rendered him the greatest of modern satirists. But during the latter part of his life he gradually abandoned the drama. His plays appeared at longer intervals. He renounced rhyme in tragedy. His language became less turgid, his characters less exaggerated. He did not indeed produce correct representations of human nature; but he ceased to daub such monstrous chimeras as those which abound in his earlier pieces. Here and there passages occur worthy of the best ages of the British stage. The style which the drama requires changes with every change of character and situation. He who can vary his manner to suit the variation, is the great dramatist; but he who excels in one manner only, will, when that manner happens to be appropriate, appear to be a great dramatist; as the hands of a watch which does not go point right once in the twelve hours. Sometimes there is a scene of solemn debate. This a mere rhetorician may write as well as the greatest tragedian that ever lived. We confess that to us the speech of Sempronius in Cato seems very nearly as good as Shakspeare could have made it. But when the senate breaks up, and we find that the lovers and their mistresses, the hero, the villain, and the deputy-villain, all continue to harangue in the same style, we perceive the difference between a man who can write a play and a man who can write a speech. In the same manner, wit, a talent for description, or a talent for narration, may, for a time, pass for dramatic genius. Dryden was an incomparable reasoner in verse. He was conscious of his power; he was proud of it; and the authors of the *Rehearsal* justly charged him with abusing it. His warriors and princesses are fond of discussing points of amorous casuistry, such as would have delighted a parliament of love. They frequently go still deeper, and speculate on philosophical necessity and the origin of evil.

"There were, however, some occasions which absolutely required this peculiar talent. Then Dryden was indeed at home. All his best scenes are of this description. They are all between men; for the heroes of Dryden, like many other gentlemen, can never talk sense when ladies are in company. They are all intended to exhibit the empire of reason over violent passion. We have two interlocutors, the one eager and impassioned, the other high, cool, and judicious. The composed and rational character gradually acquires the ascendency. His fierce companion is first inflamed to rage by his reproaches, then overawed by his equanimity, convinced by his arguments, and soothed by his persuasions. This is the case in the scene between Hector and Troilus, in that between Antony and Ventidius, and in that between Sebastian and Dorax. Nothing of the same kind in Shakspeare is equal to them, except the quarrel between Brutus and Cassius, which is worth them all three.

"Some years before his death, Dryden altogether ceased to write for the stage. He had turned his powers in a new direction, with success the most splendid and decisive. His taste had gradually awakened his creative faculties. The first rank in poetry was beyond his reach, but he challenged and secured the most honourable place in the second. His imagination resembled the wings of an ostrich. It enabled him to run, though not to soar. When he attempted the highest flights, he became ridiculous; but while he remained in a lower region, he outstripped all competitors.

"All his natural, and all his acquired powers, fitted him to found a good critical school of poetry. Indeed he carried his reforms too far for his age. After his death our literature retrograded; and a century was necessary to bring it back to the point at which he left it. The general soundness and healthfulness of his mental constitution, his information, of vast superficies though of small volume, his wit scarcely inferior to that of the most distinguished followers of Donne, his eloquence, grave, deliberate, and commanding, could not save him from disgraceful failure as a rival of Shakspeare, but raised him far above the level of Boileau. His command of language was immense. With him died the secret of the old poetical diction of England, the art of producing rich effects by familiar words. In the following century, it was as completely lost as the Gothic method of painting glass, and was but poorly supplied by the laborious and tesselated imitations of Mason and Gray. On the other hand, he was the first writer under whose skilful management the scientific vocabulary fell into natural and pleasing verse. In this department he succeeded as completely as his contemporary Gibbons succeeded in the similar enterprise of carving the most delicate flowers from heart of oak. The toughest and most knotty parts of language became ductile at his touch. His versification, in the same manner, while it gave the first model of that neatness and precision which the following generation esteemed so highly, exhibited, at the same time, the last examples of nobleness, freedom, variety of pause and cadence. His tragedies in rhyme, however worthless in themselves, had at least served the purpose of nonsense-verses: they had taught him all the arts of melody which the heroic couplet admits. For bombast, his prevailing vice, his new subjects gave little opportunity; his better taste gradually discarded it.

"He possessed, as we have said, in a pre-eminent degree, the power of reasoning in verse; and this power was now peculiarly useful to him. His logic is by no means uniformly sound. On points of criticism he always reasons ingeniously, and, when he is disposed to be honest, correctly; but the theological and political questions which he undertook to treat in verse were precisely those which he understood least. His arguments, therefore, are often worthless; but the manner in which they are stated is beyond all praise. The style is transparent. The topics follow each other in the happiest order. The objections are drawn up in such a manner that the whole fire of the reply may be brought to bear on them. The circumlocutions which are substituted for technical phrases are clear, neat, and exact. The illustrations at once adorn and elucidate the reasoning. The sparkling epigrams of Cowley, and the simple garrulity of the burlesque poets of Italy, are alternately employed in the happiest manner, to give effect to what is obvious, or clearness to what is obscure.

"His literary creed was catholic, even to latitudinarianism, not from any want of acuteness, but from a disposition to be easily satisfied. He was quick to discern the smallest glimpse of merit; he was indulgent even to gross improprieties when accompanied by any redeeming talent. When he said a severe thing, it was to serve a temporary purpose, to support an argument or to tease a rival. Never was so able a critic so free from fastidiousness. He loved the old poets, especially Shakspeare. He admired the ingenuity which Donne and Cowley had so wildly abused. He did justice, amidst the general silence, to the memory of Milton. He praised to the skies the school-boy lines of Addison. Always looking on the fair side of every object, he admired extravagance, on account of the invention which he supposed it to indicate; he excused affectation in favour of wit; he tolerated even tameness for the sake of the correctness which was its concomitant.

"It was probably to this turn of mind, rather than to the more disgraceful causes which Johnson has assigned, that we are to attribute the exaggeration which disfigures the panegyrics of Dryden. No writer, it must be owned, has carried the flattery of dedication to a greater length; but this was not, we suspect, merely interested servility: it was the overflowing of a mind singularly disposed to admiration, of a mind which diminished vices, and magnified virtues and obligations. The most adulatory of his addresses is that in which he dedicates the State of Innocence to Mary of Modena. Johnson thinks it strange that any man should use such language without self-detestation; but he has not remarked, that to the very same work is prefixed an eulogium on Milton, which certainly could not have been acceptable to the court of Charles II. Many years later, when Whig principles were in a great measure triumphant, Sprat refused to admit a monument of John Philips into Westminster Abbey, because, in the epitaph, the name of Milton incidentally occurred. The walls of his church, he declared, should not be polluted by the name of a republican. Dryden was attached both by principle and interest to the court; but nothing could deaden his sensibility to excellence. We are unwilling to accuse him severely, because the same disposition which prompted him to pay so generous a tribute to the memory of a poet whom his patrons detested, hurried him into extravagance when he described a princess distinguished by the splendour of her beauty and the graciousness of her manners.

"This is an amiable temper, but it is not the temper of great men. Where there is elevation of character there will be fastidiousness. It is only in novels and on tombstones that we meet with people who are indulgent to the faults of others and unmerciful to their own, and Dryden at all events was not one of these paragons. His charity was extended most liberally to others, but it certainly began at home. In taste he was by no means deficient. His critical works are beyond all comparison superior to any which had till then appeared in England. They were generally intended as apologies for his own poems, rather than as expositions of general principles; he, therefore, often attempts to deceive the reader by sophistry, which could scarcely have deceived himself. His dicta are the dicta, not of a judge, but of an advocate, and often of an advocate in an unsound cause; yet in the very act of misrepresenting the laws of composition he shows how well he understands them; but he was perpetually acting against his better knowledge. His sins were sins against light: he trusted that what was bad would be pardoned for the sake of what was good; what was good he took no pains to make better. He was not, like most persons who rise to eminence, dissatisfied even with his worst productions. He had set up no unattainable standard of perfection, the contemplation of which might at once improve and mortify him. His path was not attended by an unapproachable mirage of excellence, for ever receding and for ever pursued. He was not disgusted by the negligence of others, and he extended the same toleration to himself. His mind was of a slovenly character; fond of splendour, but indifferent to neatness. Hence most of his writings exhibit the sluttish magnificence of a Russian noble, all vermin and diamonds, dirty linen and inestimable sables. Those faults which spring from affectation, time and thought in a great measure removed from his poems; but his carelessness he retained to the last. If towards the close of his life he less frequently went wrong from negligence, it was only because long habits of composition rendered it more easy to go right. In his best pieces we find false rhymes, triplets in which the third line appears to be a mere intruder, and while it breaks the music, adds nothing to the meaning; gigantic Alexandrines of fourteen and sixteen syllables, and truncated verses for which he never troubled himself to find a termination or a partner.

"Such are the beauties and the faults which may be found in profusion throughout the later works of Dryden. A more just and complete estimate of his natural and acquired powers, of the merits of his style and of its blemishes, may be formed from the *Hind and Panther*, than from any of his other writings. As a didactic poem, it is far superior to the *Religio Laici*. The satirical parts, particularly the character of Burnet, are scarcely inferior to the best passages in *Absalom and Achitophel*. There are, moreover, occasional touches of a tenderness, which affects us more, because it is decent, rational, and manly, and reminds us of the best scenes in his tragedies. His versification sinks and swells in happy unison with the subject, and his wealth of language seems to be unlimited. Yet the carelessness with which he has constructed his plot, and the innumerable inconsistencies into which he is every moment falling, detract much from the pleasure which such various excellence affords.

"In *Absalom and Achitophel* he hit upon a new and rich vein, which he worked with signal success. The ancient satirists were the subjects of a despotic government. They were compelled to abstain from political topics, and to confine their attention to the frailties of private life. They might, indeed, sometimes venture to take liberties with public men,

> Quorum Flaminia tegitur cinis atque Latina.

Thus Juvenal immortalized the obsequious senators who met to decide the fate of the memorable turbot. His fourth satire frequently reminds us of the great political poem of Dryden; but it was not written till Domitian had fallen, and it wants something of the peculiar flavour which belongs to contemporary invective alone. His anger has stood so long, that though the body is not impaired, the effervescence, the first cream, is gone. Boileau lay under similar restraints, and, if he had been free from all restraint, would have been no match for our countryman.

"The advantages which Dryden derived from the nature of his subject he improved to the very utmost. His manner is almost perfect. The style of Horace and Boileau is fit only for light subjects. The Frenchman did indeed attempt to turn the theological reasonings of the Provincial Letter into verse, but with very indifferent success. The glitter of Pope is cold: the ardour of Persius is without brilliancy. Magnificent versification and ingenious combinations rarely harmonize with the expression of deep feeling. In Juvenal and Dryden alone we have the sparkle and the heat together. Those great satirists succeeded in communicating the fervour of their feelings to materials the most incombustible, and kindled the whole mass into a blaze at once dazzling and destructive. We cannot indeed think, without regret, of the part which so eminent a writer as Dryden took in the disputes of that period. There was, no doubt, madness and wickedness on both sides; but there was liberty on the one and despotism on the other. On this point, however, we will not dwell. At Talavera the English and French troops for a moment suspended their conflict to drink of a stream which flowed between them. The shells were passed across from enemy to enemy without apprehension or molestation. We, in the same manner, would rather assist our political adversaries to drink with us of that fountain of intellectual pleasure which should be the common refreshment of both parties, than disturb and pollute it with the havoc of unseasonable hostilities.

"*MacFlecknoe* is inferior to *Absalom and Achitophel* only in the subject: in the execution it is even superior. But the greatest work of Dryden was the last, the Ode on St Cecilia's Day. It is the masterpiece of the second class of poetry, and ranks but just below the great models of the first. It reminds us of the Pedasus of Achilles—

ὅς, καὶ θνητὸς ἐὼν, ἕπεθ' ἵπποις ἀθανάτοισι.

By comparing it with the impotent ravings of the heroic tragedies, we may measure the progress which the mind of Dryden had made. He had learned to avoid a too audacious competition with higher natures, to keep at a distance from the verge of bombast or nonsense, to venture on no expression which did not convey a distinct idea to his own mind. There is none of that 'darkness visible' of style which he had formerly affected, and in which the greatest poets only can succeed. Every thing is definite, significant, and picturesque. His early writings resemble the gigantic works of those Chinese gardeners who attempt to rival nature herself, to form cataracts of terrific height and sound, to raise precipitous ridges of mountains, and to imitate in artificial plantations the vastness and the gloom of some primeval forest. This manner he abandoned; nor did he ever adopt the Dutch taste which Pope affected, the trim parterres and the rectangular walks. He rather resembled our Kents and Browns, who, imitating the great features of landscape without emulating them, consulting the genius of the place, assisting nature, and carefully disguising their art, produced, not a Chamouni or a Niagara, but a Stowe or a Hagley.

"We are, on the whole, inclined to regret that Dryden did not accomplish his purpose of writing an epic poem. It certainly would not have been a work of the highest rank. It would not have rivalled the Iliad, the Odyssey, or the Paradise Lost; but it would have been superior to the productions of Apollonius, Lucan, or Statius, and not inferior to the Jerusalem Delivered. It would probably have been a vigorous narrative, animated with something of the spirit of the old romances, enriched with much splendid description, and interspersed with fine declamations and disquisitions. The danger of Dryden would have been from aiming too high; from dwelling too much, for example, on his kingdoms of angels, and attempting a competition with that great writer, who in his own time had so incomparably succeeded in representing to us the sights and sounds of another world. To Milton, and to Milton alone, belonged the secrets of the great deep, the beach of sulphur, the ocean of fire, the palaces of the fallen dominations glimmering through the everlasting shade, the silent wilderness of verdure and fragrance where armed angels kept watch over the sleep of the first lovers, the portico of diamond, the sea of jasper, the sapphire pavement empurpled with celestial roses, and the infinite ranks of the cherubim, blazing with adamant and gold. The council, the tournament, the procession, the crowded cathedral, the camp, the guard-room, the chase, were the proper scenes for Dryden.

"But we have not space to pass in review all the works which Dryden wrote. We, therefore, will not speculate longer on those which he might possibly have written. He may, on the whole, be pronounced to have been a man possessed of splendid talents, which he often abused, and of a sound judgment, the admonitions of which he often neglected; a man who succeeded only in an inferior department of his art, but who, in that department, succeeded pre-eminently; and who, with a more independent spirit, a more anxious desire of excellence, and more respect for himself, would, in his own walk, have attained to absolute perfection."

Among the recent editions of Dryden's works may be mentioned, the Prose Works, by Malone, 1800, in 4 vols.; the Poetical Works, with notes by Warton, and edited by Todd, 1812, in 4 vols. 8vo; and the whole of his Works, with a Life by the late Sir Walter Scott, Edinburgh, 1808, in 18 vols. 8vo.

DRY ROT,

A MOST destructive, and apparently infectious disease in timber, which, by decomposing the fibres, deprives it of all strength, and in no great length of time reduces it to a mass of dry dust; a circumstance from which it seems to have derived its name, which, perhaps, would better be expressed by that of *sap rot*.

Though this disease must from its nature have been co-existent with timber-trees, it would not seem to have excited much attention, and perhaps was not known, certainly not by its present name, beyond the middle of the last century; at some period, we rather think, of Sir John Pringle's presidency of the Royal Society of London. But for a long time after this little notice appears to have been taken of it; its ravages being, in all probability, inconsiderable, in comparison with what they have been of late years. Even now, the disease is in fact chiefly confined to modern built houses and modern built ships, and more particularly to the ships of his majesty's navy. The proximate cause of it has, therefore, rightly enough, as it would seem, been ascribed to the unseasonable state of

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the timber, when placed in certain situations, and under particular circumstances. It could not fail, in the course of the late long protracted war, to become a matter of general observation, that a more rapid decay than usual had become almost universal throughout the fleet, and especially amongst the newest and most recently repaired ships. Many anxious inquiries were instituted, and experiments made, with the view of ascertaining the real cause of a decay, the further prevention of which was so highly important to the national welfare and security. The alarm was greatly increased when, in 1810, the Queen Charlotte, a first-rate ship of war, shortly afterwards launched at Deptford, was discovered, after a close examination, to have all her upper works infected with the *dry rot;* or, in other words, the ends of most of the beams, carlings, and ledges, the joinings of the planks, &c. were observed to be covered with a mouldy, fibrous, and reticulated crust, and the parts of the timber so covered to be perfectly rotten. All the newspapers and journals of the day were filled with this alarming fact, and in consequence thereof a multitude of *dry rot* doctors proffered their assistance; one having a nostrum for eradicating the disease where it had made its appearance, and another for preventing its further approach. Some of these specifics were expensive and inconvenient, many of them impracticable of application, and most of them futile and objectionable in one way or another. These doctors, in fact, like the physicians for the human body when the seat of the disease is unknown, were labouring altogether in the dark, having no other guide to direct them than their own whims and fancies, each being ignorant of the effect of the respective experiments which they wished to try on this diseased machine.

Tre ses on t dry rot.

Since the period in question a number of treatises have been written on the subject, for the prevention and cure of the dry rot in ships and houses; some wild and visionary enough, and others exhibiting the proofs of plain practical good sense, deduced from long observation, or the result of judicious experiment. Of the latter description may safely be mentioned *A Treatise on the Dry Rot in Timber*, written in 1815 by the late Mr Thomas Wade, who died previous to its publication, and whilst employed in making experiments in the dock-yards; and also another *On the Prevention of Timber from Premature Decay*, by Mr Chapman, 1817. *A Treatise on the Dry Rot*, by Mr Bowden of the Navy Office, is in many respects deserving of notice, in as far as the facts and his observations on the management of timber are carried; but he unluckily sets out with a fanciful theory, which, however, is not his own, concerning the generation of *fungi*, and their connection with the dry rot, to which, like most theorists, he endeavours to make all his facts subservient. In Mr M'William's *Essay on the Origin and Operation of the Dry Rot*, published in 1818, we find stuffed into a large quarto almost every theory and every fact gathered from preceding writers, from Aristotle down to Mr Ralph Dodd, civil engineer, who has also published his *Practical Observations on the Dry Rot in Timber;* which work appears to be little more than an advertisement of *A Dry Rot Preventive*, a nostrum which, it would seem, is too valuable to be disclosed, without calling in the doctor that he may get his fee. We have also in print the opinions and the specifics of Mr Gregory, Mr Ogg, and many others of minor note, all of whom profess to explain the cause, to secure the prevention, and to effect the cure of the *dry rot.*

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These authors are at variance amongst themselves, whether the *common rot* in timber, and the *dry rot*, be not one and the same disease. A little reflection, however, will, we conceive, lead us to consider them as essentially different, both in the symptoms, the progress, and the causes, though the *effect* of destroying the fibre of the wood is pretty nearly the same. If a post of wood, for instance, be driven into the ground, seasoned or unseasoned, it will speedily begin to decay just at the surface of the ground, or, as it were, between the earth and the air; if driven into the earth through water, as in a pond, the decay will commence at the surface of the water, or, as it is technically expressed, between wind and water, whilst all above water, and all that is constantly immerged in the water, as well as the part in the earth, will remain sound. Thus also a beam of wood let into a damp wall will begin to rot just where it enters the wall; so will wooden bannisters when they are let through the top and foot rails. In these and similar cases the rot begins externally, and its progress is inwards, and is more or less accelerated by the alternate action of wind, heat, and moisture, being *greatest* when the alternatives of exposure to wet and drought are most frequent, and *least* when constantly immersed in water, or constantly preserved in a dry atmosphere. Such we conceive to be the usual process of the *common rot* in wood, and it is evidently occasioned by alternate exposure to the vicissitudes of the weather, to moisture and dryness, to heat and cold.

Process of the dry rot.

If the same post be well charred or covered over with a thick coating of paint, or varnish, or tar, no such effect will be produced *externally*, the coating being sufficient to protect it against the action of the weather; but if it should happen to be a green or unseasoned piece of wood so tarred or painted, in no great length of time the wood will be found to have begun to decay *internally*, whilst the outer surface appears uninjured, but at length it will also yield to the disease. If this piece of wood had been placed in a warm cellar or close room where there is little or no circulation of air, and more particularly if the room or cellar were damp, there would be perceived, in no great length of time, a fine mouldy coating spread over its surface, of a brownish yellow or dirty white; and shortly afterwards it would be found, on examination, to resemble in its form and structure some of the beautifully ramified *algæ* or sea weeds; which in process of time would become more compact, the interstices being so completely filled up as to give to the whole mass the appearance and consistence of leather. "At first," says one writer, "its appearance is that of fine fibres running on the surface in endless ramifications, resembling the nervous fibres of leaves; presently the interstices are filled up with a spongy or leather-like substance, assuming the character of that order of cryptogamous plants distinguished by the name of *fungus.*"

By Mr Wade the general symptoms of *dry rot* are thus described: "The wood at first swells; after some time it changes its colour, then emits gases which have a mouldy or musty smell. In the more advanced stages of it the mass arises, and cracks in transverse directions. Lastly, it becomes pulverulent, and forms vegetable earth; and generally in some of these stages of decay the different species of fungus are found to vegetate on the mass." (*Treatise on the Dry Rot in Timber.* By Thomas Wade.)

These appearances do not invariably take place, the surface of the diseased timber sometimes remaining unchanged, while the process of rotting is going on within; they are, however, pretty constant. But however sound the surface may be, it will appear, on examining the piece of wood, placed in a situation similar to those above mentioned, that the whole of the interior fibres are decomposed, and become a mass of dust inclosed within a thin external shell. No charring of the surface, no paint, tar, or varnish, will prevent this process from taking place, when the seeds of the dry rot exist, and are placed in a situation favourable for their growth, though they may prevent the external character of mouldiness from taking place on the surface.

Characteristic difference of the two rots.

The symptomatic difference, then, between the common rot and the dry rot may perhaps be thus defined. *Common rot* is a disease in timber, occasioned by the alternations of the weather acting on its surface, and destroying its fibres externally inwards. *Dry rot* is a disease in timber, occasioned by being shut up in warm, close, and moist situations, the effect of which is to destroy its fibres by a process acting internally outwards.

Causes of the dry rot.

Without stopping to inquire in what manner, and by what agency, chemical or mechanical, or both, the common rot acts on the external fibres of the wood, the effect of alternate exposure to the weather is too well known to require any further proof as to its being the immediate cause. The immediate cause of the dry rot is equally obvious; but the predisposing state of the timber to contract the disease is not so clear a problem. Accordingly, theories without end have been hatched to explain the phenomenon. A writer in a public journal, who has slightly touched on the subject, thus explains it. "It is well known," he observes, "that if a piece of green wood be laid across a fire, the air within, expanded by the heat, will drive out at each extremity a viscous fluid, possessing the property of disposing itself on the surface in reticulated filaments. The same appearance of nervous foliation is not uncommon in the intermediate spaces of the concentric layers of the *alburnum* of wood; and the core or heart of trees, and particularly of the pitch pine, after its passage in the heated hold of a ship, is often enveloped with a membranous corticle, like that which lies immediately beneath the bark. All these appearances are certain indications of the *dry rot;* and they point out, with sufficient clearness, that the *sap*, or principle of vegetation, brought into activity, is the *cause* of the disease; the *effect*, though infinitely more rapid, is the same as that of the common rot. It is still a problem in what manner this sap circulates; but there is no doubt that the tubes and cells of the alburnum, or sapwood, are filled with it in the spring of the year, and that they are empty in the winter; that it is organized matter, developing itself by heat in all the various forms of new bark, leaves, and branches. The stem of a tree cut down will, on the return of summer, make an effort to push out leaves; a more feeble effort of this organized sap ends in the production of *fungus* only." (*Quarterly Review*, No. 15.)

It is now, we apprehend, pretty well decided, that, like other vegetables, the fungi or mushroom tribe are propagated by seed so minute and numerous as to float about invisibly in the air, and to be carried into all manner of situations. The fine impalpable powder that issues from the common puff-ball, like a column of smoke, will give some idea of the almost inconceivable myriads of minute seeds which it incloses. Of these seeds, though myriads perish, yet others, by a concurrence of accidents, being thrown into proper situations favourable for their growth, reproduce the species. It cannot be supposed that the fibres found in the dung of animals, and particularly of the horse, known by the name of mushroom spawn, and from which our gardeners construct their mushroom beds, are generated spontaneously in the belly of the animal, but that the seeds being devoured with his food, have found that degree of warmth, moisture, and soil, favourable to the development of the future plant; and this plant which the fibres exhibit, by care and cultivation increases and grows to the perfect state of all plants, and throws out above the surface the parts of fructification which we call the mushroom. If it be asked why the dung of a cow, which feeds on the same food with a horse, does not produce the spawn of mushrooms, the only answer to be given is, that it is not a proper nidus for the germination of the seed.

In the same manner may the perfect plant be produced from the seed, carried up into the longitudinal tubes of a growing tree, by the rising of the sap; though it would seem that the process of vegetation in the parasite thus lodged will not commence so long as the vital principle of the sap in the tree remains in activity. Indeed it is pretty evident, from numerous observations, that the process of fermentation is necessary to the growth of all fungi; and this may explain why in the diseased and decayed parts of a tree only are fungi found to grow whilst it is in a living state.

The sap, therefore, may be the *cause* of the *dry rot*, in as far as it is favourable to the growth of *fungi*, as it would seem to be when in a state of fermentation, though it never can by any process be convertible into this order of cryptogamous plants. But the appearance of fungi, though a frequent, is by no means a constant symptom of *dry rot;* and, therefore, Mr Bowden's definition of dry rot, with his whole doctrine, must fall to the ground. "The *nature* of *dry rot* is a *vegetable substance*," and this substance, he tells us, is fungus. Though not very happily expressed, his meaning is intelligible enough from what follows. "This secretion of nature (the juice of a tree) which was destined to appear in the form of leaves, branches, &c. being diverted from its original intention, assumes a new form from its own native energies. Vegetation commences in the various tubes of the wood, under the form of those fine fibrous shoots which have been already described (as mushroom spawn). It continues to increase in every direction, until, by an extraordinary manifestation, it happily averts the otherwise unforeseen but certain destruction of the vessel. It may confidently be asserted, therefore, that this is the primary, chief, and predisposing cause of *dry rot;* and this opinion may be further confirmed by an inquiry into the nature of the juices and fungi, and the manner in which the timber is affected." (*A Treatise on Dry Rot*, by A. Bowden.)

Mr Bowden having totally mistaken the nature of fungus, by adopting the erroneous principle of the writer in the *Quarterly Review*, labours hard to prove, and with considerable ingenuity, "that dry rot is caused by a vegetative substance, and that it is one of the species of *fungi;*" and this doctrine he illustrates in the case of *spent bark* from the tan-pits, of which he says, "when taken out and exposed to the heat of summer, the juices appear desirous of *obeying the laws of nature;* and being no longer capable of adding to the bulk of a tree, is satisfied with wearing the humble garb of a mushroom;" nay, so enamoured is he with the similarity of oak bark, and fungus, and *tannin*, that "an examination of the fungous coat taken from the end of a timber, would afford a strong presumption, from its exact resemblance to *leather*, that it owes its existence to no other cause than that which communicates such peculiar qualities." Into such absurdities will crude theories sometimes drive their authors.

Mr Wade has sounder notions on the nature of fungi; he knew they possessed the principle of reproduction, and that their seeds, under favourable circumstances, will vegetate; that the proper *nidus* for the reception of certain species of fungus appears to be wood in a state of progressive decomposition, or the remains of wood entirely decomposed; that, however, the effect produced by these plants and decaying timber is reciprocal, the latter furnishing food for the former, while the decomposition of the wood is accelerated by the growth of the fungus, the gaseous and soluble products being taken up by the plants, as quickly as these principles are disengaged. The whole tribe of parasitic fungi may, in fact, be considered as the wolves and tigers of the vegetable world, destroying ultimately every plant they fix upon, and most rapidly where the principle of vegetation has ceased to act, and the putrefactive fermentation of the juices has in consequence commenced.

The real efficient cause then of the dry rot, is that of the juices of the timber being brought into a state of putrefaction, occasioned generally by exposure to a moderate degree of heat and moisture in a stagnant atmosphere. "To favour this process," says Mr Wade, "as much as possible, the air and water should not be renewed, as they undergo a decomposition, which takes place very slowly." From the structure of timber being composed longitudinally of an assemblage of pipes or tubes, it is only necessary that one end of a log of wood should be placed in a damp or wet situation, to occasion the moisture to be conveyed to the opposite end by capillary attraction; and hence arises the infectious nature of the disease, which will always spread wherever the moisture finds its way; and even where there is no moisture, it will be created by the filaments of the fungi working their way through the tubes of the dry wood, and carrying it with them. Hence, also, the rapid decay in ships of war, from the great internal heat occasioned by the number of men, the moisture, and the close air. Hence, also, in houses, the *dry rot* always first appears in the lower apartments, where the floors, partitions, skirting-boards, &c. are supplied with moisture from the wet walls on the ground. In the London houses there is generally a room on the basement story, called the housekeeper's room, which is boarded, and carefully covered over with an oiled floor-cloth. In such a room the dry rot is sure to make its appearance. The wood absorbs the aqueous vapour which the oil-cloth will not allow to escape; and being assisted by the heat of the air in such apartments, the decay goes on most rapidly; and, as Mr Wade observes, "if the seed of fungus be present, the plant is developed in all the superfluity of vigour exhibited in a hot-house, where the same means are resorted to, namely, an atmosphere scientifically and artificially heated, and highly charged with aqueous vapour." Timber may, in fact, have the seeds of dry rot within it, and yet by proper treatment be kept sound for a great length of time. Thus ships laden with particular cargoes afford remarkable instances of the effects of such cargoes on their duration. The warm moisture created by a cargo of hemp is communicated to the timber, and promotes a rapid putrefaction. Mr Chapman says, that the ship Brothers, built at Whitby, of green timber, proceeded to Petersburg for a cargo of hemp. The next year it was found on examination that her timbers were rotten, and all the planking, excepting a thin external skin. A lading of cotton is always injurious to the ship, and even teak is affected by a cargo of pepper. The timber which is brought from America in the heated hold of a ship, is invariably covered over, on being landed, with a complete coating of fungus. It was the too general use of this timber in his majesty's ships that at one time increased the disease to such an alarming degree. Those ships, on the contrary, which are employed constantly in the coal and lime trade, are very durable, and have been known to last for a century. These effects are obviously to be ascribed to the exclusion of air in the one case from, and the free admission of it in the other to, the interior surface of the ship, assisted, in the latter instance, by the absorption of moisture, by the coals and lime, from the timbers and planking.

Pr ntion of rot,

If we are arrived at the right conclusion as to the *cause* of *dry rot* in timber, we can be at no loss with regard to the mode of treatment for the *prevention* of the disease. The experiments for this purpose have been very numerous, but may be classed under three general heads; desiccation or seasoning; immersion in earth, sand, or water; and impregnation with some foreign matter, which will resist putrefaction.

by desiccation or seasoning.

The most simple and common mode of preventing the decomposition of vegetable matter, is by depriving it of moisture. Various schemes have been put in practice for drying the juices in large logs of timber. Time alone will do it when the wood is placed in favourable situations, that is to say, in a dry atmosphere, and constantly exposed to a free circulation of air; but time will also produce the rot in timber when piled up in stacks in the open air, imbibing moisture from the earth, and exposed to the vicissitudes of the seasons, and the alternatives of weather; scorched at one time by the heat of the sun, at another drenched with rain, and rent and split in every possible way by the freezing of the water which has insinuated itself into the pores and crevices of the wood. It was formerly, and, indeed, till very lately, the practice to let ships of war remain on the stocks *in frame* for two, three, or four years, to *season*, as it was called; but there never was so mistaken a notion. "When a ship," says Mr Wade, "is built, exposed to the weather, the lower part forms a grand reservoir for all the rain that falls; and as the timbers in that part are placed as close together as possible, the wet escapes very slowly. Those timbers are always soaked with moisture, and, to some distance from the keel, exhibit a green appearance; their green matter, when viewed through a microscope, is found to be a beautiful and completely formed moss, which vegetates at the expense of the timber. If to season timber be only to dry it, the sooner it is dried the better; and when completely dry, it cannot too soon be employed in ship-building, when it should be kept dry. It cannot answer any end to have seven years wear out of a ship on the stocks." At length our ship-wrights are convinced of this truth, and every ship of war now building in the dock-yards has excellent roofs placed over them, with the sides open to admit a free current of air, but to exclude all moisture, as well as the rays of the sun (See DOCK-YARDS); a practice which we have tardily adopted from the Swedes and the Venetians. A new system seems also to have been adopted on the piling the timber stacks. Instead of their being placed on old, useless, and often rotten logs of timber resting on the ground, they are now insulated from the earth on stone or iron pillars; and in place of their surfaces coming in contact with each other, pieces of wood are placed between them so as to admit of a circulation of air. Nothing further appears to be wanting but to protect the tops and the ends of the stocks or piles from the effects of the weather.

Of the various modes of artificial and rapid desiccation, that of charring is perhaps the best; but it is liable to two objections, the first is, that if the surface be completely charred, it diminishes very much the strength of the timber; and, secondly, it the more readily attracts moisture. The juices of timber may be drawn off or hardened by kiln-drying; but this also disturbs the arrangement of the fibres, and deprives the wood of a great part of its strength.

Mr Lukin's experiments for seasoning timber.

The experiments made by Mr Lukin for the rapid seasoning of green oak timber, promised at one time much success, but ended in disappointment. He conceived, that if the acid and the watery particles were driven out of a piece of oak timber by some process which should prevent the surface from splitting, the fibres would be brought closer into contact, and whilst the log lost in weight it would gain in strength. With this view he buried a piece of wood in pulverized charcoal in a heated oven. The log wore a promising appearance; the surface was close and compact; it had lost in its weight and dimensions; but when divided with the saw, the fibres were discovered to have started from each other, exhibiting a piece of fine net-work, resembling the inner bark of a tree.

His next contrivance was to supply the place of the fluids driven out by heat, with some other substance of an oily or resinous nature, which, while it destroyed the principle of vegetation, should preserve the timber in a compact state. For this purpose he erected a large kiln in Woolwich dock-yard, capable of containing from two to three hundred loads of timber. At each end, on the outside, was a retort in which the saw-dust of the pitch-pine was submitted to distillation. From the heads of these retorts were iron pipes, perforated with holes like a cylinder, continued along the upper part of the kiln the whole length in the inside. By this arrangement it was expected, that while the heat of the kiln drove off the aqueous matter of the timber, the product of the saw-dust, which resembled weak oil, or rather spirit of turpentine, would drop through the holes in the tubes upon the logs, and supply its place. But before the process of transfusion was judged to be complete, an explosion took place, which proved fatal to six of the workmen, and wounded fourteen, two of whom shortly afterwards died. The explosion was like the shock of an earthquake; it demolished the wall of the dock-yard, part of which was thrown to the distance of 250 feet; an iron door, weighing 280 pounds, was driven to the distance of 230 feet, and other parts of the building were borne in the air upwards of 300 feet. The experiment was not repeated.

The bad effects of applying artificial heat to the seasoning of green timber were strongly exemplified by a practice introduced very generally into our ships of war which had exhibited indications of the dry rot, particularly in the *Queen Charlotte*. Enormous fires were made in stoves placed in various parts of the ship, and the heat led in tubes to the cavities between the timbers, &c. The consequence of which was, as might be expected, an increase of the mischief they were intended to prevent. Every part of the ship was converted into a hot-house, and every part where the seeds of fungi had been deposited began to throw out a luxuriant crop of mushrooms; and where these did not appear, the juices of the wood were thrown into a state of fermentation, and, in the course of a twelvemonth, a great part of her upperworks became a mass of rottenness. After staving the powder magazines of some of the ships, there appeared under their floors, which are contiguous to much moisture, numbers of large excrescences of a leathery consistence, of the size and shape of a quart glass-decanter; and in all such parts where two surfaces of the wood were imperfectly brought into contact, were whole masses of fungi.

Winter-felled timber.

Another mode, of very ancient standing, was practised for getting rid of the juices of timber. This was supposed to be effected by felling the tree in the winter season, when the sap had descended and the vessels were empty. But by this practice the bark of the oak, so valuable in the process of tanning, was lost, as it will strip only from the wood in the spring of the year, when the sap is said to be rising. The supposed superior quality of the wood when winter-felled, and the general practice of felling oak timber at that season, may be inferred from a statute of James I. by which it is enacted, that no person or persons shall fell, or cause to be felled, any oaken trees meet to be barked, when bark is worth 2s. a cart-load (timber for the needful building and reparation of houses, ships, or mills, only excepted), but between the first day of April and last day of June, not even for the king's use, out of barking time, except for building or repairing his majesty's houses or ships.

The old Sovereign of the Seas is the standing example generally quoted to prove the beneficial effects of winter-felled timber. We are informed by one writer that, when taken in pieces, after forty-seven years' service, the old timber was still so hard that it was no easy matter to drive a nail into it, and all future writers have taken it for granted that this was owing to its being winter-felled. Mr Pett, however, who built her, takes no notice of any such circumstance. He merely says he was commanded by the king, on the 14th May 1635, to hasten into the north to procure the frame-timbers, plank, and trenails, for the great new ship at Woolwich. But he left his son behind to ship the moulds, provisions, and workmen, in a hired ship, to transport them to Newcastle; that the frame, as it was got ready, was sent in colliers from Newcastle and Sunderland; and that, on the 21st December, *in the same year*, the keel was laid in the dock; and in less than two years after this she was launched. Now, as it was the middle of May before Mr Pett received his majesty's commands to procure timber for this ship, and as she was on the stocks the same year, it is not very probable that the timber procured and sent in colliers from Newcastle to Woolwich was felled in the winter; much less could it have been "stripped of its bark in the spring, and felled the *second* succeeding autumn," as Mr Wade has it.

Neither is there the least proof of the old Royal William, recently broken up, when a century old, being built of winter-felled timber. The fact is, that she was rebuilt half a dozen times, and the only old and original timber remaining in her was in the lowest part of her hull, always immersed in the salt water externally, and washed with the bilge-water internally; and the wood from this part of her, when broken up, was perfectly sound, but quite black, having the appearance of being charred.

As far as experiments have been made, there is no reason to conclude that timber felled in the winter is at all more durable than that which is felled at the usual time. In the year 1793, the Hawke sloop of war was ordered to be built, one side being of timber that had been barked in the spring and felled in the winter, and the other side with timber felled at the usual time. In 1803 she was reported to be in so bad a state of rottenness, that she was ordered to be taken in pieces, when no difference whatever could be discovered in the state of the timbers of the two sides. It is said, however, in Derrak's *Memoirs of the Navy*, "that the timber had been stripped in the spring of 1787, and not felled until the autumn 1790," and this is given as an explanation of the failure. Why the barking in the spring should add to the durability of timber, is not easily conceived, if the object be to fell the timber when all the sap-vessels are empty, as, if the sap *descends* at all, which is doubtful, it might be expected to descend more freely when the bark is on than off the tree. The experiments which, we understand, are now making by the commissioners of his majesty's woods and forests, will, it is to be hoped, throw more light on a subject so vitally important to the British navy. In France, so long ago as 1669, a royal ordonnance limited the felling of timber from the 1st October to the 15th April; and the conservators of the forests directed that the trees should be felled when the "wind was at north," and "in the wane of the moon;" and we find an instruction of Bonaparte, that "as ships built of timber felled at the moment of vegetation must be liable to rapid decay, and require immediate repairs, from the effect of the *fermentation of the sap* in those pieces which had not been felled at the proper season;" the agents of the forests should abridge the time for felling naval timber, which should take place "in the decrease of the moon, from the 1st November to the 15th March."

Immersion in earth, sand or water.

The facts are so numerous and so strong in favour of the durability of timber when steeped in water or buried in earth or sand, that no doubt whatever can be entertained of the efficacy of such a practice. At Brest all the timber used in ship-building is deposited in the narrow creek of the harbour which runs through the middle of the dock-yard, and it is said that the Brest built ships never had the dry rot. The same practice prevailed at Cadiz and Carthagena. Indeed there is reason to think that steeping in fresh water is a preventive of dry rot, probably by dissolving the juices of the timber. It was an ancient practice, and we believe is still followed in some parts of England, to place the timber intended for thrashing-floors in the midst of a stream of water, to *harden* it; and all the oak plants intended for the wainscotting of the old mansions were previously steeped in running water.

"I know it," says Mr Chapman, "to be the opinion of some well-informed men, whose sentiments are highly deserving of notice, that the sap of trees does not descend, but, like the arterial blood, is prevented by valves from returning; as a proof of which, it is asserted, that fresh-cut timber, if laid in a running stream, with the but-end towards the current, will have the water percolating through it, and carrying off the mucilaginous matter, but not otherwise." "There can be no doubt," he adds, "that the effect will be produced sooner in this direction than the other, and it should therefore be attended to." The reason is obvious; the extractive matter, which is the chief, though not the only, cause of putrefaction, is dissolved and driven off. The usual mode of preserving timber for masts, is to keep it immersed in water in what are called mast-locks. The mast of the Kangaroo sloop of war was dug out of the mud at the bottom of the mast-pond, at Deptford dock-yard, where it had been fifty years, and was one of the most serviceable masts in the navy. Burying timber in sand is a usual process for preserving it in warm climates. Yet, with all these facts and long experience, it was but the other day that the steeping of timber in salt water was practised in the king's dock-yards, and this originated in an accident. The Resistance frigate went down in Malta harbour. But as she had been reported in such a state of dry rot, or rather the surface of her timbers so covered with fungus, as to render it expedient to send her home, she was suffered to continue under water for many months. On her arrival in England it was observed that all appearance of fungus had vanished, and she remains a sound ship to this day. Yet even this fact does not seem to have attracted much attention. But when the dock-yard was removed from the northern to the southern side of Milford-haven, a few loads of timber that was covered with fungus were suffered to remain in the water for several months; and it was observed that, after being taken out and stacked in the new yard, the timber did not exhibit those appearances of dry rot which the same timber did most abundantly which had not been immersed in the salt water. This fact being reported to the navy board, it was proposed to sink one of two sister ships, the Mersey and the Eden, both alike infected with the dry rot, in Plymouth Sound. The Eden was the ship selected for this purpose. She remained under water for about eighteen months, and, on being raised, every trace of fungus had totally disappeared, whilst the Mersey was almost wholly covered with it. After remaining a year at home perfectly sound, she was sent out to the East Indies, where she now is.

It is said, and there seems to be no reason for doubting the fact, that the planks of ships near the bows, which are obliged to be boiled in water or steam in order to bend them, are never infected with the dry rot: if the water in which they are boiled be strongly impregnated with salt, the effects would probably be more durable and decisive.

In a lecture read by Mr Ogg, a salt refiner, to the Plymouth Institution, on the prevention and cure of dry rot in ships of war, common salt is strongly recommended, for its cheapness, its wholesomeness, and its easy application; but he proposes a saturated solution of salt, in which he would steep not only single logs or planks, but the whole frame of a ship, or even the ship itself. "Let every ship in the navy," says the salt refiner, "be immersed a sufficient time in this fluid, and let every new ship be prepared in the same way, and dry rot would be heard of no more. But how is this to be accomplished? I answer, provide a dock or docks sufficiently capacious to receive five, ten, or twenty ships, and the work is done." As common sea-water will answer the purpose equally well, the apparatus of extensive docks and water saturated with salt are wholly unnecessary. But Mr Ogg, like Mr Bowden, appears to mistake the real cause of dry rot. "I affirm," says he, "that dry rot is occasioned by the vegetative principle; brine will destroy this principle; then sink the ship in brine." The experiments in the case of the Resistance and the Eden show that brine is not necessary.

The Dutch having observed that their busses, in which the herrings were caught and stowed away in pickle, lasted longer than any other craft, adopted the practice of filling up the vacancies between the timbers and planks of ships with salt, and of boring holes in the large timbers and cramming them full of salt. The Americans also found, that the ships employed in carrying out salt for their fisheries and domestic purposes were the most durable; and both they and the Dutch are glad to get a cargo of salt into a new ship, as the surest means of preserving her. The carpenter of the Franklin, an American seventy-four gun ship, when at Spithead, told some of her visitors, that at the junction of the beams, and at the but-ends of the timbers, pieces were cut, and the hollow part filled with salt, and covered over with felt, for the purpose of preserving those parts where two surfaces are imperfectly brought together, from the dry rot, where it is always most prevalent.

There are, however, very serious objections to the immersion of ships in a strong solution of salt, and the practice of inserting salt in the vacant space between the timbers, which may not, perhaps, apply with equal force to their immersion in sea-water. It is observed by a writer in the *Quarterly Review* for October 1814, that "the attraction for moisture which salts and acids possess, would keep the whole interior of the ship dripping wet; which would not only destroy the ship with the wet rot, but the ship's company also, whose health, experience has proved, is best preserved by keeping the ship as dry as possible; and thus the remedy would be worse than the disease." These bad effects have unquestionably been experienced, the muriate of magnesia, which exists in sea-water, being one of the most deliquescent salts; but whether the abstraction of moisture from the atmosphere be of long duration, is a fact which remains to be proved. In corroboration of the injurious effects above described, Mr Strange, in his *Evidences*, observes, "that the practice at Venice of the fresh cut timber being thrown into salt water prevents its ever becoming dry in the ships, and that the salt water rusted and corroded the iron bolts." Mr Chapman also observes that "the *Florida*, a twenty gun ship, taken from the Americans, and subsequently commissioned in the British service, had been salt-seasoned; and the result was, that in damp weather every thing became moist, the iron work was rusted, and the health of the crew was impaired; in fine," he adds, "vessels so circumstanced are perfect hygrometers; being as sensible to changes of the moisture in the atmosphere as lumps of rock salt, or slips of fuci, or the plaster of inside walls where sea-sand has been used."

Mr Chapman, however, is of opinion, that vessels impregnated with bay-salt, or the large grained salt of Limington or of Liverpool (being pure muriate of soda, without admixture with the bitter deliquescent salts), will possess decided advantages, as would also vessels laden with saltpetre, if it has been dispersed among their timbers; and Mr Ogg sees no difficulty in refining salts so as to deprive it of its deliquescent quality. But if a very weak solution of salt, or even fresh water, shall be found to answer the purpose, the objection against immersing timber in sea-water seems to be got rid of. That it will immediately destroy all vegetable life in the delicate fibres of the fungus, and also prevent its future growth, is quite clear; and if it shall be found to prevent also the putrefactive process, it may be considered as the most advisable way to prepare timber for all purposes of house carpentry and ship-building.

Impregnation of timber with foreign substances.

A great variety of substances besides common salt, indeed almost any salt or acid, will destroy and prevent the growth of fungus. Sir Humphry Davy recommends a weak solution of the corrosive sublimate as the most efficient. A solution of sulphate of iron or copperas is much used in Sweden for hardening and preserving wood for wheel-carriages, &c. It is first boiled in this solution for three or four hours, and then kept in a warm place to dry, by which process it is said to become so hard and compact that moisture cannot penetrate it. "The wooden vessels," says Mr Chapman, "in which the sulpho-ferruginous solution is finally placed for the copperas to crystallize, become exceedingly hard, and not subject to decay." A solution of alum has been recommended; but Mr Chapman seems to think that its earthy basis would become a nidus of putrefaction. The wood, however, which is used about alum works, becomes hard and durable, and resists fire in an extraordinary manner. All timber, in fact, when completely saturated with saline matter, is more or less indestructible, and absolutely incombustible. A solution of arsenic has not been found to prevent the dry rot. With regard to the impregnation of oils there are various opinions, some thinking them beneficial and others injurious to the durability of timber. It is known, however, that ships in the Greenland trade have their timbers and planks preserved as high up as they are impregnated with whale oil from the blubber; and Mr Chapman says, that one of the masters of a Greenland ship having payed her upperworks with twelve or more successive coats with whale oil in hot weather, they became covered with a thin varnish, much harder and more compact than if filled with successive coats of turpentine. Resinous substances, however, are probably better than oil.

After a variety of experiments and sensible observations, Mr Chapman sums up the three great operations by which timber may be brought to resist the tendency to dry rot.

1. To deprive the timber of its mucilage, which is very liable to fermentation.

2. To impregnate timber with any strongly antiseptic and non-deliquescent matter.

3. To dry timber progressively by the sun and wind, or by the latter alone; and then to close its pores completely with any substance impervious to air and moisture, and at the same time highly repellant to putrescency.

Mr Wade recommends the impregnation of timber with sulphates of copper, zinc, or iron, rejecting deliquescent salts, as they corrode metals, and would destroy the bolts and metal fastenings of a ship. He observes, that timber impregnated with saline matter is no longer capable of fermentation, and that, of course, the gases necessary for the nutriment of fungi are not evolved. Selenite is recommended as being insoluble, or nearly so, and not liable to any alteration in the ordinary temperature of the atmosphere; but all salts, he observes, composed of barytes, should be rejected, because, though they are plentiful, cheap, and have some qualities eminently fitting them to be employed for this purpose, yet they are, without any exception, very poisonous.

From all experiments that have been made, it appears that the most effectual method of preventing the dry rot, and of giving durability to timber, is that of depriving the sap of its mucilage, more especially in the alburnum, where it most abounds; for though seasoning in the dry way will coagulate and harden the extractive matter of timber, yet when exposed to heat, moisture, and a stagnant air, the process of putrefaction will commence, and all the symptoms of dry rot will speedily make their appearance. It will be preferable, therefore, that such timber as is likely to be exposed to the vicissitudes of weather, should be seasoned by immersion or impregnation, rather than by the dry way.

Cur the dry

In this disease, as in those incident to animal life, prevention is much easier than cure. In fact, there is no other cure for the part affected than excision, and the sooner it is done the better, as the disease spreads most rapidly when fungi are propagated, throwing their minute fibres into the tubes of the contiguous sound wood, and producing that moisture which is a condition absolutely necessary to the putrefactive process. If, however, the fibre of the wood is still sound, and the roots of the fungi extend not beyond the alburnum near to the surface, immersion in sea water, as in cases of the Resistance and the Eden, or impregnation with some of the solutions above mentioned, may stop the progress of the disease; but the only safe cure, we apprehend, is that of cutting out the infected part. The sinking of the Royal George at her moorings has not been the means of preserving her timbers. On being visited in the diving-bell, her oaken sides were broken down into a confused mass of timber and black mud; having, no doubt, been too far gone in decay when the fatal accident happened; but her fir deck appeared as sound as the day when she sunk.

Mis neou serv

It is a great mistake to suppose that the ancients were unacquainted with the dry rot, or premature decay of timber. Pliny has a number of valuable observations on the preservation of timber, and on its decay occasioned by the juices; and, among other things, recommends that a tree should be cut to the heart all round, in order to let the juices escape, and that it should not be felled until the whole had run out. He knew that the sappy part of oak was more subject to rot, and advised that it should be cut away in squaring. He knew, too, that resinous and oleaginous matter in wood preserved it; observing, that the more odoriferous a piece of timber is, the more durable. He knew that much depended on the close texture of timber, and that box, ebony, cypress, and cedar, might almost be considered as indestructible. We also know that cedar, teak, and mahogany, are very durable woods.

The felling of timber while young and full of vigour, making use of the sap-wood or alburnum, and applying it to ships and buildings in an unseasoned state, have no doubt contributed to make the disease of dry rot infinitely more common and extensive than it was in former times, when our ships were "hearts of oak," and when in our large mansions the wind was suffered to blow freely through them, and a current of air to circulate through the wide space left between the pannelled wainscot and the wall.

In those old mansions which yet remain, and in the ancient cathedrals and churches, we find nothing like the dry-rot, though perhaps

> ....perforated sore
> And drill'd in holes, the solid oak is found
> By worms voracious eaten through and through.

Numerous examples of the extraordinary duration of timber may be produced, both from complete desiccation and exposure to the air, and from the complete exclusion of air and immersion in earth or water. Without adducing the surturbrandt of Iceland, covered with several strata of solid rock, or the logs of wood dug out of peat-moss, the antiquity of which is mere conjecture, we may instance the mummy cases of Egypt as being in all probability the most ancient timber in existence that has been worked by the hand of man. When Belzoni entered the splendid tomb of the kings of Thebes, in which was the transparent sarcophagus of gypsum, he found two human figures larger than life sculptured in wood, in as good preservation as if it had been worked in his own time; but the sockets of the eye, which had been copper, were entirely wasted away. We are told by Pliny, that the image of Diana at Ephesus, supposed to be of ebony, remained entire and unchanged, though the temple itself was ruined and rebuilt seven times. He adds that, in his own time, the image of Jupiter in the capitol, made of cypress wood, was still fresh and beautiful, though set up in the year after the foundation of Rome 551, nearly three hundred years before. He further says that there was a temple of Apollo at Utica, the timbers of which, being of Numidian cedar, are said to have stood 1188 years. The roof of Westminster Hall, which is constructed of chestnut, has stood for more than three hundred years, and is probably better now than when newly erected. Similar instances of the long duration of timber have occurred in situations where the atmospheric air has been excluded. In the Leverian Museum was a post said to be dug out of Fleet Ditch, charred at the lower end, having the name of Julius Cæsar cut into it. The foundation on which the stone piers of London Bridge are laid consist of huge piles of timber driven close to one another, on the top of which is a floor of planks ten inches thick, strongly bolted together; on these the stone piers rest, at above nine feet above the bed of the river, and, at low water, may be seen or felt at a very few inches below the surface. These piles have been driven upwards of six hundred years, and, from the solidity of the superincumbent weight, it may be concluded that they are perfectly sound. In the old city wall of London, timber is frequently dug out as sound and perfect as when first deposited there. As the last instance of the extraordinary preservation of timber, we may mention, that, in digging away the foundation of the Old Savoy Palace, which was built about six hundred and fifty years ago, the whole of the piles, consisting of oak, elm, beech, and chestnut, were found in a state of perfect soundness, without the least appearance of rottenness in any part of them, and the plank which covered the pile-heads was equally sound. Some of the beech, however, after being exposed a few weeks to the air, but under cover, had a coating of fungus spread over the surface; which affords a striking proof of the immense length of time that the seeds of this parasite will remain dormant, without parting with the principle of vegetable life, which is called into activity from the moment that they are deposited in a situation favourable to their growth. In this instance we have only to suppose that the indurated juices of the wood became dissolved by its exposure to the moist atmosphere, and the phenomenon of fungous vegetation is capable of receiving a satisfactory explanation. (M.)

DSJABBE TAR, a small island in the Red Sea, pertaining to Arabia, about forty miles west-south-west of Loheia. Long. 41. 35. E. Lat. 15. 32. N.

DSJABBEL, a small island in the Red Sea, about twenty-four miles from the coast of Arabia. Long. 43. 34. E. Lat. 15. 32. N.

DSJAR, a sea-port of Arabia, in the province of Hedsjaz, situated on the coast of the Red Sea, supposed to be the Eziongeber of the Scriptures. It is sixty-seven miles west of Medina.

DSJEBI, a walled town and district of Arabia, in the country of Yemen, with a citadel. It is the residence of a chief. The surrounding country is mountainous, and produces coffee. It is fifty-six miles east of Hodeida. Long. 43. 40. E. Lat. 14. 44. N.

DSJOBLA, a town of Arabia, in Yemen. The streets are paved, and the houses high and well built. It contains 600 houses. Part of the population consists of Jews, who inhabit a particular quarter without the town. It is twenty-two miles north of Taas, and sixty miles north-east of Mocha.

DSJOF, an extensive province of Arabia, in the country of Yemen, consisting chiefly of sandy plains and deserts. It is celebrated for its horses and camels, which are exported in great numbers; and Mareb, its principal town, sends salt to Sana.

DUBLIN, the metropolitan county of Ireland, in the province of Leinster, is bounded on the north by the county of Meath, on the east by the Irish Sea, on the south by the county of Wicklow, and on the west by those of Kildare and Meath. It is the smallest county in Ireland except Louth and Carlow, containing 248,631 acres, or 388½ square miles, of which 237,819 acres are cultivable, the remaining 10,812 being bog or mountain. Its greatest length from north to south is thirty miles, it greatest breadth from west to east twenty-three. A small portion, detached from the rest, lies at a distance of between twenty-four and thirty miles from the city, and is surrounded by the counties of Wicklow and Kildare. In Ptolemy's geography it is stated to be inhabited by the tribe of the Eblani. At the period of the English invasion, and for some time previously to that event, the city of Dublin and all the adjoining districts were in the possession of the Danes, from whom the tract to the north of the city was called Fingal, or the country of the White Strangers, a name given by the natives to those invaders on account of their fair hair and complexion; and that on the south was called Harold's country, which name it retained long after it fell into the hands of the English. Of the nine baronies into which the county is divided, those of Balrothery, Castleknock, Coolock, and Nethercross, are on the north of the Liffey; those of Donore, Newcastle, Rathdown, St Sepulchre, and Uppercross, are on the south of the same river. The baronies are subdivided into seventy-eight parishes, besides four parts of parishes, the remainders of which are in the city. The ultimate subdivision of townlands is retained here, as in other counties, but is little used, because the county is divided in a different manner for the purpose of collecting the local taxes; the whole surface being considered as broken up into 114,657 parts, a proportionate number of which is allocated to each barony.

The northern portion of the county is flat, and the soil good, particularly in the parts bordering on Meath; but, on the southern side, the land soon rises into elevations of considerable height, which extend into the adjoining county of Wicklow. Of these, Kippure Head is 2527 feet above the level of the sea, and the Three Rock Mountain 1585 feet. The soil in these mountains is very poor, affording no encouragement for tillage, being chiefly covered with heath, except where a subsidence in the ground affords a nucleus for the formation of bog, with which about two thousand acres are covered. There are also a few small tracts of bog in the northern part of the county. This mountain district is well adapted for timber, to the growth of which much attention has lately been paid, and the labours of the improvers are already rewarded by some fine plantations equally ornamental and profitable. This range of mountain ground produces a very striking effect on the traveller proceeding to the metropolis from Wicklow county. On arriving at its brow, the whole of the plain, watered by the Liffey, studded with villas, and enriched with groups of trees, spreads itself out before him, in the midst of which may be seen the spires and domes of the city rising through the dusky canopy of smoke that envelopes them; whilst beyond, the beautiful expanse of Dublin Bay, backed by the Hill of Howth, and the islands of Lambay and Ireland's Eye, and still more remote the peaked summit of Slieve Donard towering above them all on the horizon's verge, present a view of highly improved nature not often to be surpassed.

Though by much the greater part of the soil is inclined to clay, it is not of the deep and tenacious character so common in England; for scarcely any part is without a mixture of gravel; and due search will generally discover limestone or other beneficial substrata at no very great depth, attended with the further advantage, that the operation of draining generally raises a sufficiency of gravel to manure the whole surface. The position of the ground, usually more or less sloping, affords peculiar facilities for drainage; and the circumstance of a great city in a central position furnishes large quantities of ashes and other species of refuse well calculated to conquer the natural stubbornness of such soils. Along the coast between Howth and Balbriggen are salt marshes, but not of any extent. The only stream deserving the name of river is the Liffey, which, rising in the table-land of Wicklow, and precipitating itself over the fine cataract of Polaphuca, near which it is joined by the King's River, traverses the level county of Kildare; on leaving which it rushes over another elevated ledge of rocks called the Salmon-leap at Leixlip, after which it resumes its tranquil character, and, passing through the centre of Dublin city, discharges itself into the bay of the same name. It is joined at its mouth by the Dodder, a mountain stream which, though too insignificant to afford depth sufficient for the smallest boat, supplies water for several mills of various description during its short course from Kippure Hill to the sea. The other streams, which are numerous, have all an eastern direction, but are too small to be noticed, except the Delvan and Braywater, and these only as forming the county boundaries to the north and south.

Dublin Bay, much admired by strangers who arrive by sea, and deemed inferior only to the Bay of Naples in scenic grandeur, is very unsafe for shipping. It is five and a half miles wide at the entrance between the Point of Howth and Dalkey Island, and six miles deep to the mouth of the Liffey at Ringsend. It is dangerous to navigators, being exposed to a heavy sea from the east. To guard against wreck, a lighthouse has been erected at the Point or Bailey of Howth, another on a pier projecting from the mouth of the Liffey, and a third on the Kish Bank, outside the bay. Two artificial harbours have also been constructed, the smaller at Howth, occupying an area of fifty acres, at an expense of L.300,000. It is now little used. The other is at Dunleary or Kingstown, formed by two immense moles, including a space of 250 acres, from three to four fathoms deep at low water. Its entrance is marked by a revolving light. A small obelisk, surmounted by a regal crown, has been erected close to the pier, to point out the place where King George IV. took his departure from Dublin in 1821. The place of his previous landing at Howth has not been marked by any similar memorial. A rail-road from Kingstown to Dublin has been commenced. The only other harbours are those of Balbriggen and Skerries, to the north of Howth. Each of them has been improved by artificial piers, but both are dry at low water. The former admits vessels of some size, and enjoys a small coasting trade. The latter is little more than a fishing station. The sailors are considered as among the most skilful and hardy on the eastern coast. They fish in decked wherries, manned by a full crew of twelve or fourteen hands, all of whom have a share in the boat, and consequently an interest in the capture of fish.

The largest island on the coast is Lambay, to the north of Howth, comprehending somewhat more than 650 acres. A castle on it serves as the occasional residence of the proprietor. Shell-fish of every description is taken in abundance on the shore, and during the summer season it is frequently visited by fishing and pleasure parties from Dublin. To the north are the Skerries, consisting of the islets of Innispatrick, Colt, Shenex, and Red Island, the last named of which is connected to the mainland by the pier already noticed. Innispatrick is noted in the ecclesiastical annals of the country as being the place on which St Patrick first landed, and where he built a church. Between Lambay and Howth is Ireland's Eye, or, as it should be named, Hirlandsie, a craggy rock, comprehending about thirty acres, and supposed by some geologists to be an insulated portion of the neighbouring peninsula. At the southern extremity of Dublin Bay is Dalkey Island, formerly called St Begnet's or Bennet's, and at present remarkable only for a martello tower erected on it. The channel which separates it from the mainland occasionally affords a good roadstead for shipping. It has been considered by some engineers as the most appropriate situation on which the public money could be laid out on a safety harbour with the greatest economy, and the most probable return of advantage to the trade of Dublin.

The greater part of the county is the eastern extremity of the great bed of floetz limestone that extends over the middle of the island, widening as it spreads westward. It rises in its southern part into a range of mountains, which forms the verge of an elevated district, extending thence for more than thirty miles to the south. Through this latter tract a large body of granite passes in a south-western direction, bounded on its eastern and western sides by incumbent rocks of great variety of structure and relations. Within the portion of this district included in the county of Dublin, and distinguished by its beautiful scenery, are veins of lead ore at Dalkey and near the Scalp. The country near Bray presents, within a small space, an instructive series of rocks; and at Killiney, schistoze beds are to be seen to a considerable extent, reposing on granite. Near Bootcrstown, in Dublin Bay, a mass of compact limestone is visible, within a few fathoms of the granite. The calp of Kirwan, a variety of limestone, is the prevailing rock in the immediate vicinity of Dublin, and is much used for building. The brown spar of Jameson is found in veins in the quarries of Dolphinsbarn, and beds of magnesia limestone in the Dodder. Petrifactions abound in many parts of the limestone country. In the peninsula of Howth gray ore of manganese, with brown iron stone, and brown iron ore, have been obtained in quantities; and a variety of the earthy black cobalt of Werner has been found on the side of the hill, forming a crust of a rich blue colour, lining the fissures of a rock of clay slate nearly approaching to whet slate; a mineral found in great abundance at Killiney, and for some time considered as a nondescript species, is to be referred to the andalusite. It appears thickly on the surface of beds of mica slate, and seems to abound also imbedded in the substance of the same rock. White clay, potters' clay, and yellow and brown ochre, are found in Howth, and at Rush and Skerries. Indications of lead show themselves at the commons of Kilmainham, near Castleknock, at Clontarf, and near Dalkey and Killiney. The copper mines at Lough Shinney have been badly wrought; the ore was of a rich quality, and apparently derived from contemporaneous veins of quartz of uncertain extent.

At Lucan, to the west of Dublin, there is a spring strongly impregnated with iron and sulphur; another exists at Goldenbridge, near Kilmainham; and both are much frequented by invalids. Chalybeate springs have been discovered in various places in the vicinity of Dublin city.

The population of the county, taken detached from that of the city, has until lately been calculated on very uncertain data, and the results are consequently very unsatisfactory. De Burgho, in his *Hibernia Dominicana*, published in 1762, estimates it at 211,674, including the city; but this is evidently too high. Beaufort, in 1792, estimates it at 64,000, which is probably too low. The subsequent parliamentary returns give the following results: In 1812 it amounted to 132,000, in 1821 to 150,011, in 1831 to 183,042.

The state of education has been ascertained by parliamentary returns to be as follows:

	Boys.	Girls.	Sex not ascertained.	Total.
1821,	15,237	9235	...	23,425
1824–6,	17,989	14,524	495	33,008

The numbers in the latter return are thus classified according to the religious persuasion and pecuniary capabilities of the pupils: Of Roman Catholics, 20,440; of the established church, 10,372; of dissenters, 465; of those whose religious persuasion was not ascertained, 1731. As to the mode of payments, there are stated to be 730 schools, fifty-four of which, containing 3301 pupils, are supported by grants of public money; 140 schools, containing 13,467 pupils, by voluntary contributions; while those in the remaining 535 schools, amounting to 16,605 pupils, are supported wholly by the fees paid for education by the parents and friends of the children.

Previously to the union the county returned ten representatives to parliament; two for the county, two for the city, two for the university, and two for each of the boroughs of Swords and Newcastle. The number was reduced to five by the act of union; the members for both boroughs being struck off, and one withdrawn from the university, but this latter has been restored to it by the reform act. The constituency at various periods, before, during, and since the alterations made in consequence of the Catholic relief bill, presents the following results:—

	L.100.	L.50.	L.20.	L.10.	40s.	Total.
1st Jan. 1829,	...	1092	434	...	2490	4016
1st Jan. 1830,	...	1135	465	49	...	1649
1st May 1831,	...	1223	496	109	...	1828
1st Jan. 1833,	...	674	592	759	...	2025

From this table it appears that, though the constituency has been increased by the reform act beyond what it had been reduced to by the disfranchisement of the forty-shilling freeholders, it still amounts to but one half of what it had been before that period. The county court, in which the elections are held, the county business transacted, and the records kept, is at Kilmainham, a suburb of Dublin. When opened for legal proceedings, the chairman of the county, who is a barrister, nominated by the crown, but not allowed to practise as such, presides. In many points the jurisdiction of the city police, of which an account will be given in the description of the city, extends throughout a great part of the county.

The manners, appearance, and dress of the lower classes differ less from what may be considered as being peculiarly characteristical of the rural population of remoter districts, than might be expected in the vicinity of a large metropolis. Even in the immediate neighbourhood of the city are to be seen groups of cabins, exhibiting, both in their external appearance and in the dress and manners of their inmates, much to remind the observer of the peasantry of the interior. The farms are in general small. Near Dublin, particularly on the southern side, they are chiefly villas, with land attached to them, more for ornament and convenience than for agricultural profit. The rents are proportionally high, being rated rather from local circumstances than from the quality of the soil. Tillage, though not in a backward state, is by no means so far advanced as might be expected. Dairy farms, for the supply of the city with milk and butter, are much run upon. Vegetable gardens are numerous, particularly in the superior soil of the northern outlets of Dublin. Grazing farms for black cattle and horses are also frequent. The fences are generally of white thorn, close, and well kept. Manure of every kind is abundant; blue, brown, and white marl is extracted in many parts; fine shelly sand is drawn from the flat shores; and coal ashes, night soil, and other refuse of the metropolis, furnish abundant supplies of this important material, varying in quality according to the taste of the farmer and the peculiarity of the soil. The waste from gas works has also been beneficially used for the same purpose, when mixed with other substances.

Manufactures are carried on, but in a limited manner, in the country parts. At Balbriggen is a stocking manufactory of some extent. The Dodder furnishes sites for several paper-mills, a distillery, and some cotton and woollen factories. There is also an extensive woollen factory at Kilmainham, and a few smaller ones in the liberties of Dublin.

This county is distinguished for the superior quality of its eels; they are found in great abundance in Tullagheen river, where they are called silver eels, from their clear white colour, supposed to be derived from the superior purity of the water they inhabit. The mud eels are of a yellow tinge and less pleasant flavour. Sand eels are found in plenty along the coast. At Rush and Skerries the curing of cod and ling is carried on. Sturgeon has at times appeared in Dublin Bay; and the sprat is found in the Liffey, in which river there is also a profitable salmon fishery. There are oyster beds at Howth, Lambay, and Poolbeg; the fish was originally brought from Arklow. Porpoises are frequent on the Dublin coast. The principal supply of fish for the Dublin market is from Skerries and Howth.

Among the amusements of the lower classes, horse-racing and steeple chases are peculiarly attractive. Latterly a new direction has been given to the public taste for manly diversions by means of the new harbour at Kingstown. A regatta is annually held there, where prizes are distributed, by a club of noblemen and gentlemen, for races of yachts and row-boats. The annual assemblages occasioned thereby every summer give rise to much festivity in the neighbourhood. Formerly a club devoted to conviviality used to assemble once a year on the island of Dalkey, where, during the period of the meeting, a king of the island, elected for his superior qualifications, from among his boon companions, and who therefore might justly be styled the king of good fellows, held his mimic court, with all the appendages of burlesque royalty. But, during the period subsequent to the first French revolution, the love of frolic, as was to have been expected, took a democratic bent. The good king of Dalkey was formally deposed. The events which followed were ill adapted for the indulgence of this species of sociability; the annual meetings were discontinued, and have never since been revived. At Finglas, a village to the north of Dublin, Mayday is celebrated by amusements of a different kind, yet not less grotesque, consisting of races of asses, men in sacks, pigs with soaped tails, and other feats of waggish skill and eccentricity. But of all places calculated to exhibit the peculiarities of Irish frolic in its wildest mood, Donnybrook bears the palm. A fair is held here annually in August, ostensibly for the sale of cattle; and there is generally a good show at it, particularly of horses; but its leading attraction is the great variety of diversions of every kind likely to draw to it the artizans and lower classes of Dublin. The festivities are kept up night and day for a week, and sometimes for a fortnight. Latterly, however, the irregularities it gave rise to have induced the civic authorities to restrain its duration, and it is consequently on the decline as a place of public amusement.

This county reckons three round towers among its antiquities; one at Clondalkin in a high state of preservation; another at Swords, where also is the remains of a large monastic institution; a third at Lusk, forming one of the angles of the steeple. The church of St Doulaghs is worthy of note for the extreme antiquity of its architecture; it is covered with a double stone roof. A fine cromleach is still preserved near Cabinteely. The remains of a stone chair, and a rudely sculptured piece of granite, mark the former existence of an ancient temple near Killiney. At Old Connaught is a cross of considerable antiquity formed of granite. Its shaft is surmounted by a circle, on which the crucifixion is rudely sculptured. Among modern monuments may be noticed the Wellington memorial in the park; obelisks at Stiltorgan and on Killiney Hill, built by the proprietors of those demesnes, to supply employment during seasons of scarcity; and another also near Killiney, on the spot where the young Duke of Dorset was killed by a fall from his horse. This county can boast of no large town except the capital. Balbriggen, the second in size, contains a population of only 3016 souls.

Dublin, the capital city of Ireland, and the second in the united kingdom in magnitude and population, is situated nearly in the middle of the county of the same name, and at the mouth of the river Liffey. It was known as a place of importance as early as the time of Ptolemy, who notices it by the name of Eblana. By the Irish it is called Athcliath or Bally-Ath-Cliath, signifying the town of hurdles, and by that of Drom-Col-Choil, or the hill of the hazel wood, which latter name is supposed to have been more peculiarly applied to the hill on which the castle of Dublin now stands, a conjecture confirmed by the fact, that on removing the walls of the old castle chapel in 1806, they were found to have been laid on piles of hazel wood. Its modern name is said to be compounded of the Irish words Dubh and Linn, the black water or black bath, from the dark appearance of the river in the marshes near its mouth.

The city was in possession of the Ostmen at the close of the fifth century, who maintained themselves in it, and in the adjoining district, until the arrival of the English, by whom it was taken after a stubborn resistance, and Asculph Mactorkill, the Danish governor, made prisoner and put to death by the conquerors. When Henry II. landed in Ireland he made it his place of residence, and constructed a palace of wattles "after the country manner," in which he received the native chieftains who came to do homage to him. It is also said that he held a parliament here, but no records of it are now in existence. Before his departure for England he invited over a colony from Bristol, encouraged them to settle by the grant of a charter, the original of which is still to be seen in the archives of the city, conferring on them all the rights of citizens of Bristol. King John visited the city during his father's lifetime, as Earl of Morton, and again in 1210, after he came to the throne, when upwards of twenty Irish chieftains swore allegiance to him, he on his part covenanting to establish the English laws and customs throughout the island, and consequently opening courts of justice according to the forms of the law of England. In 1216 Magna Charta was granted to the Irish by Henry III.; a copy of it is to be found in the Red Book of the Exchequer. In 1217 the city was granted to the citizens at 200 marks per annum. In 1227 the same monarch confirmed the charter of John, fixing the city's boundaries and the jurisdiction of its magistrates. During the invasion of Ireland by Edward Bruce, in the commencement of the reign of Edward II. some of the suburbs were burnt to prevent them from falling into his hands when besieging the city. Richard II. erected it into a marquisate for his favourite Robert de Vere, whom he also created Duke of Ireland. The same king visited it twice, first in 1394, on which occasion he bestowed the honour of knighthood on four Irish princes in Christ Church; and again in 1399, when his continuance there was cut short by the rebellion of the Duke of Lancaster. In 1404 the statutes of Kilkenny and Dublin were confirmed in a parliament held in the city by the Earl of Ormond. The attachment of the people of Dublin to the house of York induced them to acknowledge Lambert Simnel, who was crowned in Christ Church in 1486. The rash rebellion of Lord Thomas Fitzgerald, son of the Earl of Kildare, seriously endangered the city in 1534. On his appearing before the walls with a powerful force, the citizens were induced through fear to give admission to a detachment of his troops to besiege the castle; but, on hearing that he had met with a reverse in another quarter, they suddenly closed their gates and detained his men as prisoners. He then attacked the city itself; but finding it too strong to be seized by a *coup de main*, he raised the siege on condition of having his captured soldiers exchanged for the children of some of the principal citizens who had fallen into his hands. At the breaking out of the civil war in 1641, a conspiracy to seize on Dublin Castle was detected on the eve of the day in which it was to be effected, and the city was thus preserved for the king's party. In 1646 it was besieged by the Irish army, but without success, as the Marquis of Ormond, then lord-lieutenant, had put it into a respectable state of defence, in doing which he was aided by his wife and the other ladies of distinction residing there, who assisted in carrying baskets of earth to repair the fortifications. He was, however, compelled to surrender it on conditions the next year to Colonel Jones, commander of the parliamentary forces; and in 1649 he was totally defeated at Rathmenes in an attempt to recover possession of it. The same year Oliver Cromwell landed in Dublin, and proceeded thence on his career of conquest, which commenced with the capture of Drogheda by storm, and the subsequent massacre of its inhabitants. On the resignation of Richard Cromwell in 1659, the castle was surprised by a party of officers favourable to the royal cause; and though immediately retaken by Sir Hardress Waller, it was forced to surrender again in a few days. When James II. landed in Ireland in 1688, to assert his right to the British throne, he held a parliament in Dublin, and erected a mint there, in which a large quantity of base money was coined, in the hope of relieving his financial difficulties. On his return thither, after the defeat of the Boyne, it is said that he refused to listen to a proposal to burn the city, in order to check his adversary's pursuit. Such a step was, however, as unnecessary as it would have been flagitious; for William advanced by slow marches, and on his arrival encamped at Finglas, and did not enter the city till the ensuing day, when he went in state to St Patrick's Cathedral to return thanks for his victory. In 1783 a convention of delegates from all the volunteer corps in Ireland assembled in Dublin for the purpose of procuring a reform in parliament; but the House of Commons refused to entertain the proposition, and the convention separated without coming to any practical result. In May 1798 the explosion of a conspiracy planned by the united Irishmen to seize the city was prevented by the capture of Lord Edward Fitzgerald and some of the other leaders. In 1800 the act of union between Great Britain and Ireland was passed in both parliaments, and on the 1st January following the imperial standard of the united kingdom was hoisted on Dublin Castle. In 1803 another insurrection, headed by Robert Emmett, a young barrister of great talents, broke out, but was immediately quelled with the loss of some lives in the tumult, and the death of its leaders on the scaffold. The only remarkable event in which Dublin was more peculiarly interested since that event, was the visit of George IV. to Ireland in 1821, when he spent several days in inspecting its public institutions and receiving the congratulations of his Irish subjects; and on quitting it left behind him a letter expressive of his feelings on the reception he had met with, and of his wishes for their welfare and prosperity.

The site of the city was long confined to the hill on the south side of the river of which High Street forms the crest, and the castle the eastern declivity. The walls, which may still be traced on maps, though scarcely a vestige of them now remains, did not exceed a mile in length. From the north tower of the castle they were carried over Cork Hill, near which was an entrance called Dame's Gate, looking towards Hoggin's, now College Green. Near Essex Bridge was another entrance called Essex Gate, erected on the site of Isod's Tower. The wall was then carried westwards along the course of the river to the end of Fishamble Street. Here stood Fyan's Castle, sometimes used as a state prison. Thence it continued along Wood Quay to Winetavern Street, where was another castle; and, still continuing parallel to the river, it joined a castle through which was one of the principal entrances, opposite to Bridge Street. Thence it was carried to New Row, and up the hill to Cutpurse Row, at the end of which was Newgate, also used as a prison. From Corn Market it passed along the rear of Back Lane to Nicholas Gate, thence between Ross Lane and Bride's Alley to Pool Gate, afterwards Werburgh Gate, and thence in a straight line till it joined the castle at Birmingham Tower. The part of the city now called Dame Street and College Green was a low swampy plot, subject to inundations of the river, to the north of which were a Danish settlement, now called Oxmantown, a corruption from Ostmen's Town, and the extensive monastery of St Mary's, with its appendage the friary of St Saviour. The only passage across the river by land was by a bridge at the end of Bridge Street, formerly called Old Bridge, Dublin Bridge, and for some time Friars' Bridge. It was taken down in 1815, and its place supplied by an elegant new erection of three arches called Whitworth Bridge. In sinking for a foundation the traces of two or three former ones were discovered, one of them of excellent workmanship, supposed to have been the original, laid in the reign of John, and which, having been swept away in 1385, was replaced by the Dominican friars, who repaid themselves by a toll. All the other monastic buildings were on the south side of the river. These were, the two cathedrals, to be described more minutely hereafter; the abbey of St Thomas the Martyr, since called Thomas Court; the priory of All Hallows, now Trinity College; the monastery of St Francis in Francis Street; the monastery of the Holy Trinity, on the site of the late theatre in Crow Street; the Carmelite or Whitefriars' Monastery, lately restored, in Whitefriar Street; and the nunnery of St Mary de Hogges, on the ground where St Andrew's Church now stands. The precise situations of the nunnery of St Mary des Dames, whence Dame Street has its name, of the abbey of St Olave, somewhere in Castle Street, of the monastery of Witeshan in the west of Dublin, and of the priory of Knights Templars in Catgott, in the southern suburbs, are now unknown. The hospital of St Stephen occupied the site of Mercer's Hospital; the Steyne Hospital stood on Lazar's Hill, now Bank Street; and Allen's Hospital lay between St Kevin Street and the bounds of the archbishop's palace in St Sepulchre's. Though the buildings spread themselves from an early period in all directions, the walls were never extended beyond their original limits. During the civil wars in 1641, indeed, entrenchments were thrown up between the castle and the college, from the river to the vicinity of St Patrick's Cathedral; but being constructed of earth, they did not long survive the necessity to which they owed their origin.

In general it may be observed, that the progress of architectural improvement has taken an eastern direction. Most of the public buildings and new streets lie on that side of the castle, whilst those towards the west are rapidly falling into decay. Hence it is that the boundaries of the civic jurisdiction are in some parts strangely at variance with the arrangement of the buildings. In the north-eastern district the entire parish of St George is beyond the scope of the municipal authorities, whilst in the south-eastern they extend beyond the low-water mark on the South Bull, and to the Blackrock, a village five miles from the castle, including a large tract of arable and pasture land, and the villages of Ringsend, Irishtown, Sandymount, Merrion, Ballsbridge, and Donnybrook. About the year 1770 a road was carried round the city, so as to connect all the outlets; it was called the Circular Road. The boundary thus formed measures somewhat less than nine miles. Latterly the lines of the Royal and Grand Canal on the north and south have afforded a boundary line still more comprehensive; but the entire of the included area is not covered with buildings. A circle, with Essex Bridge as a centre, and with a radius of one mile, will comprehend very nearly all the inhabited part of the city, exclusive of the outlying villages subject to municipal jurisdiction. The area within the limits of the Circular Road covers a space of 1264 acres, of which about 785 are on the southern side, and 478 on the northern side of the Liffey, or Anna Liffey, a name said to be derived from Awen Luiffa, the black river. This river, which, after traversing the city from west to east, through an extent of two miles and a half, reckoned from the King's Bridge to the quay point, near Ringsend, discharges itself into the Bay of Dublin, forming a harbour singularly ill calculated for commercial purposes, in consequence of two sand-banks called the North and South Bulls, between which it flows. Attempts were made to diminish the dangers arising from them, and to deepen the bed of the river, particularly at the entrance, where a bar having but six or seven feet water at low tide prevents the entrance of ships of heavy burden, by carrying out two piers called the North and South Walls, into the sea. The former of these, which is much the shorter, is terminated by a small light-house;

the latter extends in the form of a broad road, a mile and a half in length, to the Pigeon House, a collection of buildings originally intended as a landing place for the Holyhead packet boats, but, since the removal of these to the Howth Harbour, converted into a military magazine. It is continued two miles farther as a solid wall, thirty-two feet broad at the bottom, to a light-house at the end of the South Bull. These walls have not had the desired effect of deepening the channel. Within them there is safe anchorage, and vessels not drawing more than fourteen feet water can moor at the quays near Carlisle Bridge. Beyond this point the river is navigable for lighters and row-boats only as far as Sarah Bridge, to the west of the city, where a weir thrown across it puts a stop to further navigation. Both sides of the river are cased by walls of granite, forming spacious quays. These are intersected by nine bridges; Carlisle Bridge, nearest the sea; Wellington Bridge, a single arch of cast-iron, for foot passengers only; Essex Bridge; Richmond Bridge; Whitworth Bridge, formerly Dublin Bridge; Queen's Bridge; Barrack, formerly Bloody Bridge; King's Bridge; and Sarah Bridge. The two last named are each of a single arch, the first of them of iron, the other, a building peculiarly elegant in its proportions, of stone. All except Barrack Bridge are modern and beautiful.

Besides the splendid avenue from east to west formed by the quays, and combining elegance and convenience with health, there are several lines of communication formed of fine streets. The passage through the city from the great northern road is peculiarly striking, particularly at Sackville Street, on account of its great width, and the fine houses of which it is built. The entrance from Kingstown is equally imposing. Both these avenues meet in College Green, an opening surrounded by palaces, and having an equestrian statue of William III. in its centre; their continuance to Dublin Castle, through Dame Street, is also fine. But on deviating from these main lines, the decline of the bustle of business, and of the display of luxury, is immediately visible. Dublin can boast but of five squares; St Stephen's Green, the largest, exhibits some fine mansions, but the houses are irregular, and of very unequal merit in their architectural structure. An equestrian statue of George II. is in its centre. Merrion Square, the next in size, is more uniform and modern. Fitzwilliam Square, the smallest in the city, pleases from its extreme neatness. All these are on the southern side, and nearly contiguous to each other. Rutland Square, also of very limited dimensions, is surrounded on three sides by ranges of splendid private mansions, the fine edifice of the Lying-in-Hospital forming the interior of its fourth side. Mountjoy Square resembles Fitzwilliam Square in its style of architecture, but on a larger scale. These two are in the north-eastern quarter. The streets are well paved, flagged, and lighted, and kept in a very respectable state of cleanliness.

The city, taking the word in its larger acceptation, is divided into nineteen parishes, fourteen in the south and five in the north. The southern are St Andrew's, St Anne's, St Audoen's, St Bridget's, St John's, St Luke's, St Mark's, St Michael's, St Nicholas', within the walls, and St Werburgh's within the civic boundaries; St Catherine's, St James's, and St Peter's, partly within them; and St Luke's wholly without them. St Kevin's parish is included in that of St Peter. Besides these, there are the extraparochial liberties of the deaneries of St Patrick's and Christ Church. The northern parishes are St Mary's, which originally embraced all those on the north side of the river; St Michan's, St Paul's, and Thomas's within the city; St George's in the county; and the late manor, but now the parish, of Grangegorman.

The population of the city is stated by Stanihurst, a native, to have been upwards of 300,000 in 1584. Porter, who wrote in 1680, computed it at the same amount. Though it is nearly certain that each of these estimates is far above the truth, it is impossible to account satisfactorily for the smallness of the numbers in 1645, particularly when compared with the sudden and enormous increase in the beginning of the subsequent century. The accounts, according to calculations at various periods and by different rules, some being merely conjectural, others expressing the number of houses, others that of souls, others again resting on actual enumeration, are given in the following table. In those cases in which the number of houses only is stated, the average of inhabitants is calculated at twelve and a half, that being nearly the amount ascertained in those estimates in which both houses and souls have been taken by actual enumeration.

Date.	Authority.	Houses.	Inhabitants.
1584	Stanihurst	Not stated	300,000
1644	Annals of Dublin	Not stated	8,159
1681	Lynch	Not stated	40,000
1690	Porter	Not stated	300,000
1732	Lynch	13,000	By estimation, 162,500
1744	Lynch	11,923	By estimation, 149,037
1753	Rutty	12,887	By estimation, 161,088
1760	Lynch	13,421	By estimation, 167,758
1788	Bushe	14,327	By estimation, 179,088
1798	Whitelaw	14,854	By enumeration, 182,370
1813	Parliament	14,696	By enumeration, 175,319
1821	Parliament	14,949	By enumeration, 185,881
1831	Parliament		By enumeration, 203,752

In the parliamentary return of 1821 the population of the city has been given in three forms, the first containing the parishes and parts of parishes within the canals, and also within the corporate jurisdiction; the second containing the total area within the canals; the third the same area as the second, together with those parts of parishes beyond the canals. The brief extracts from the returns of 1831 as yet published by parliament give also a threefold view of the population, but whether the limits are the same as those of 1821, cannot be satisfactorily ascertained until the returns shall have been fully before the public. The three statements give the following result:—

	1821.	1831.
1st	175,585	203,752.
2d	224,317	232,362.
3d	227,335	265,316.

Few large cities present a more striking picture of the extremes of splendour and destitution than Dublin. A line drawn from the King's Inns in the north of Dublin, directly south, through Capel Street, the castle, and Aungier Street, will, together with the line of the Liffey, divide the whole area into four districts, materially differing from each other in appearance and character. The south-eastern district, which comprehends three of the great squares, is chiefly inhabited by the nobility, the landed gentry, and the liberal professions. The north-eastern, which includes the two other squares, contains the residences chiefly of the mercantile and official classes. The post-office and custom-house are in this division. These two districts present every appearance of affluence and luxury. But on proceeding westward the scene suddenly changes. The south-western district, which includes the liberties of St Sepulchre's and Thomascourt, and was formerly the seat of the silk and woollen manufactures, is in a state bordering on ruin, as is also the north-western district, in which are the barracks, and the great market for cattle and hay.

Dublin is the seat of the local executive, consisting of the lord lieutenant and the privy council. It is also the seat of the supreme courts of judicature, from which an appeal lies only to the House of Lords in Westminster. The lord lieutenant resides, for a few months during spring, in Dublin Castle, but spends most part of the year at an elegant villa in the Phœnix Park. The castle was built in 1205, by Henry de Loundres, archbishop of Dublin. It originally consisted of a single square flanked by towers at each angle, the two southern of which still remain. It contains a suite of apartments for the lord lieutenant, in which are two magnificent rooms, the audience chamber, and St Patrick's hall, where balls are given on that saint's day. The remainder of the buildings are appropriated to the privy council, the apartments of the state officers, and some of the public offices. Other buildings without the square have been successively attached to the castle. The principal of these is the chapel royal, projecting from one of the towers yet standing. It is a beautiful pile of highly finished florid Gothic architecture, of small proportions. Its interior has a fine painted window, and is ornamented with the arms, carved in oak, of all the lord lieutenants of Ireland to the period of its erection. The treasury, the ordnance, the quarter-master's office, and some other minor departments, occupy the remaining space. A guard of state of horse, foot, and artillery, is mounted here daily.

The judicial functions are committed to the lord chancellor, who presides in the court of chancery, the master of the rolls, who holds a subordinate court, and the three law courts, viz. the king's bench, the common pleas, and the exchequer, over each of which four judges are placed. The building where the courts are held, on the King's Inns quay, is a large and highly ornamented pile, consisting of a central part containing a circular hall of large size, in each angle of which one of the four principal courts is held, that of the master of the rolls being in a detached apartment. The wings, which form two small squares, are appropriated to the offices and record repositories belonging to the courts. The prerogative, consistorial, and admiralty courts, are held in the King's Inns buildings, to be described hereafter.

The boards of commissioners which had charge of the principal branches of the revenue all sat in Dublin until very lately. They are now removed to London, and the details here managed by inferior agents. The customs and excise offices were both held in the custom-house, which at first stood on the south side of the river, close to Essex Bridge, but on the erection of Carlisle Bridge they were removed to the magnificent structure erected for them on the north wall, a square building 375 feet by 209, with four fronts, each highly ornamented, and having a beautiful cupola rising from the centre, but recently consumed by fire. At present the officers of customs have little more to do than to collect the duty still levied on coal imported for the use of private families. The business of the stamp-office, which had been transacted in a separate building in William Street, once the private mansion of the Earl of Powerscourt, has been transferred to some of the apartments of the custom-house, vacant since the removal of the boards to London; and the building in William Street has been sold to a mercantile establishment. The post-office, which on its first opening had been held in College Green, is carried on in a fine building in Sackville Street, under the care of a secretary acting under the postmaster-general in London.

A large military force has always been maintained in and near Dublin. The principal barracks are at the western extremity of the city. They consist of four large squares, capable of accommodating two thousand men, both infantry and cavalry. A temporary barrack, capable of containing a regiment of infantry, has been fitted up in some unfinished houses south of the castle. Richmond barrack, for infantry, on the banks of the Grand Canal, beyond Kilmainham, on an elevated and healthy situation, forms a fine and substantial fabric of great extent. Portobello barrack, for cavalry, is on the banks of the same canal, near Harold's Cross. At Island Bridge, near Kilmainham, there is an artillery barrack; and another at the magazine at the Pigeon House.

The municipal government is vested in the lord mayor, two sheriffs, a board of aldermen, and an assembly consisting of ninety-six representatives from the twenty-five guilds of trade, together with an unlimited number of sheriffs' peers. The charter of Henry II. already mentioned was confirmed and enlarged by John, and by numerous others from succeeding monarchs. The latest is that by James II. The chief magistrates were originally styled provost and bailiffs. The former title was changed to that of mayor in 1409, the latter to that of sheriff in 1547. In 1660 Charles II. granted the lord mayor a golden collar, a company of foot, and the right of having a sword of state, a mace, and a cap of dignity. In 1665 the title of lord mayor was conferred on him, and L.500 per annum granted in lieu of the foot company. In 1672 the Earl of Essex, then lord lieutenant, issued new rules for the regulation of the corporation. In 1682 the tholsel was built as its place of assembly; it was taken down in 1807, and the corporation since meets in a plain building in William Street.

The city assembly is formed of two bodies, the aldermen and commons. The latter consists, as already noticed, of representatives chosen every three years by the twenty-five guilds of trades, in numbers proportioned to the estimated importance of each; besides which, every person who has been elected to the office of sheriff has a seat in the commons for life, under the name of sheriffs' peer. In this assembly the sheriffs preside; they are annually chosen from among the representatives of the guilds, by the common council. Each person elected must prove himself by oath worth L.2000. Those who please may decline to serve the office, on paying a sum of L.500. Such persons are said to *fine*, but are not therefore disqualified from sitting as sheriffs' peers.

The aldermen, twenty-five in number, are chosen by the common council out of a list of four names sent down to them by the board of aldermen, which sits in a separate chamber, where the lord mayor presides. They hold office during life. The lord mayor is elected by the aldermen generally, according to seniority; he must be approved and sworn in by the lord lieutenant. This ceremony takes place at Michaelmas. He holds a court for the trial of petty offences and misdemeanours, and settles disputes between workmen, journeymen, and servants, and their employers. During the year subsequent to that of office he presides at the court of conscience, which takes summary and final cognizance of suits of debt under L.2 Irish. Every third year he perambulates the city bounds on horseback, attended by the civic authorities. The tour commences at low-water mark on the South Bull, where he determines the boundary of his jurisdiction by flinging a javelin into the sea. This ceremony, called riding the franchises, was formerly made the occasion of a splendid procession of all the guilds dressed in uniform, and preceded by banners and appropriate emblems. The corporation appoints a recorder, treasurer, town-clerk, secretary, sword-bearer, and other inferior officers. It has also the regulation of the markets. The principal wholesale markets are that of Smithfield for cattle, hay, and straw, and those near the new prison for fruit, potatoes, vegetables, eggs, and fish. There are ten retail meal markets, generally well supplied, but not remarkable for cleanliness, with the exception of the Northumberland market, lately opened in the neighbourhood of Sackville Street by a spirited individual as a private speculation. The custom of slaughtering cattle in private yards is carried on to an offensive extent. A small market for hay, straw, and butter is held beyond the jurisdiction of the corporation in Kevin Street, in the manor of St Sepulchre. The supply of fuel is also in some degree under the control of the corporation. It consists chiefly of coal from England, and some from Scotland; turf is brought in large quantities by both canals. Native coal is also sent to the city from Leitrim and Kilkenny, but not in quantities or at prices to do away with the demand for the imported article. The corporation has also the charge of supplying the city with water, which is brought from the canals into the reservoirs, whence, after having been forced through a filtering machine of excellent construction, it is conveyed by pipes through all parts, so that the inhabitants are copiously supplied with this necessary of life on moderate terms. Fountains are also set up in several places in the poorer parts of the town; but these are under the control of a special corporation.

Four distinct courts, besides the court of conscience, are held within the limits of the lord mayor's jurisdiction; the quarter sessions, at which the recorder, aided by two aldermen at least, presides to try petty offences; the court of oyer and terminer, held by two of the puisne judges of the superior courts for crimes of a graver nature; the recorder's court, which is held in January, April, July, and October, for actions of debt by civil bill process; and the lord mayor's court already mentioned. All are held in the sessions' house, a neat building of hewn stone in Green Street, erected in 1797. The records of the city are preserved in some of the apartments of this building.

For the purposes of police, the city is divided into four districts, nearly corresponding with those already described. In each there is an office, at which three magistrates, one an alderman, the second a common council man, and the third a barrister, all appointed by the crown, sit every day. They have under them an armed force, consisting of fifty-two peace-officers, thirty mounted, and a hundred and seventy dismounted police, and six hundred and fifty watchmen, which last body remains on duty from an hour after sunset till an hour before sunrise. The police has the regulation of the public carriages plying in the city and its neighbourhood. These are chiefly hackney coaches and jaunting cars, which latter are now distributed on convenient stands through most part of Dublin, like the former.

The criminal prison was formerly at Newgate, between Thomas Street and Cutpurse Row, but has been removed to a square building flanked with towers, built in Green Street for the purpose. Originally it was intended for prisoners of every description; but in consequence of arrangements lately made to diminish the numbers by which it was thronged, it is not now often overstocked. It is under the control of the corporation, which appoints all the officers, and has been annually reported by the inspectors-general as among the worst arranged prisons in Ireland. The Richmond General Penitentiary, an extensive pile of building in Grangegorman Lane, was erected to prevent the necessity of transportation, being intended for convicts sentenced to long periods of punishment. It was under the immediate control of the government, by whom the jailor and other officers were appointed. The experiment has not succeeded. An enquiry into its internal management disclosed several grave abuses, the jailor has been removed, and the building was used for a cholera hospital in 1832. Juvenile offenders are sent, on conviction, to a house of correction in Smithfield. The bridewell on the Circular Road for minor offences is under the city magistrates. It is well regulated. Useful works are carried on so far as to defray part of the expenditure. The treadmill has been introduced into it. The prisoners are also employed in cultivating a large garden for the use of the inmates. The prisons for debtors are four. The Four Courts' Marshalsea receives prisoners both from the city and from all the counties in Ireland. It is in a healthy situation on a rising ground near Thomas Street, and well secured by a lofty wall, but badly ventilated. A plan proposed by an intelligent architect for correcting this defect without the risk of escapes, has not been carried into effect. The Sheriffs' Prison in Green Street is intended for all cases of debt above L.10 contracted within the city. Previously to its erection in 1794, debtors were detained in the residences of the bailiffs, commonly called spunging-houses, a custom which occasioned many gross abuses. For some time also after the opening of this prison, the keeper was partly remunerated by the rents of the apartments. The abolition of prison fees has put an end to this abuse, and the only well-founded cause of complaint at present arises from the limited extent of its accommodations. The City Marshalsea, adjoining the Sheriffs' Prison, receives debtors for sums less than L.10, under decrees of the lord mayor's court and the court of conscience. The prisoners are generally of the poorest classes, and many of them have no resource but casual charity for the support of life; even a lodging in the common hall must be purchased at the rate of a penny a night. The state of the Dublin prisons in general, though considerably improved by the degree of attention lately paid to remedy the defects of their construction and their internal economy, still requires much amelioration, not only with respect to the classification and treatment of the prisoners, but also to the expenditure, which is much greater than what would be found to be necessary under a better arranged system.

Those parts of Dublin not under the civil magistrates are, the manor of Grangegorman, which includes a district in the neighbourhood of Glasnevin and Mountjoy Square, of which the dean of Christ Church is the lord, and appoints a seneschal, who holds his court in a private house. The manor of Thomascourt and Donore, granted to an ancestor of the Earl of Meath, on the dissolution of the monastery to which it had been appendant. Its court was first established in the reign of King John, and still continues open for trial of petty debts and offences. The manor of St Sepulchre, including the parishes of St Kevin and St Nicholas Without, of which the Archbishop of Dublin is lord, with extensive powers that have now nearly become obsolete. It has a court-house and prison attached to it. The ground immediately adjoining the cathedrals of Christ Church and St Patrick are also exempt jurisdictions, subject to their respective deans; but their authority is now little more than nominal.

The seat of the archiepiscopal see is in this city. The palace was till lately in an old building in St Sepulchre's, now converted into a police barrack. The archbishop resides in a house purchased for him in Stephen's Green. He exerts spiritual jurisdiction over the two cathedrals of Christ Church and St Patrick. Of these the former claims the priority by right of antiquity; its foundation is attributed to the Danes in 1038. It stands nearly in the middle of the old city, on the northern declivity of the hill. Earl Strongbow, the invader of Ireland, is interred here, and his tomb was long the place at which the tenants of the church were bound to pay their rents. The monument was much injured by the fall of one of the cathedral walls; but was repaired, and is still to be seen in good preservation, with a smaller tomb by its side, having on its top the representation of the superior extremities of a boy cut off at the waist, which circumstance tradition accounts for by informing us that the youth had been cut in two by his father for his cowardice in battle. Several fine monuments are in the aisle; and in the chancel is that of the nineteenth Earl of Kildare, father of the Duke of Leinster. Under the same roof with the cathedral is a small building called St Mary's Chapel. The chapter consists of the dean, precentor, chancellor, treasurer, the three prebendaries of St Michael, St Michan, and St John, and four vicars choral. The cathedral is well endowed; its economy fund, amounting to L.2400 annually, is applied to the payment of the dignitaries and officers, and to the maintenance of the structure, which has lately undergone a thorough repair, both internally and externally. The deanery-house was in Fishamble Street, which being considered a situation unsuitable to a dignitary of the establishment, was sold, and it is now a merchant's warehouse. The dean resides on some of the cathedral lands at Glasnevin, in one of the northern outlets. The cathedral of St Patrick was founded in 1190 by John Comyn, archbishop of Dublin, in a very low situation, and therefore subject to the bad effects of floods, by which it is liable to be inundated. About a hundred years after its erection it was completely burnt, but was soon after raised from its ruins in increased splendour. At the reformation it was dissolved, and the building used for some of the purposes of the courts of justice. King Edward projected its change into a university; but in the succeeding reign of Mary it was restored to its primary destination, which it still retains. The installations of the knights of St Patrick, the first of which took place in 1783, are held here. Its walls have since been ornamented with the helmets, swords, and banners of the knights, those of the present members being suspended over their stalls in the chancel, whence they are removed on their decease into the aisle. This cathedral contains the monuments of several illustrious persons, among which the most celebrated, not so much for the execution of the sculpture, as for the more durable fame of the characters they commemorate, are those of Dean Swift; of Mrs Johnston, immortalized by him under the name of Stella; of Archbishop Marsh, who bequeathed a fine library to the public; of the first Earl of Cork; and of Duke Schomberg, who fell at the Boyne. The northern transept is used as the parochial church of the adjoining parish of St Nicholas Without. The chapter consists of the dean, precentor, chancellor, treasurer, the two archdeacons of Dublin and Glandalogh, nineteen prebendaries, four minor canons, and twelve vicars choral. The economy fund amounts to L.2050 per annum. The singing men of these cathedrals perform conjointly at both, and at the chapel of Trinity College, at different hours on Sundays; so that it may be said there is only one choir in Dublin; but that one, from the combination of musical talent, is excellent, although it is a question with many whether the amalgamation, by stifling emulation, does not injure rather than serve the cause of sacred music. The deanery house is in the immediate vicinity of the church. Sir James Ware, who wrote in the reign of Charles I., pronounces this cathedral to be superior to all others in Ireland for magnificence of structure and for extent. Some of the parish churches possess strong claims to admiration. St George's is a fine insulated Grecian fabric, with a highly ornamented steeple and spire. St Andrew's, commonly called the round church, from its elliptical form, is remarkable for a statue of its patron saint over its entrance; this being the only instance of a statue erected in such a place in Dublin. St Peter's and St Michan's are chiefly noted for their size. The cemetery of the former possesses the bones of the ambitious and arrogant Earl of Clare, who signalized himself in the stormy scenes of 1798. The piety of the inheritor of his title and fortune suffers the remains of him to whom he owes his rank to moulder under the undistinguishing protection of a plain grave-stone. The vaults of St Michan's are remarkable for an antiseptic quality, which preserves the relics deposited there from decay. Among these are the bodies of the two Shears, brothers and barristers, who were among the first victims of the law on the breaking out of the rebellion just alluded to.

The Roman Catholic Archbishop of Dublin also resides in the city. The metropolitan church, in Marlborough Street, is considered as more peculiarly under his charge. This is a building of great dimensions, highly ornamented internally in the Grecian style, but as yet unfinished on the outside, from the want of adequate funds. When complete it will be among the finest specimens of architecture which the city can boast of. The total number of Roman Catholic parish chapels is twelve, all large, but few externally elegant; a circumstance easily accounted for by the fact, that previously to the year 1745 the strict enforcement of the penal laws prohibited the public exercise of their forms of worship. The relaxation of the law was occasioned by the falling in of the floor of an upper apartment, where a Catholic congregation had assembled to celebrate mass secretly, and by which several lives were lost. On hearing of the accident, Lord Chesterfield, then lord lieutenant, nobly declared that he would no longer be accessory to the enforcement of a statute productive of a catastrophe so fatal. The Catholic places of worship have ever since been kept open without molestation; but the apprehensions of their pastors, and the jealousy of the ruling powers, compelled them long after to select places of comparative privacy for their erection. The interior of the chapels in Anne Street and Exchange Street are highly worthy of inspection. Besides the parochial chapels, there are seven belonging to friaries of the Franciscans, the Calced and the Discalced Carmelites, the Capuchins, the Dominicans, the Augustinians, and the Jesuits, and nine belonging to nunneries, viz. two of Discalced Carmelites, two of Poor Clares, two of the Presentation, one of Dominicans, one of the Sisters of Mercy, and one of the Sisters of Charity; the ladies of which last-named order signalized themselves by their zealous and indefatigable attendance on the dying beds of the sufferers in the hospitals during the late awful visitation of the cholera.

Protestant dissenters are by no means numerous in Dublin. There are four congregations of Presbyterians, two of which profess the Trinitarian, and two the Unitarian doctrine; four congregations of Independents, six of Methodists, and of Quakers, Seceders, Baptists, Moravians, Kellyites, and German Lutherans, one each. The few Jews resident in Dublin have no synagogue. The following table will afford a concise view of the comparative numbers of the respective places of abode:

Protestants.		Catholics.		Dissenters.	
Cathedrals	2	Parish chapels	9	Presbyterians	4
Parish churches	19	Chapels of ease	3	Independents	4
Chapels of ease	7	Friaries	7	Methodists	6
Unattached chapels	12	Nunneries	9	Other dissenters one each	6
	40		28		20

Each of the parish churches has a cemetery attached to it, in which the parishioners of every religious persuasion were interred, until the restraints imposed on Catholics by the law called the burial casement act, as to performing their burial service over the dead, obliged them to open two large cemeteries, the one at Golden Bridge, the other at Glasnevin, which, though but two years instituted, are both nearly full, to the serious diminution of burial fees to the Protestant functionaries. The profits of these cemeteries, which are considerable, though the fees are much less than what had been previously demanded, are devoted to educating the children of the poor. The vaults of the newly built Roman Catholic places of worship are also appropriated to the reception of the dead. The Jews, the Quakers, the French Calvinists, and the Moravians, have each a cemetery in or near the city.

Dublin has had its full share of the benefits arising from improvements in education. As early as the year 1311 a university was erected in it, under a bull of Clement V. in St Patrick's Church; but it gradually declined, until it became virtually extinct at the close of Henry VII.'s reign. After the Reformation, Sir Henry Sidney and Sir John Perrot exerted themselves to convert that cathedral into a university; but they were overruled by Archbishop Loftus, who protested successfully against what he deemed an encroachment on the rights of the church. In lieu of it, however, he prevailed on the corporation of Dublin to apply the dissolved monastery of All Saints or All Hallows to the same purpose. Hence arose the university of Trinity College, which at first consisted only of a provost, three fellows, and three scholars; but now of a provost, seven senior fellows, who together form a board which has the regulation of all the concerns; eighteen junior fellows, and seventy scholars, besides several professors in various branches of science. The number of under graduates amounts to more than 1200. The buildings form three large squares, and are used partly as dwelling apartments, partly for the purposes of education. The library, consisting of more than 100,000 volumes, is deposited in a noble gallery 210 feet long, adorned with busts of distinguished literary and scientific characters from Homer to the present day. It is rich in modern English publications, in consequence of having the right to a copy of every book published under the copyright act, and also in theology. It likewise possesses some valuable manuscripts. Its greatest defect is a want of modern continental publications. The chapel and examination hall are also fine buildings; the latter contains a very fine monument of Dr Baldwin, one of the chief benefactors to the college, and some portraits of other remarkable personages. The dining-hall, a plain building, has also some similar portraits. The museum is not well stocked; but the botanic garden in the suburbs is maintained in a manner highly creditable to the college. The school of anatomy is of first-rate excellence. The regular course of studies for a batchelor's degree continues for four years, during each of which the student is subjected to four examinations; and at the close of this period gold medals are awarded to the two best answerers in science and the classics. The college observatory is at Dunsink, about five miles north-west of Dublin. The revenues arise from lands to a large extent, and from the fees of pupils. The college has also the disposal of a number of valuable benefices, which, when vacant, are offered to each of the fellows successively, commencing with the senior. The acceptor consequently vacates his fellowship, which is filled up by election, after a severe public examination by the provost and senior fellows. During the short reign of James II. a college for Roman Catholics was opened in Back Lane, but was extinguished on his abdication.

The Inns of Court were intended for the instruction of law students. Collet's Inn, the first appropriated to this purpose in the reign of Edward I., having been erected without the city walls, was destroyed, together with the king's exchequer, by an incursion of the Irish from the Wicklow Mountains. The inns were revived during the reign of Edward III. in a building near the castle, given by Sir Robert Preston, chancellor of the exchequer, and thence called Preston's Inns, where the institution was maintained for upwards of two centuries. But the society being dispossessed in consequence of a flaw in the title, the inns were removed to the dissolved monastery of St Saviour's, where the four courts now stand, and there took the name of King's Inns. These buildings having been suffered to fall to ruin, a new site was chosen in the northern extremity of Dublin, where they are now held. The principal apartments are the dining-hall and the library, which latter forms a detached building. Law students are obliged to attend terms here for two years previously to being allowed to practise as barristers; but as no arrangements have been made for literary instruction beyond the use of the library, punctuality of attendance is ascertained solely by their presence in the dining-hall, and therefore they are facetiously said "to eat their way to the bar."

The school of medicine is partly under the control of the board of Trinity College, which nominates and maintains professors of anatomy, chemistry, and botany, and partly under that of the college of physicians, which nominates the professors of the practice of medicine, of the institutes of medicine, and of materia medica, who are paid by grants of public money; but the emoluments of all depend likewise on the fees of pupils. The college of physicians was first incorporated by Charles II., and renewed by William and Mary. It enjoys some important privileges; among others, the right of inspecting the shops and stores of apothecaries, druggists, and chemists, and of destroying drugs of bad quality. The college consists of fourteen fellows, on whom the management devolves; of honorary fellows, who are excluded from any interference with the financial arrangements; and of licentiates, who, though not entitled to take any part in the management of the collegiate concerns, are summoned on occasions of importance. Every physician practising in Dublin deems it necessary to take out a license, which is granted on examination. The college meets at an infirmary in the south of Dublin, founded by Sir Patrick Dun, who bequeathed a large estate to it, and to other uses connected with the advancement of medical knowledge.

Surgery was long considered in Ireland, as well as in England, as a trade, the practitioners being included in the worshipful corporation of barber-surgeons. Nor was it till 1784 that a charter, founding a college of surgery, put the practice of that inestimable art on a basis enabling it to advance in a manner suited to the wants and character of a civilized nation. Still, indeed, so much of the antiquated prejudice prevails as to require, though not of necessity, the servitude of an apprenticeship for five years. The college, which was at first held in an obscure building near Mercer's Hospital, has been removed to an elegant range of buildings in St Stephen's Green, where lectures on all the most important branches are delivered, a museum, dissecting-room, and library kept up, and examinations held for the admission of practitioners. The large amount of fees on a diploma has, however, deterred many from taking advantage of this arrangement, and obliged them to have recourse to London, where the low rates of fees more than compensate for the trouble and expense of the journey thither.

The apothecaries also have some share in the completion of a medical education, by lectureships and examinations on chemistry and pharmacy at their hall in Mary Street. Their establishment consists of a governor, deputy-governor, treasurer, secretary, and thirteen directors.

There is in Dublin no classical school on a public foundation similar to the great grammar schools in London and Westminster; but the institutions for the literary instruction of the poor are numerous. According to the returns made in 1824–26, there were then nineteen parochial schools maintained partly by the incumbent and partly by subscriptions and charity sermons, eleven assisted by issues of public money through the Kildare Place Society, two assisted in a similar manner by the Association for discountenancing Vice, one by Erasmus Smith's bequest, two by the Charter School Society, and fifty-six by private contributions from charitable societies and individuals. The number of schools wholly maintained by the pupils' fees is 323, making the total number 412.

Hospitals or asylums for those reduced by age or other causes are also numerous, and liberally supported. The chief is the House of Industry, in North Brunswick Street, originally established in 1773, in the vain hope of abolishing mendicity. After an experience of forty-five years, it was found to be totally inadequate to attain its object, notwithstanding the great outlay in buildings, and the heavy annual charges for its maintenance. The buildings, therefore, instead of being, as before, open to mendicants of every description, now receive only the aged and disabled poor. The main edifice consists of a large square 265 feet by 230, attached to which are other ranges for workhouses, stores, and the like.

Lunatics are maintained in St Patrick's Hospital, founded by the celebrated Dean Swift, and conducted by governors appointed under its charter. The unhappy inmates have every indulgence compatible with their situation. The General Lunatic Asylum, erected near the House of Industry, and placed under the care of officers appointed by government, originally received patients from all parts of the country; but, under a late act of parliament, it has been limited to a district consisting of the counties of Dublin, Louth, Meath, and Wicklow, each of these contributing towards its expenses in proportion to the number of patients sent in. The number in 1831 was 239, of which 101 were males and 138 females. A lunatic department is also attached to the House of Industry, to which incurable and epileptic patients are periodically transferred from that just described. There were, in 1831, 470 patients in it, namely, 179 males and 291 females, of whom 105 males were employed, chiefly in gardening, and 152 females in occupations suitable to their sex, and conducive to the economy of the institution. They are well and economically supported. Cases requiring severe corporeal restraints are uncommon; and the whole institution, notwithstanding the limited extent of accommodation, is conducted in a manner highly creditable. Besides these public establishments for the recovery and safe custody of lunatics, five others are maintained by private resources; one near Donnybrook, called the Retreat, by the Society of Friends, and four others by medical practitioners for their own emolument.

The principal institution for the blind is Simpson's Hospital, founded by a merchant of Dublin, who had laboured under severe affections of the eyes, and under gout. The income is upwards of L.2500 per annum, by which fifty patients, either blind or gouty, are comfortably maintained, in a large plain edifice in the northern side of Dublin. The apartments can accommodate a hundred inmates. The Richmond National Institution in Sackville Street was founded in order to instruct the blind in some of the more useful handicraft occupations. The principal branches taught are weaving, netting, and basket-making. The number of inmates is about thirty-two, besides some externs, who, after having been taught, are allowed to work there, and to dispose of the produce of their industry for their own benefit. These two hospitals are for males only. The Molyneux Asylum, opened in Peter Street, in a large building which had been an amphitheatre for equestrian exhibitions, is confined to blind females, of whom those above the age of fifty have in it a permanent asylum, while those under that age are admitted to a temporary residence, until they can procure a permanent livelihood elsewhere. There are about twenty on the establishment; the building could accommodate fifty. The Retreat at Drumcondra was opened, and is supported, by some private individuals, to afford a temporary asylum to aged and indigent persons of respectability suffering under some sudden emergency. The Old Men's Asylum, near Mountjoy Square, accommodates twenty-four inmates, who must be at least sixty years old on admission, and Protestants; servants and retailers of spirituous liquors are specially excluded. The Vintners' Asylum, in Charlemont Street, affords a place of shelter for indigent persons of the last-named class. The Goldsmiths' Jubilee, founded in the jubilee year by members of that corporation, affords a similar place of shelter for reduced and superannuated artizans of the trade. An institution for the maintenance and education of children born deaf and dumb is maintained at Claremount, near Glasnevin. The plan of the Royal Hospital, for decayed and maimed soldiers, was first suggested by the Earl of Essex, when lord lieutenant, and was carried into effect through the repeated applications of the Duke of Ormond to Charles II. The site chosen for it had been the ancient priory of Kilmainham, founded by Strongbow for Knights Templars. Upon the extinction of that order, and the confiscation of its property, which was effected by a simultaneous and secret movement of all the crowned heads in Europe, this part of their possessions was transferred to the Knights of St John of Jerusalem, and it became an hospital for guests and strangers only, to the exclusion of the sick and maimed. On the dissolution of monasteries, it devolved to the crown, and so continued till applied to its present use by Charles II. The building, which is according to a plan of Sir Christopher Wren, is a square 306 feet by 288, three sides of which are dwelling-rooms, connected by covered corridors. The fourth contains the chapel, a venerable building, of limited size; the dining hall, in which the banners taken from the Spaniards at Gibraltar are suspended; and the apartments of the master, who is always the commander of the forces for the time being. Connected with the main building are several subordinate offices, a garden, and avenue bordered by rows of stately trees. The entrance from Dublin is through an embattled gateway on the south side of Barrack Bridge. The resident veterans wear the military costume of Charles II. Besides these, there is a great number of out-pensioners. The annual expenditure of the house is about L.20,000, that of the externs L.50,000. Of hospitals for reduced and aged women there are, 1. widows' alms houses; thirteen of these are of Protestant foundation, the principal one being for clergymen's widows, who are comfortably lodged and maintained in an asylum in Mercer Street; three are Roman Catholic, one Presbyterian, one Independent, one Moravian, and one Methodist: 2. an asylum for superannuated female servants, on Summer Hill: 3. two houses of refuge for young women of good character when out of service, one for Protestants, in Baggot Street, the other for Catholics, in Stanhope Street: 4. six female penitentiaries, four under the direction of Protestants, viz. the Magdalen Asylum, in Leeson Street, founded by Lady Arabella

Denny; the Female Penitentiary, on the North Circular Road; another under the same name on the South Circular Road, near Baggot Street, and the Lock Penitentiary, for the special reception of penitents from the Lock Hospital; two under the management of Catholics, viz. the General Asylum, in Townshend Street, and the asylum in Bow Street. This latter has something romantic connected with its origin. The founder, a merchant of the name of Dillon, had been exposed, when an infant, at the door of a bricklayer, who preserved him, and taught him his trade. On arriving at years of maturity, he was accosted, while returning homewards, by an unfortunate street-walker. Instead of yielding to her allurements, he persuaded her to relinquish her abandoned line of life, and engaged to provide her with the means of subsistence till a permanent asylum could be procured. While thus occupied he was recognised by his parents, and succeeded to a considerable estate, part of which he devoted to the endowment of this asylum. A penitentiary has also been opened on the South Circular Road, for females discharged from prison, until means of honest employment present themselves.

Among the asylums for destitute children, the Foundling Hospital was by much the most extensive. It was opened in 1730 for destitute children of every age, but afterwards limited to the reception of those under a year old, who are sent to nurse in the country until old enough to be instructed. When arrived at a suitable age, they are apprenticed. The institution was maintained partly by voluntary contributions, partly by a local tax on Dublin, but chiefly by large parliamentary grants, which have been gradually diminished for several years past, and restraints put on the admission of children. The average number of children admitted for twenty years up to 1825 was 2000. Dr Bell's system of education is adopted in the schools. The buildings, with large gardens attached to them, are situated in a healthy and elevated situation in the west of Dublin. The Blue Coat Hospital was originally intended as a place of refuge for all the poor in the city. This object being soon found impracticable, it was reduced to an asylum for aged citizens and their orphan sons, and ultimately confined to this last-named class. The buildings in Oxmantown originally covered a considerable space; and previously to the building of the parliament house in College Green the parliament held its sittings there. The present edifice is built nearly on the site of the former. It consists of an elegant centre, with detached wings, one used as a chapel. Of 120 boys it receives, fifty-eight are named by the corporation, fifty by the governors of Erasmus Smith's schools, ten by the Bishop of Meath as trustee to a bequest, and two by the incumbent of St Werburghs on a similar title. They are educated in the tenets of the Protestant church, and apprenticed to Protestant masters. The Hibernian Nursery in the Park supports and educates the children of soldiers. A preference is given to those whose fathers have been killed, or died on foreign stations. The buildings, which are spacious, have gardens and exercising ground attached to them; and the boys, in addition to the usual routine of scholastic instruction, are trained to the rudiments of military tactics. On the southern quay, near Ringsend, is the Hibernian Marine School, instituted for sailors' children. It consists of a centre building and two wings, the latter containing the school and chapel. The age of admission is six years, and the course of instruction nautical. At a proper age the pupils are placed in the royal navy, or apprenticed to merchants, who take them without fee. The number of boys was 180; but it has been contracted in consequence of the reduction of the parliamentary grant. The Bedford Asylum, for industrious children, is one of the existing branches of the House of Industry. It forms three sides of a square, and contains apartments for 390 children of both sexes, in which they are taught various kinds of useful works. The teachers are paid by a portion of the profits of the children's labour in lieu of salary. The principal establishment for female orphans is that on the North Circular Road, originating with two benevolent ladies, who formed an institution for maintaining female orphans under ten years old. The funds were soon considerably augmented by the exertions of the celebrated Dean Kirwan, whose appeals from the pulpit for several years brought in a large additional income. It is now supported by subscriptions, charity sermons, and a grant of public money. It can accommodate 160 children, who are educated for servants, and apprenticed at a proper age. The freemasons of Ireland formed an institution in 1797 for the support of female orphans of the craft. It supports about twenty children. In Pleasants' Asylum twenty female Protestant children are maintained and educated; and, when of age, receive a handsome portion on marrying conformably with the rules laid down in the founder's will. Most of the places of religious worship have attached to them schools, in which a certain number of the destitute children of the parishioners, chiefly orphans, are maintained by the contributions of the benevolent part of the congregation.

The progress of disease is combated, and the sufferings from accidental injuries assuaged, by means of numerous infirmaries and dispensaries. Of the former, the most extensive of those which take in cases of all kinds, surgical and medical, is Stevens' Hospital. It was founded by the bequest of a physician whose name it bears, and erected by his sister, who having been left a life interest in the property previously to its being applied to its final purpose, immediately devoted the greater part of it to fulfil her brother's intentions, reserving to herself only L.120 per annum, and apartments in the hospital. In addition to the original estate, and to other contributions and bequests, it receives a grant of public money; through all which means, its income, amounting to L.2200 per annum, supports about 200 beds. The Meath Hospital, originally built on the Coombe, for the benefit of the liberties of Dublin, and afterwards converted into a county hospital by act of parliament, has been transferred from its former confined and low situation to another in the outlets, where a large building was erected for it, chiefly through the munificence of Mr Thomas Pleasants, who contributed L.6000 towards its building and maintenance. Its annual income exceeds L.1000. The medical officers at first received salaries of L.100 each, which they have resigned for the benefit of the institution. The hospital on the Coombe, after having been closed for some time, has been restored to its former purpose by voluntary subscriptions. The Charitable Infirmary, in Jarvis Street, the oldest in Dublin, and opened at first in Cook Street by the contributions and exertions of a few gentlemen of the medical profession, was transferred to its present situation in 1792. It is capable of accommodating fifty patients, but the state of its funds seldom admits of more than thirty. The Royal Military Infirmary in the Phœnix Park, near its entrance, is a general infirmary for the army. The edifice, though plain, is much admired for the elegance of its proportions. The interior is provided with everything requisite for such an institution. The total annual expense of each patient is estimated at L.33, which is defrayed by a public grant, and by stoppages of the soldiers' pay while in hospital. Sir Patrick Dun's Hospital is appropriated exclusively to medical cases, for the instruction of the pupils attending the professors of the College of Physicians. The Richmond Hospital, a part of the House of Industry, and Mercer's Hospital, founded by a benevolent lady of that name in Stephen Street, on the site of the decayed hospital of St Stephen, are set apart for surgical cases and accidents. There are three fever hospitals. The House of Recovery in Cork Street, the first and largest, supported by subscriptions and public money, has contributed to check considerably the progress of low fever prevalent among the ill-fed artizans and paupers in that district. Its beneficial effects led to the opening of a second in the north of Dublin, on a smaller scale, called the Whitworth Hospital; the third, the Hardwick Hospital, is another of the appendages of the House of Industry. The Lock Hospital was opened in Townshend Street in 1792, for the reception of venereal patients of both sexes; but in 1820 male patients were excluded, and it has been ever since confined to females. The number of beds, originally 300, is now reduced to half that number. The building, of plain granite, consists of a centre containing apartments for the officers, and two wings in which are the patients' wards. It is wholly under the control of a board appointed by the lord lieutenant.

The formation of dispensaries is encouraged by a special act of parliament authorizing grand juries to present in aid of them a sum equal to that subscribed by individuals. Most of the infirmaries in Dublin have dispensaries attached to them, besides which there are several unattached. St Mary's and St Thomas's was the first established; the next in importance is the Dublin General Dispensary. The Meath Dispensary has connected with it a department for supplying food, from a conviction that much of the disease incident to the poor arises from or is augmented by unwholesome or deficient nutriment. A vaccine establishment is carried on extensively in Sackville Street; and a second, connected with a dispensary for the infant poor, in Clarendon Street; their efficacy is more highly appreciated every year. There are also several minor district or parochial dispensaries in various situations, for particular complaints.

The most remarkable charitable institution among those which do not undertake to supply lodging as well as maintenance, is the Mendicity Association, formed in 1818, and since supported solely by voluntary contributions. It originated in a well-founded conviction of the inefficacy of the attempt to prevent the practice of street-begging in Dublin, through the medium of the House of Industry, from which it differs in two important points; the one, in declining to provide the poor with lodging, but merely with food, and in obliging them to procure the means of lodging and clothing themselves by their own labour, for the exertion of which the society procures the means; the other, its total dependence on voluntary contributions, to the utter rejection of grants of public money. The manager's committee publishes annual reports, which show that, though it has been more than once on the eve of dissolution through want of pecuniary resources, it still continues to exist in vigour sufficient to diminish considerably, though not wholly to suppress, the custom of street-begging. The Sick and Indigent Room Keepers' Society originated in an effort made in 1790, by a few householders in the neighbourhood of Corn-market, to provide for the most urgent necessities of the poor in their neighbourhood, by affording a temporary weekly stipend in money for their lodging and maintenance. It has since extended itself throughout the whole city, and is managed by four committees for its four divisions, who hold a joint meeting every month to receive reports and issue grants. The Strangers' Friend Society somewhat resembles that just described, but is more particularly directed to the relief of strangers reduced to want during their temporary sojourn in the city. It was set on foot, and is chiefly supported, by the Methodists. The Charitable Association has for its object the relief of all paupers not street beggars, and the procuring of work for the industrious poor. Another society, confined to the latter object alone, and established by the Society of Friends, meets at the House of Refuge in Dorset Street. The Dorset Institution in Abbey provides suitable work for industrious females; children are also taught in it to plait straw; and a wareroom is opened, in which wearing apparel, made up by the poor employed, is sold at reduced prices. The Debtors' Friend Society is formed for the release of debtors confined for sums under L.5, and not contracted for spirituous liquors, or for other improper purposes. The Musical Fund, for the special relief of distressed musicians, was formed from the profits of concerts, and is supported by the annual subscriptions of the members, who have thereby a right to its benefits under certain restrictions. The Literary Teachers' Society has the same object with respect to members of their own profession, by whom also it is chiefly supported. There are two associations for lending small sums to poor tradesmen, payable by instalments without interest; the one, the Meath Charitable Society, and the other, the Charitable Loan. They meet monthly in the vestry rooms of St Catherine's and St Anne's parishes. The system of Savings' Banks was introduced into the city by an association, which had influence enough to procure an act of parliament, establishing them on provisions adapted to the country. The principal bank is in School Street, which now has several branch banks in various parts of the city. Another was afterwards opened in St Peter's parish; but after continuing some time, its affairs fell into confusion, from which it is now endeavouring, it is hoped successfully, to extricate them.

Most of the religious societies spring from kindred sources in England. The chief among them is the Hibernian Bible Society, founded in 1807, and which has now a fine establishment in Sackville Street. Several minor societies for the distribution of the Bible, and differing from one another chiefly as to the channel into which their labours should be directed, have arisen from it, some detached, others auxiliaries or branches of the parent association. The Irish Society was formed for promoting the religious instruction of the Irish through the medium of their own language, by publishing Bibles, Testaments, tracts, and rudimental books in that tongue, and by sending itinerant teachers through the country for their instruction. The names of the Church Missionary, the Tartarian Missionary, and the Methodist Missionary Societies, announce the origin and objects of each. The Jews' Society undertakes the conversion of that nation to the Christian faith. The Religious Tract Society has an extensive store and sale-room in Sackville Street. The Continental Society professes generally to promote religious knowledge and sentiments throughout Europe.

Scientific and literary societies are few. The Royal Dublin Society is foremost in seniority and importance. It owes its origin to some literary characters, who in 1731 formed an association for scientific purposes. In 1749 it was incorporated by charter, and received an annual parliamentary grant of L.500, which was gradually augmented until it amounted to L.10,000, but latterly it has been reduced to L.7000. It embraces a variety of objects. The encouragement of agriculture and rural economy is attempted by shows of cattle, and by botanical lectures, for which the society maintains a fine garden near Glasnevin, containing upwards of twenty acres. The study of mineralogy is promoted by a professorship, and a museum classed according to the Wernerian system. It contains the Leskean collection, which is peculiarly rich in shells, butterflies, beetles, and reptiles. Lectures are also delivered by professors of chemistry and natural philosophy.

The professorships of mining and the veterinary art have been discontinued. A drawing school is established, in which pupils of promising talents are instructed gratuitously in landscape, figure drawing, architecture, and modelling, and premiums are periodically awarded. The society is also provided with a good library, containing upwards of 12,000 volumes. It is particularly rich in works on botany, and in those relating to Ireland. It has likewise a gallery of statuary, in which are casts from the Elgin marbles. The museum and gallery are open to the public on particular days. The members, who are admitted by ballot, on payment of an admission fee of L.30, which covers all subsequent expenses, have the exclusive advantage of the library, and of a reading-room well supplied with newspapers and periodicals. By a late bye-law, annual members are admissible to most of the advantages of the society on payment of a subscription of three guineas. The society held its meetings in Shaw's Court until 1767, when it removed to Grafton Street, and thence in 1796 to a building erected for it in Hawkins Street. It 1815 it purchased the splendid museum and grounds of the Duke of Leinster in Kildare Street, where it still continues. The Farming Society was formed in 1800, and incorporated in 1815. It was maintained by grants of public money; but as the results were ultimately found not to be commensurate with the expenditure, the grants have been withdrawn, and the society has sunk into non-existence. The Kirwanian Society, which takes its name from the celebrated chemist and mineralogist, was formed in 1812 for the advancement of chemistry, mineralogy, and natural history. It is supported wholly by individual subscription. The Zoological Society, formed in 1830, on the model of those in Dublin, has a garden on land granted to it by the lord lieutenant in the Phœnix Park, in which it has already collected an assemblage of living animals, which makes it an object of general attraction to the citizens of Dublin. It is supported by subscriptions, and by the money paid by the public for admission. The Royal Irish Academy was instituted by patent in 1786, to promote the study of polite literature, science, and antiquities. Its formation was chiefly owing to the exertions of its president, the first Earl of Charlemont. It holds its meetings in Grafton Street, where it has a small library containing some valuable manuscripts, and occasionally publishes a volume of transactions. This society receives an annual parliamentary grant of L.300. Several fruitless attempts have been made to excite a taste for Irish antiquities and literature, by societies under the names of the Gaelic, the Hiberno-Celtic, and the Archæologian. Each has successively failed, but not until the two first named had sent forth some publications connected with the objects of their formation. The Dublin Institution, formed in 1811, in imitation of the London Institution for literary and scientific purposes, collected a literary and philosophical apparatus for the use of its members by means of a capital of L.1500 raised in L.50 shares. The society has been virtually dissolved this year (1833), by the sale of its books, and the announcement of its intention of disposing of its mansion in Sackville Street, on which a considerable sum had been expended for a lecture room and laboratory.

Several attempts have been made to excite a taste for the fine arts in Dublin. In 1764 an association of artists erected a neat building in William Street for their meetings, and for the exhibition of their works; but the profits of the scheme did not cover their expenses, and the building was consequently offered for sale, and purchased by the corporation of Dublin as an assembly-house. Exhibitions of pictures by native artists were afterwards opened in Hawkins Street, under the patronage of the Dublin Society. On their discontinuance there, in consequence of the society's removal to Leinster House, which afforded no suitable room for it, the artists attempted their revival in the Royal Arcade in 1821, but without success. These failures are attributable not merely to the indifference of the public to the subject, but to dissensions among the artists themselves. The want of a permanent place of exhibition has at length been supplied by the liberality of Mr Francis Johnston, an architect to whom Dublin is indebted for several of its modern buildings, particularly the new Castle Chapel. He built an elegant and appropriate structure, at an expense of L.10,000, which, when finished, he presented to the Society of Artists. Their exhibitions have been held in it since its opening in 1825. The society was incorporated in 1823. The progress of the arts has been still further promoted by an association of noblemen and gentlemen, who, under the name of the Royal Irish Association, have erected a building near College Green, in which an annual exhibition of pictures of the old masters, sent in for the occasion by their owners, is held, and premiums are occasionally offered to excite emulation among the young artists. This association also defrayed the expenses of procuring the patent for the Irish artists' charter, amounting to L.350.

The principal library in Dublin for the number and value of its books is that of Trinity College. It is open of right only to such graduates of that university as take a strict oath relative to their conduct while in it, and to their treatment of its contents. Admission by special favour is attainable, but with some difficulty. The King's Inns Library is next in value. The right of reading in it is confined to the members of the King's Inns Society; that is, to barristers, attorneys, and law students. Each of these libraries is well supplied with modern English publications, in consequence of the right conferred on them by act of parliament, of receiving a copy of every new publication. Marsh's Library, attached to St Patrick's Cathedral by the munificent bequest of an archbishop of Dublin of that name, contains a good collection of old books, and is open to the public on liberal terms; but, from the very small portion of its funds appropriated to the purchase of books, it is very deficient in modern publications. It possesses some valuable manuscripts. Stevens' Hospital, the Royal Hospital, Sir Patrick Dun's Hospital, and the College of Surgeons, have each a small library attached to it, chiefly of medical books, for the use of the practitioners. The want of a public library easily accessible, and provided with the works most in request, was attempted to be supplied by a society, which, having been formed in 1791, has collected a large number of books in a handsome and well-arranged building, raised for their reception in Dolier Street. Attached to it is a fine reading-room, well supplied with newspapers. But as the fund, arising solely from annual subscriptions, is not sufficient to stock the library with new publications, and to furnish a sufficient assortment of newspapers, the former of these demands has been made subordinate to the latter, and the library consequently impoverished. The other public reading-rooms are that in the Commercial Buildings, to which members are admitted by ballot and the payment of an annual subscription; and the Northumberland Reading-room, opened by the proprietor of an hotel near the Custom House as a pecuniary speculation.

Dublin owes its commercial rank chiefly to its political position as the metropolis of Ireland, and to its being the main pivot of communication with England. The natural impediments to the entrance of large vessels into the river, combined with the dangerous navigation of the bay, present serious checks to the ardour of mercantile speculation. The want of a communication with the interior by water is but imperfectly supplied by the two lines of inland navigation proceeding from it. A particular account of these must be postponed to its appropriate place in the general account of Ireland. As far as Dublin is concerned, they are mainly serviceable in conveying to it bulky articles, such as stone, bricks, potatoes, grain, and turf. The increase of commercial transactions occasioned by a long continuance of domestic tranquillity after the revolution of 1688, excited a desire among the merchants to have a suitable place for transacting their public business with one another, and consequently the foundations of the Royal Exchange were in 1769 laid on Cork Hill, and the building was opened in ten years after, at an expense of L.40,000, procured by subscriptions, lotteries, and grants of public money. It is one of the most admired structures in Dublin. Its principal front consists of a Corinthian portico of six pillars. The interior is chiefly occupied by a magnificent circular hall lighted from above, with which several smaller apartments are connected. The progress of civic improvements already noticed gradually threw this fine building out of the more convenient channels of business. A more central position for mercantile transactions presented itself in College Green. Thither therefore the sagacity of speculation was directed, and a new building has been raised, principally by L.50 shares, with more numerous and suitable accommodations, under the name of the Commercial Buildings. The value of the Royal Exchange has consequently diminished. It is now little used except for public meetings, for which the reverberation of the voice from its lofty dome, and the intercolumniations of the great hall, render it unfit. It is also a depository for the statues of celebrated characters, and has in it those of George III., Henry Grattan, and Doctor Lucas. The Commercial Buildings form a small square of simple architecture fronting College Green. They contain a large saloon occupied as a news-room, and a number of offices for merchants and brokers, together with an hotel and coffee-house. In order still further to promote the commercial interests of Dublin, an association was formed about thirty years ago, under the name of the Chamber of Commerce; but it soon died away. The idea was revived in 1820, when a number of merchants formed themselves into a society under the same name, which still exists. Its objects are the protection and promotion of the manufacturing and commercial interests of Dublin, and of the country in general. The business is transacted by a council, which is instructed to communicate with the officers of government on the subjects of the association. Their office is held in the Commercial Buildings. The Ouzel Galley is another voluntary association of merchants, for determining commercial differences by arbitration. It takes its name from that of a vessel, which was the occasion of a complicated and protracted suit, that was ultimately adjusted in an amicable manner by the interference of some of the most respectable merchants in Dublin. The effect of steam-navigation on the cross-channel trade has produced a great alteration in the state of commerce in Dublin. Most of the business formerly transacted through the merchants of this city is now carried on by letter with the English broker, and not unfrequently by a personal visit to the trading and manufacturing towns in England, to which access is obtained with extraordinary expedition and cheapness, by the steamers, and by the peculiar facilities for travelling which that country affords.

The Bank of Ireland was formed in 1783, in order to give security to commerce. It was opened at first in some old houses in Mary's Abbey, with a capital of L.600,000, which was afterwards increased to L.3,000,000. In the year 1802 the parliament-house was purchased by the directors, and adapted to its present destination. This edifice was erected in 1729; and notwithstanding the changes made in it since it was diverted from its original purpose, the exterior has been but little altered. It consists of three fronts. The principal, towards College Green, a colonnade of the Ionic order, formed of a façade and two projecting wings, is much admired for the noble simplicity of its elevation. The western front, a portico of four Ionic columns, was connected with the other by a colonnade of the same order, forming the quadrant of a circle. The eastern front, which was the entrance of the House of Lords, was, by their special order, a colonnade of the Corinthian order, which the architect found great difficulty in uniting with the other parts. The apartment for the Lords, a fine room, was hung with tapestry. That of the Commons having been burned in 1792, whether by accident or design has never been fully ascertained, was reconstructed after a more elegant design, in the form of a circle surrounded by pillars, between which was a gallery for hearers. This fine hall was taken down by the bank directors, and converted into a square room, now the cash-office. The bank possesses a very curious and complicated system of machinery, worked by steam, for printing the notes, whereby the number struck off can be ascertained at any moment without the chance of error. It has also an armory, containing small arms for all the clerks and servants, who were formed into a corps in 1798 and 1803. The building is still further secured from assault by embrasures and loopholes concealed in the walls. Tanks of great magnitude, and powerful forcing pumps, have been provided for guarding against casualties by fire. The private banking houses are those of Latouche and Company, which transacts the Dublin part of the business of the provincial bank, the Hibernian, Shaw's, and Ball's.

The silk, woollen, and cotton manufactures, have been carried on in Dublin. The first was introduced by some French refugees on the revolution of the edict of Nantz. It employed a number of hands, until the alteration in the duties in 1815 gave it a blow from which it has never recovered. It is now nearly extinct. The article most in demand was a mixed fabric of silk and worsted, called tabinet, or Irish poplin. The woollen manufacture gave employment for many years to the greater part of the population of the liberties. Their hall on the Coombe is embellished with a statue of George II. The process of tentering the cloth was long performed in the open air; but as the broken weather to which the country is subject frequently interrupted this part of the manufacture, or compelled the workmen to have recourse to public houses to dry their webs, Mr Thomas Pleasants, whose name has been already more than once mentioned as a most munificent contributor to the benevolent institutions, erected a tenter-house in Cork Street, at an expense of L.13,000. This branch is also rapidly declining. The cotton trade has always been carried on to some extent in Dublin since its introduction into Ireland, but there is no public building especially connected with it. The board of trustees for the linen manufacture at first met in a room on Cork Hill, afterwards in an apartment in the castle, and ultimately in buildings erected for the promotion of the manufacture in the north of the city. These buildings occupy nearly three acres, and consist of six courts, surrounded by stores communicating by piazzas and galleries. Part is used as a yarn hall. The trustees, who were nominated from among the leading personages in each of the four professions, were entrusted with the distribution of a large sum for premiums and other expenses. The board has been dissolved; but the buildings are still kept up as warerooms and stores, under the care of a chamberlain.

Dublin.

The Corn-Exchange was built to obviate the inconveniences felt from the want of a well-situated mart. A charter was obtained in 1817, and a fund raised by shares, with which a large hall has been erected on Burgh Quay, in which grain is sold by sample. Attached to it are buildings intended for an hotel, and hall for public meetings, which latter was used as such by the Catholic Association, and since by the National Political Union.

There are few cities in which the pleasures of domestic society are more indulged in than in Dublin. A spirit of sociability pervades all ranks. One consequence of this peculiar feature is a disregard of public amusements. In Queen Elizabeth's time plays were performed in the ball-room of the castle by the nobility and gentry. In 1635 Lord Strafford erected a theatre in Werburgh Street, for which Shirley wrote. It was closed in 1641. After the restoration a new theatre was opened in Orange Street, now Smock Alley, under the former patent. In 1733 there were three theatres; one in Bainsford Street, in the liberty of Thomascourt; another in George's Lane; and the third in Smock Alley. In 1745 Mr Sheridan had a theatre in Aungier Street, which was destroyed in a riot in 1754. Smock Alley still continued open; and in 1758 another was opened in Crow Street, after which both continued, until, after a violent struggle for twenty-five years, the former was given up. On the expiration of the patent, about 1820, the new patentee, not being able to procure the building in Crow Street on what he deemed reasonable terms, purchased the Dublin Society's premises in Hawkins Street, then used as the Mendicity Asylum, on which a large and elegant theatre has been constructed; but it is not well attended, unless during the extraordinary excitement of first-rate performers, particularly singers. A building called the Arena, set up in Abbey Street for equestrian performances, after having been closed for some years, was taken as their place of meeting by the Dublin Trades Political Union. Shortly after the opening of the Lying-Inn Hospital, an adjoining suite of rooms was splendidly fitted up for balls, concerts, and assemblies. The principal is a circular hall eighty feet in diameter, called the Rotunda; the others, of smaller dimensions, are used as music and supper-rooms. They communicate with the interior of Rutland Square, and were originally thrown open on Sunday evenings as a place of relaxation, where the respectable part of society met together to walk, to look at one another, and to take refreshments. These promenades, as they were called, were ultimately put down by the interference of the clergy. The rooms have since been used for concerts, public meetings, particularly of religious societies, and latterly for auction rooms. The gardens are opened two evenings in every week, and lighted with illuminated lamps, during the summer season. Military bands attend, and rope-dancers and tumblers occasionally exhibit. The attractions thus held out have been found sufficient to draw together occasionally a large concourse of company. The profits arising from the trifle paid for admission are applied to the use of the hospital.

The town residence of the Marquis of Waterford, in Marlborough Street, and that of the Earl of Charlemont, in Rutland Square, are fine buildings. The latter contains a large and choice library, particularly rich in continental literature, some fine antiques and statues, and a good collection of pictures.

Steam navigation has considerably augmented the concourse of strangers to Dublin, and consequently increased the number of hotels, and improved their management. The Commercial Hotel, on Usher's Quay, which forms part of a large pile of buildings, intended for a mart for native manufactures, is remarkable for a colonnade in front; and Gresham's, in Sackville Street, is a splendid and well-appointed concern.

There are but two public monuments worthy of particular notice,—Nelson's pillar in the centre of Sackville Street, which is 108 feet high, surmounted by a colossal statue of Nelson, and raised at an expense of L.6856; and the Wellington memorial in the Phœnix Park, near its entrance, a stupendous obelisk 205 feet in height, and not yet finished.

At the north-western extremity of the city, the Phœnix Park, an inclosure containing about 1000 acres, belonging to the crown, is thrown open for the recreation of the citizens. Reviews of the garrison also take place in it. It contains the lord lieutenant's lodge, and the residences of some of the public officers. The name is derived from one of the town-lands, of which it is formed. The communications from Dublin to the interior are maintained by the mail coaches, thirteen of which leave the city every day; and by numerous stage-coaches, caravans, and public jaunting cars. These latter vehicles also afford a convenient and economical, though by no means elegant, mode of conveyance to visit the picturesque and romantic scenery that on all sides embellishes the outlets of this beautiful city. Dublin is situated in long. 6. 21. W. and lat. 53. 23. N., and is distant from London 300 miles in a direct line, 339 miles by Holyhead, and 350 by Liverpool in a direction nearly west-north-west.

DUBNO, a circle in the Russian province of Volhynia. It is bounded on the north-west by Luzk, on the north-east by Rowno, on the east by Ostrog, on the south by Kremenez, and on the south-west by Austrian Galicia. It is the most fertile part of the rich province to which it belongs, is watered by the Slyr, and yields abundant crops of wheat, flax, tobacco, and rye. The capital, of the same name, is situated on the river Irwa. It is a large ill-built town, chiefly consisting of wooden houses, with crooked and ill-paved streets, and contains 5650 inhabitants, a great proportion of whom are Jews. Long. 25. 35. E. Lat. 50. 26. N.

DUBOI, a town of Hindustan, in the province of Gujerat and district of Chumpaneer, situated in a low and marshy situation. Here are the remains of a Hindu city of great antiquity. The fortifications which surround it are nearly three miles in circumference. It is forty miles north-east from Broach. Long. 73. 35. E. Lat. 22. 4. N.

DUBOS, JEAN-BAPTISTE, an eminent French author, was born at Beauvais in December 1670. At first he applied himself to theology, but soon renounced this pursuit for the study of public law, and of the political interests of Europe. M. de Torcy, when minister of foreign affairs, employed him with advantage in several secret negociations; and both the regent and Cardinal Dubos made the same use of his talents, with the same success. Having retired from the field of politics, he entered upon that of history and literature; and, in 1720, his works opened to him the doors of the French academy, of which, in 1722, he was appointed perpetual secretary, in the room of M. Dacier. He died at Paris on the 23d of March 1742, at the age of seventy-two, repeating as he expired the well-known remark of an ancient, "Death is a law, not a punishment." According to Dubos, "there are three things which ought to console us for parting with life; the friends whom we have lost, the few persons worthy of being loved whom we leave behind, and lastly, the recollection of our follies, with the certainty that we shall commit no more." His first work was *L'Histoire des quatre Gordiens, prouvée et illustrée par des Médailles*, Paris, 1695, 12mo. The common opinion, which only admits three emperors of this name, has prevailed in spite of all the efforts of his erudition and criticism. About the commencement of the war of 1701, being charged with different negociations both in Holland and in England, in order if possible to engage these powers to adopt a pacific line of policy, he, in order to promote the objects of his mission, published a work entitled *Les Intérêts de l'Angleterre mal entendus dans la Guerre présente*, Amsterdam, 1703, 12mo. But as this work contained indiscreet disclosures, of which the enemy took advantage, and predictions which were not fulfilled, a wag took occasion to remark that the title ought to be read thus: *Les Intérêts de l'Angleterre mal entendus par l'Abbé Dubos.* His next work was *L'Histoire de la Ligue de Cambray*, Paris, 1709, 1728, and 1785, 2 vols. 12mo. This history, says Voltaire, is profound, political, interesting; it makes us acquainted with the manners and usages of the time, and is a model of its kind. In 1734 he published his *Histoire Critique de l'établissement de la Monarchie Française dans les Gaules*, 3 vols. 4to; a work the object of which was to prove that the Francs had entered the Gauls, not as conquerors, but at the request of the nation, which, according to him, had called them in to govern it. But this system, though unfolded with a degree of skill and ability which at first procured it many zealous partizans, was victoriously refuted by Montesquieu at the end of the thirtieth book of the *Esprit des Lois.* "C'est un colosse," said Montesquieu, "qui a de pieds d'argile, et c'est parce que les pieds sont d'argile que le colosse est immense. Si le système de M. l'Abbé Dubos avait eu de bons fondemens, il n'aurait pas été obligé de faire trois mortels volumes pour le prouver; il aurait tout trouvé dans son sujet; et sans aller chercher de toutes parts ce qui en était très loin, la raison elle-même se serait chargée de placer cette vérité dans la chaîne des autres vérités. L'histoire et nos lois lui auraient dit: 'Ne prenez pas tant de peine; nous rendrons témoignage de vous.'" His *Réflexions critiques sur la Poésie et sur la Peinture*, published for the first time in 1719, 2 vols. 12mo, but often reprinted in three volumes, constitute one of the works in which the theory of the arts is explained with the utmost sagacity and discrimination. "All artists," says Voltaire, "read it with advantage. It is the most useful book which has ever been written on the subjects of which it treats, in any nation of Europe. The excellence of the work consists in this, that it contains few errors, and many reflections which are just, novel, and profound. It is not a methodical book; but the author thinks, and makes others think. He was, however, ignorant of music; he had never been able to make verses, and he had not a single picture in his possession; but he had read, seen, heard, and reflected much." Besides the works above enumerated, a manifesto of Maximilian, elector of Bavaria, against Leopold, emperor of Germany, relative to the succession in Spain, has been attributed to Dubos, chiefly, we believe, by reason of the excellence of the style, which has been greatly commended. (A.)

DUBRIS, in *Ancient Geography*, a town of Britain; now *Dover*, from *Dovoria* of the lower age, and a port-town in Kent, opposite to Calais.

DUCAL, in general, something belonging to a duke. See Duke.

The letters patent granted by the senate of Venice were called *ducal*; and so also were the letters written in the name of the senate to foreign princes. The denomination of ducal is derived from the circumstance that, at the beginning of such patents, the name of the duke or doge was written in capitals. The date of ducals is usually in Latin, but the body is in Italian. In 1716 a courier was dispatched with a ducal to the emperor, returning him thanks for renewing the treaty of alliance with the republic of Venice, against the Turks.

DUCAS, a learned Greek, who wrote a history of what passed under the last emperors of Constantinople, until the capture of that city, and the fall of the eastern empire. This work, which is esteemed, was printed at the Louvre in 1649, with the Latin translation and notes of Boillaud.

DUCAT, a foreign coin, either of gold or silver, struck in the dominions of a duke. The origin of ducats is referred to one Longinus, governor of Italy, who, revolting against the emperor Justin the Younger, made himself duke of Ravenna, and called himself *Exarcha*, that is, *without lord or ruler*; and, in order to show his independence, struck pieces of money of very pure gold in his own name, and with his own stamp, which, as Procopius relates, were called *ducati*, ducats. After him, the first who struck ducats were the Venetians, who called them *zecchini*, or *sequins*, from Zecca, the place where they were first struck. This was about the year 1280, and in the time of John Dandolo. But we have pretty good evidence that Roger king of Sicily had coined ducats as early as 1240; and Du Cange scruples not to affirm that the first ducats were struck in the duchy of Apulia in Calabria. See Money.

DUCATOON, a silver coin, struck chiefly in Italy, particularly at Milan, Venice, Florence, Genoa, Lucca, Mantua, and Parma, though there are also Dutch and Flemish ducatoons. See Money.

DUCENARIUS, in *Antiquity*, an officer in the Roman army, who had the command of two thousand men. The emperors had also ducenarii among their procurators or intendants, called *procuratores ducenarii.* Some say that Ducenarii were those whose salary was two hundred sesterces; as in the games of the circus, horses hired for two hundred sesterces were called *ducenarii.* Others hold that ducenarii were those who levied the two hundredth penny, or the officers appointed to inspect the raising of that tribute. In the inscriptions at Palmyra, the word *ducenarius*, in Greek δουκεναριος, occurs very frequently.

DUCENTESIMA, in *Antiquity*, a tax of the two hundredth penny, exacted by the Romans.

DUCHAL, James, D. D. a pious and learned dissenting minister, was born in Ireland, and finished his studies at the university of Glasgow, which afterwards, from a regard to his merit, conferred on him the degree of doctor of divinity. He resided ten or eleven years at Cambridge as the pastor of a small congregation, and there enjoyed his beloved retirement, with the advantage of books and of learned conversation, which he improved with the greatest diligence. On Mr Abernethy's removal from Antrim he succeeded him there, and on that gentleman's death he again succeeded him as a minister of a dissenting meeting-house in Wood Street, Dublin. In this situation he continued till his death, which happened on the 4th of May 1761, when he had completed his sixty-fourth year. He published a volume of excellent discourses on the presumptive arguments in favour of the Christian religion, together with many occasional tracts; and after his death a number of his sermons were published, in three volumes 8vo.

DUCHENPARAH, a town of Cashmere, the capital of a district of the same name, situated at the foot of a ridge of high mountains which bound Cashmere on the side of Great Thibet. Long. 74. 58. E. Lat. 34. 51. N. The district is situated between the thirty-fourth and thirty-fifth degrees of north latitude.

DUCHOWTSCHINA, a circle in the Russian government of Smolensko, north-east from the city, well watered and cultivated. The capital, of the same name, is situated on two rivers, the Ehewistitza and the Zarrewitza, which here join. The inhabitants amount to 950 only.

DUCHY, in *Geography*, an appellation given to the dominions of a duke.

DUCHY *Court*, a court where all matters belonging to the duchy or county palatine of Lancaster are decided by decree of the chancellor of that court. The origin of this court was in the time of Henry IV. who obtained the crown by the deposition of Richard II. and having taken the duchy of Lancaster by descent, in right of his mother, became seised thereof as king, not as duke; so that all the liberties, franchises, and jurisdictions of the said county passed from the king by his great seal, and not by livery or attornment, as the earldom of March, and other possessions, which descended to him by other ancestors than the king's did. Henry IV. by authority of parliament, dissevered the possessions, liberties, &c. of the said duchy from the crown, but Edward IV. restored them to their former nature. The officers belonging to this court are, a chancellor, attorney-general, receiver-general, clerk of the court, and messenger, besides the assistants, such as an attorney in the exchequer, another in chancery, and four counsellors.

DUCK. See ORNITHOLOGY.

DUCK, *Stephen*, originally a common thrasher in a barn, was born about the beginning of the eighteenth century. By his poetical talents he first attracted the notice of some gentlemen at Oxford; and having been recommended to Queen Caroline, he, under her patronage, took orders, and was preferred to the living of Byfleet in Surrey. Swift, who, one would have thought, might have overlooked such an object as Duck, but whose splenetic humour prompted him to be satirical for any reason or none, chose to feel piqued at the generosity displayed by the queen, and under the influence of this feeling wrote the following bitter Epigram "on Stephen Duck the thresher and favourite poet:"

> The thresher Duck could o'er the queen prevail;
> The proverb says, "No fence against a flail."
> From threshing corn he turns to thresh his brains,
> For which her majesty allows him grains.
> Though 'tis confess'd that those who ever saw
> His poems, think them all not worth a straw.
> Thrice happy Duck, employ'd in threshing stubble!
> Thy toil is lessened, and thy profits double.

Duck's abilities, however, were much more conspicuous in his primitive station than in his advancement, though it is said he was not disliked as a preacher. At length, having fallen into a low-spirited melancholy way, probably owing to his change of life, and the cessation of his usual labour, he in a fit of insanity threw himself from a bridge near Reading, into the Thames, and was drowned. This unhappy accident occurred in the year 1756.

DUCKING, plunging in water, a diversion anciently practised among the Goths by way of exercise; but among the Celts, Franks, and ancient Germans, it was a sort of punishment for persons of scandalous lives.

DUCKINSHAHABAZPOOR, a large island of Hindustan, in the province of Bengal, situated at the junction of the great river Meyna with the sea, thirty miles in length by fifteen in average breadth. It lies low, and during the rains is almost wholly submerged.

DUCKUP, at sea, is a term used by the steersman when the mainsail, foresail, or spritsail hinders his seeing to steer by a landmark; upon which he calls out, *Duckup the clew-lines of these sails*, that is, haul the sails out of the way.

DUCLOS, CHARLES PINEAU, a French author of some celebrity, was born at Dinant, in Bretagne, in the year 1704. At an early age he was sent to study at Paris. The imprudence of youth, and his love of pleasure, led him at first to contract certain intimacies which were little suited to his circumstances; but having afterwards disengaged himself from these, he courted the society of all the wits of his time, by whom he was well received. He became a member of that club, or association of young men, who published their juvenile productions under the titles of *Récueil de ces Messieurs, Etrennes de la St Jean, Œufs de Paques*, &c. The romance of *Acajou and Zirphile*, which was composed after a series of plates which had been engraved for another work, was one of the fruits of this association, and was produced in consequence of a sort of wager amongst its members. The epistolary dedication to the public, which was prefixed to this trifle, gave umbrage to some, in consequence of the flippant tone which the author assumed. Duclos had previously written two other romances, which were more favourably received: *The Baroness de Luz*, and the *Confessions of the Count de* ***. His first serious publication was the *History of Louis XI.* The style of this work is dry and epigrammatical, but the author has displayed in it considerable powers of research, and preserved the character of an impartial historian. The reputation of Duclos as an author was confirmed by the publication of his *Considérations sur les Mœurs*, a work which is much praised by Laharpe, and not without justice; for although the style, as in most of the writings of this author, is rather stiff and sententious, the book undoubtedly contains a great deal of just and ingenious reflection. It was translated both into English and German. The *Mémoires pour servir à l'Histoire du dix-huitième Siècle*, which were intended by the author as a sort of sequel to the preceding work, are nevertheless much inferior both in respect of style and matter, and are, in reality, little better than a kind of romance. In consequence of his *History of Louis XI.* he was appointed historiographer of France, when that place became vacant on Voltaire's retirement to Prussia. His *Secret Memoirs of the Reign of Louis XIV. and Louis XV.* and his *Considerations on Italy*, were not published until after the revolution. The former work is highly spoken of by Chamfort.

Duclos became a member of the Academy of Inscriptions in 1739, and of the French Academy in 1747. Of the latter he was appointed perpetual secretary in 1755. Both of these academies were indebted to him, not only for many valuable contributions, but likewise for several useful regulations and improvements. As a member of the Academy of Inscriptions, he composed several memoirs on the Druids; on the origin and revolutions of the Celtic and French languages; on trial by battle, and proof by ordeal; and on scenic representations, and the ancient drama. As a member of the French Academy, he assisted in compiling the new edition of the *Dictionary* which was published in 1762; and he made some just and philosophical remarks on the *Port Royal Grammar*. On several occasions he resolutely supported the honour and prerogatives of the societies to which he belonged, and maintained the respectability of the literary character in general. He used to say of himself, "I shall leave behind me a name dear to literary men." His fellow-citizens, whose interests he always supported with zeal, appointed him mayor of their town in 1744, although he was resident at Paris. He was afterwards elected deputy from the commons to the assembly of the states of Bretagne; and upon the requisition of this body the king granted him letters of nobility.

In 1766 he was advised to retire from France for some time, in order that the government might have an opportunity of forgetting some opinions which he had hazarded, on the subject of the dispute between the Duc d'Aiguillon and M. de la Chalotais, the friend and countryman of Duclos. Accordingly he set out for Italy, and, on his return, he wrote an account of his travels, which is also praised by Chamfort. He died at Paris on the 26th of March 1772, in the sixty-ninth year of his age.

The character of Duclos, although it exhibited many singular traits, was still respectable, whether we consider him as a man or as an author. Rousseau described him very laconically as a man, *droit et adroit.* In his manners he displayed a sort of bluntness in society, which frequently rendered him disagreeable; and his caustic wit on many occasions created enemies. To those who knew him, however, he was a pleasant companion. He was a great lover of anecdotes, and had the talent of relating them in a very agreeable manner. A considerable number of his good sayings have been preserved by his biographers.

A complete edition of the works of Duclos was published by Desessarts, at Paris, in 10 vols. 8vo, 1806. (See *Biog. Universelle.*)

DUCT, in general, denotes any tube or canal. It is a term much used by anatomists.

DUCTILITY, in *Physics*, a property possessed by certain solid bodies; it consists in their yielding to percussion or pressure, and receiving different forms, without breaking.

Some bodies are ductile both when they are hot and when they are cold, indeed in all circumstances. Such are metals, particularly gold and silver. Other bodies are ductile only when heated to a sufficient degree; such as wax and other substances of that kind, and glass. Other bodies, again, particularly some kinds of iron, called by the workmen *red short,* brass, and some other metallic mixtures, are ductile only when cold, and brittle when hot. The degrees of heat requisite to produce ductility in bodies of the first kind, vary according to their different natures. In general the heat of the body must be such as is sufficient to reduce it to a middle state, betwixt solidity and perfect fusion. As wax, for instance, is fusible with a very small heat, it may be rendered ductile by a still smaller; and glass, which requires a most violent heat for its perfect fusion, cannot acquire its greatest ductility until it is made perfectly red hot, and almost ready to fuse. Lastly, some bodies are made ductile by the absorption of a fluid. Such are certain earths, particularly clay. When these earths have absorbed a sufficient quantity of water to bring them into a middle state betwixt solidity and fluidity, that is, to the consistence of a considerably firm paste, they have then acquired their greatest ductility. Water has precisely the same effect upon them in this respect that fire has upon the bodies above mentioned.

DUDLEY, Edmund, a celebrated lawyer and statesman in the reign of Henry VII., who with Sir Richard Empson, another lawyer of the same stamp, assisted in filling that rapacious monarch's coffers by arbitrary prosecutions of the people on old penal statutes. Dudley and Empson were beheaded on the accession of Henry VIII. in order to pacify the clamours of the people for justice.

Dudley, *John*, Duke of Northumberland, son of the above, a statesman memorable in the English history for his unsuccessful attempt to place the crown on the head of his daughter-in-law, Lady Jane Grey, who fell a victim to his ambition, was born in 1502, and beheaded in 1553. Ambrose, his eldest son, was a brave general and able statesman under Queen Elizabeth, and received the appellation of "the good Earl of Warwick." Henry, the duke's second son, was killed at the siege of St Quintin. Robert, the third son, a man of bad character, was created Earl of Leicester, and became one of Queen Elizabeth's favourites. His fourth son was the unfortunate Lord Guildford Dudley, whose only crime was his being the husband of Lady Jane Grey, an offence for which he was beheaded in 1554.

Dudley, *Sir Robert*, as he was called in England, and, as he was styled abroad, *Earl of Warwick and Duke of Northumberland*, was the son of Robert above mentioned, by the Lady Douglas Sheffield, and born at Sheen in Surrey in 1573, where he was carefully concealed, in order to prevent the queen acquiring a knowledge of the earl's engagement with his mother. He was entered of Christ Church, Oxford, where he remained some time. In 1588 his father died, and left him, after the decease of his uncle Ambrose, his castle of Kenilworth, the lordships of Denbigh and Chirk, and the bulk of his estate, which before he was of age he in a great measure enjoyed, notwithstanding the enmity borne him by the Countess Dowager of Leicester. He was at this time one of the finest gentlemen in England; and having a particular turn for navigation, he fitted out a small squadron at his own expense, with which he sailed to the river Orinoco, and took and destroyed nine sail of Spanish ships. In 1595 he attended the Earl of Essex and the lord high admiral of England in their expedition against the Spaniards, and, for his gallant behaviour at the taking of Cadiz, he received the honour of knighthood. He now endeavoured to prove the legitimacy of his birth, in order to be entitled to his hereditary honours. But being overpowered by the interest of the Countess Dowager of Leicester, he applied for a license to travel; and being well received at the court of Florence, he resolved to continue there, notwithstanding his receiving a letter of recall; upon which his whole estate was seized by King James I. and vested in the crown. At the court of Cosmo II. great duke of Tuscany, he discovered those great abilities for which he had been admired in England, and was at length made chamberlain to his serene highness's consort. Whilst in this situation, he contrived several methods of improving shipping; introduced new manufactures; and by other services obtained so high a reputation that, at the desire of the archduchess, the Emperor Ferdinand, in 1620, created him a duke of the holy Roman empire. He afterwards drained a vast tract of morass between Pisa and the sea, and raised Leghorn, which was then a mean and insignificant place, into a large and beautiful town, improving the haven by a mole, which rendered it both safe and commodious; and having engaged his highness to declare it a free port, he by his influence and correspondence drew many English merchants to settle and set up houses there, which proved of very great service to his native country, as well as to the Spaniards. He was also the patron of learned men, and held a high place himself in the republic of letters. His most celebrated work is his *Del Arcano del Mare*, Firenze, 1630, 1646, folio. This work, which has always been scarce, has now become extremely rare. There is a copy in the British Museum, dated 1661, and called the second edition; but that which we have seen and examined belongs to the Society of Writers to the Signet, Edinburgh, whose valuable and well-selected library contains many works of the greatest merit, and literary gems and rarities. The work, which consists of a collection of tracts, comprehends a great number of projects for the improvement of navigation and commerce, with the charts and plans relative thereto; all of them schemes which, considering the time when they were devised, are quite remarkable for the boldness and originality with which they are conceived, and the extent of scientific acquirements which they exhibit.

Dudley.

Dudley, a large town of the hundred of Halfshire, in the county of Worcester, 130 miles from London. It contains two parishes, with their respective churches. The country around it abounds with coal and iron. The chief employment consists in making nails and other hardware. It is a very ancient town, the castle of which is reported to have been built in the seventh century, by a Saxon prince Dodo or Duddo. There is a large market held every Saturday. The inhabitants in 1801 amounted to

10,107, in 1811 to 13,925, in 1821 to 18,211, and in 1831 to 23,043.

DUEL, a combat between two persons. To distinguish it from the unpremeditated combat or rencontre, it must take place at a time and place appointed in consequence of a cartel or challenge, and generally in presence of two or more witnesses or umpires.

The word is derived from *duellum*, used by the barbarous Latin writers *quasi duorum bellum*; and, as a judicial trial, it has been defined "singularis pugnus inter duos ad probandum litem, et qui vicit probâsse intelligitur." (*Fleta.*)

The origin of duelling may be traced to that barbarous state of society in which personal courage was followed as the ruling principle, and esteemed as the noblest ornament, of life. Under the influence of such principles, the considerations of justice and humanity were little regarded; and patience under injuries being branded as infamous and cowardly, men were naturally impelled, not only to avenge their own wrongs, but to gratify their private resentments, at the point of the sword.

Before the dawn of Christianity had thrown its light upon the interesting doctrine of a providence superintending the affairs of men, the belief of an adequate distribution of rewards and punishments in the present life seems to have been generally received. The rich, the prosperous, and the happy, were apt to be considered as the peculiar favourites of Heaven; whilst disease, misfortune, and sudden or violent death, were regarded as the inflictions of divine vengeance on the crimes of the sufferers. Hence, in a superstitious age, arose the practice of making a direct appeal to the deity in the single combat, under the persuasion that the justice of Heaven would infallibly declare for the innocent, and visit the perjured and the guilty with dishonour and death.

The duel, as a judicial trial, prevailed at an early period amongst the Germans, Danes, and Franks; and by a law instituted in 501, by Gondeband, king of Burgundy, it was allowed in legal proceedings in lieu of swearing.

Louis le Debonnaire was the first French monarch who permitted to litigants the trial by arms; and the same mode of trial was introduced into England, with other Norman customs, by William the Conqueror. It was only used, however, in three cases: in the court martial or court of chivalry, in appeals of felony, and in civil cases upon issue joined in a writ of right; in which last it was the only decision, until Henry II., with consent of parliament, introduced the grand assize. None were exempt from the trial by battle but females, the sick and the maimed, and persons under fifteen or above sixty years of age; ecclesiastics, priests, and monks, being allowed to produce champions in their stead.

The trial by battle, however, soon degenerated into a convenient pretext for gratifying private revenge under sanction of the law, or on pretence of discovering truth and punishing perjury. Under the feudal system it was of course warmly patronized, being but too congenial with the feelings and habits of the fierce and haughty barons, who, uncontrolled by any principles of law or religion, disdained to submit their differences to any arbitration, or to seek any reparation for an injury but by the sword. Arms were the sport, plunder and revenge the business, of their lives. And to such a height did the evils arising from their private quarrels and petty warfare increase, that it became necessary to adopt some means for controlling and directing the torrent of military violence, which threatened to sweep away every feeling of justice and humanity, and subject the peace and comfort of the community to the unrestrained passions of a fierce and lawless aristocracy. Martial societies were accordingly instituted, whose duty it was to protect the weak and defenceless, to relieve the oppressed, to correct abuses, and to promote the public good.

Hence arose chivalry and knight-errantry, which, although they modified in some degree the evil of duelling, by imposing a minute and punctilious system of observances, had yet a tendency to perpetuate the practice, by instituting those false and fantastic principles of honour, the evils of which are still felt in the modern duel. With the code of punctilious regulations, the grounds and motives of the duel were changed and extended. Malice and revenge gave place to the gratification of personal vanity, and the desire of that renown for deeds of arms which was considered as the glory of the age. Tilts and tournaments were the pastime of the nobles, and were not only countenanced by the presence of the prince, who not unfrequently shared the dangers of the field, but graced by the attendance of female beauty and distinction, from whose hands the successful champion received the prize of his achievements, and at whose feet he longed to lay the trophies of his victory. See CHIVALRY.

The tournament continued in high estimation, notwithstanding the many valuable lives sacrificed on the most frivolous occasions, until the middle of the sixteenth century, when the death of Henry II. of France, in a tournament given in honour of his sister's marriage, gave a check to these sanguinary amusements. At this entertainment Henry sent his lance to Count Montgomerie, the captain of his guards, who at first declined the challenge; but on the king repeating his commands, he was compelled to obey. At the encounter, Montgomerie purposely broke his lance against the king's breastplate; but unhappily for the monarch he wore his helmet open, and a splinter of the lance flying up into his eye, pierced his brain. He survived for about a month in great agony, and died on the 10th July 1559. (Cockburn *on Duels.*)

In no country has the duel on private and personal quarrels prevailed to so great an extent as in France. Francis I. encouraged the practice by his well-known determination "that the lie was never to be borne without satisfaction but by a base-born fellow." By his challenge to the Emperor Charles V. he set an example which his high-minded nobles were but too eager to follow; and under the countenance of their monarch their native propensity to the single combat was indulged to an extent which all the power of his successors was scarcely able to control.

The power of the church was frequently exerted to restrain these bloody proceedings, especially by a council at Valentia in 855, and lastly by the council of Trent, session xxv. chap. 19, which excommunicated not only the combatants, but their associates, and even the spectators of the battle; declaring the custom to be detestable, introduced by Satan for the destruction both of body and soul. It adds, that "all advisers, supporters, witnesses, or those in any way concerned, are likewise excommunicated. Princes also who connive at duels are to be deprived of all temporal power, jurisdiction, and dominion over the places where they have permitted duels to be fought."

Philip the Fair, at the close of the thirteenth century, forbade all gages or pledges of battle; but this prohibition was afterwards relaxed in several instances, and in 1306 a royal ordonnance was published, prescribing rules, conditions, and ceremonies for the combat.

In the reign of Henry II. a noted duel was fought in the king's presence between Guy Chabot de Jarnac and Francis de la Chastaignerie, in which the latter was slain; and on this occasion Henry is said to have taken an oath never to allow another during his reign. An edict was published accordingly; but this, which appears to have been the first royal prohibition of the duel, was productive of no good effects. The prohibition indeed arose rather from the king's grief for the loss of his friend Chastaignerie than from any desire on public grounds to abolish the custom; and it appears rather to have aggravated the evil, by increasing the number of private duels: for the same punctilious notions of honour from which the duel generally originated, and the same dread of the imputation of cowardice which kept it alive, were still entertained; and as the royal permission, without which the duel had formerly been high treason, could not now be obtained, each man became the judge in his own cause; and in those delicate cases, of which the law could take no cognizance, the point of honour was more likely to be stretched than curtailed.

The parliament of Paris in 1599 declared all persons who had assisted or been present at the prosecution of these unlawful quarrels to be rebels to the king, transgressors of the laws, and disturbers of the public peace.

Henry IV., during the first eighteen years of whose reign no less than four thousand gentlemen are said to have perished by the duel, alludes in his edict at Blois, 1602, to the disorders arising from this barbarous custom; and in 1609 he added to the penalties already imposed, punishment by death, confiscation of goods, fines, imprisonment, and degradation from honour, on all who were in any way concerned in these combats, not only principals and seconds, or bearers of challenges, but spectators, and even those who, being accidentally present, did not interfere to prevent bloodshed. The severity of these edicts might have contributed greatly to diminish the evil; but unfortunately they arose rather from the complaints of the people, and the persuasions of the Duke of Sully, than from any desire on the part of Henry himself to abolish a custom for which he privately entertained a great partiality, as was evident from the readiness with which he granted pardons to offenders, and even privately encouraged particular duels. He readily gave permission to Crequi to fight Don Philip of Savoy, and even added this encouraging compliment, "If I were not a king I would gladly offer myself to be your second."

It was not be expected that laws, however severe, the open violation of which was thus countenanced by the monarch himself, could be productive of any beneficial effects; and we find the passion for the single combat continuing unabated during the reign of the succeeding monarch Louis XIII. To such extent indeed did it prevail, that the common inquiry when acquaintances met was not, "what is the news to-day," but "who fought yesterday;" and Lord Herbert, who was ambassador at the court of Louis, says, that "there is scarce a Frenchman worth looking on who has not killed his man in a duel."

Two noblemen, however, Montmorenci count de Bouttevillle, the most renowned duellist of the day, and the Marquis de Beuoron, persisting to fight in defiance of the royal interdict, were tried according to law, and both beheaded. This execution caused for a time a cessation of the sanguinary custom; but it was reserved for Louis XIV. to give the first effectual check to the continuance of the practice.

During the minority of this prince a very desperate battle was fought between the Dukes de Beaufort and de Nemours, each attended by four friends. The seconds of the Duke de Nemours were the Marquis de Villars, the Chevalier de la Chaise, D'Uzerches, and Compan; and the Duke de Beaufort was attended by D'Henricourt, De Ris, Buri, and Brillet. They fought five against five, with swords and pistols. Nemours was shot by Beaufort, the Marquis de Villars killed D'Henricourt, and D'Uzerches slew De Ris: the rest were only slightly wounded.

This, with another desperate encounter fought in 1663, four against four, determined the king on taking some decided step to prevent the recurrence of such disgraceful and bloody quarrels. The famous edict published in 1679, with the solemn agreement entered into by the principal nobility, "that they would never fight a duel on any pretence whatever," and the firmness of Louis in refusing pardon to all offenders, contributed more to restrain this unhappy propensity than all the efforts of his predecessors.

The practice of duelling in England, although it never prevailed to such an extent as in France, may be traced to the same causes which gave rise to it on the Continent. The duel, as we have already mentioned, was early in use amongst the Franks and Normans, and was probably by them introduced into England.

One of the latest instances of the trial by battle occurred in the reign of Elizabeth in the year 1571, of which Sir Henry Spelman, who was eye-witness, gives an account of the whole proceedings, which were conducted, he says, "non sine magna jurisconsultorum perturbatione." A proceeding having been instituted in the Court of Common Pleas, for recovery of some manorial rights in the Isle of Hartic, Kent, the defendant offered to maintain his right to possession by the duel. The petitioners accepted the challenge, and as the court does not appear to have had the power of refusal, champions were appointed, and all the requisite forms adjusted. The queen, to prevent bloodshed, had commanded the parties to compromise; but, anxious at once to save the credit of the defendant, who demanded the combat, and to support the authority of the law, which enjoined its being fulfilled, the ceremony of the duel was allowed to proceed. On the appointed day the justices of the common pleas and the counsellors appeared at Tothil Fields as umpires of the combat; but as the petitioners did not appear to acknowledge their champion, they were nonsuited, and victory declared for the defendant. Thus ended the last judicial combat we read of in a civil case. Another, however, occurred in the court of chivalry in 1631, and in the county palatine of Durham in 1638; and the trial by battle was claimed so late as 1818, in the case of Thornton v. Ashford, in an appeal of murder.

But although the duel was disused in judicial proceedings, the fantastic notions of honour to which it gave rise still prevailed; and as the law could take no cognizance of points of honour and personal affronts, private duelling rather increased in the reigns of Elizabeth and James I.

During the civil wars the minds of men were too much occupied with the agitating events of the time to pay much attention to the settlement of points of etiquette; and as the contest was between the commonalty and all that was royal and noble in the land, private feuds were forgotten, and those who would have turned their swords against each other in private quarrel, disdained to employ them in such a cause against men of mean birth and ignoble sentiment.

The custom, however, again gained ground after the restoration of Charles II.; and although he did issue a proclamation to put the existing laws in force, this object was defeated by his great laxity in pardoning offenders.

In consequence of a duel between the Duke of Hamilton and Lord Mohum in 1712, which was fought with the greatest ferocity and apparent determination of murder, and in which both parties were killed, the subject again came under the consideration of government. At the meeting of parliament in the following year, the queen's speech alluded to the subject in this sentence: "the pratice of duelling requires some speedy and effectual remedy." No precise notice was taken of this part of the speech in the address from the House of Commons; and a bill which was brought in for the more effectual restraint of the duel was thrown out on a second reading.

Since the fashion of wearing the sword has been abandoned, private duels have become less frequent in this country, and we have not now to deplore the numerous and often fatal rencontres which, during the last century, were so frequently begun and concluded in the moment and heat of passion, and not seldom on the most frivolous occasions. Such was the duel between Lord Byron and Mr Chaworth in 1765, which originated in a dispute during dinner about the quantity of game on their respective manors. The parties retired to an adjoining room, where they fought by the uncertain light of one small tallow candle, and Mr Chaworth, although the more expert swordsman, was mortally wounded.

By the laws of this country all the parties concerned in a duel which terminates fatally are guilty of murder, however fairly the combat may have been conducted, and however great the provocation.

The suddenness of the provocation, and the agitation of excited feelings, which in other cases may be pled in extenuation of the crime, cannot be urged in favour of those who, after ample time for deliberation, meet for the avowed purpose of murder. It is seldom indeed that the extreme penalty is inflicted, except in cases where unfair advantage has been taken, or which are otherwise attended with peculiar aggravation.

The duel between Major Campbell and Captain Boyd, for which the former was executed in 1808, is well known, and was considered as little better than deliberate assassination. But in the case of Lieutenant Blundell, who was killed in a duel at Carisbrooke Castle, in the Isle of Wight, in 1813, every thing appears to have been conducted with perfect fairness; yet the surviving principal, the seconds, and two others who were considered accessary, were convicted of murder at the Hampshire assizes, and sentenced to death; and although the royal pardon was obtained, they were all dismissed from his majesty's service.

Foster expresses the following opinion: "Deliberate duelling, if death ensueth, is in the eye of the law murder. For duels are generally founded on deep revenge. And though a person should be drawn into a duel, not upon a motive so criminal, but merely upon a punctilio of what swordsmen falsely call honour, that will not excuse. For he that deliberately sheddeth the blood of another, upon a private quarrel, acteth in defiance of all laws, human and divine, whatever his motive may be." And Judge Blackstone: "When both parties meet avowedly with an intent to murder, thinking it their duty as gentlemen, and claiming it as their right, to wanton with their own lives, and those of their fellow-creatures, without any warrant or authority from any power either divine or human, but in direct contradiction to the laws both of God and man, the law has justly fixed the crime and punishment of murder on them, and on their seconds also."

In a moral point of view the practice admits of no defence, for the very principle on which the duellist proceeds is one which, if universally adopted, would be subversive of all good order, namely, that an individual may be the judge of his own cause, and the avenger of his own wrongs. The legislature has provided a reparation for all those injuries which the wisdom of legislators has thought it reasonable to redress; and for an individual, or body of individuals, to adopt a law for the regulation of their own conduct, differing in spirit and opposed in principle to the laws of the country, is alike inconsistent with sound moral and political philosophy. Such is the law of honour, as it is called, a law by which no wise or sober-minded man would desire to regulate his life: it prescribes none of those duties which we owe to God as his creatures, it admits or connives at many direct violations of his laws, and it imposes no restraint on that indulgence of the sensual passions, which is degrading to human nature, injurious to society, and opposed to all that is really good and honourable in the character of man. But unfortunately "the law of honour having annexed the imputation of cowardice to patience under an affront, challenges are given and accepted with no other design than to prevent or wipe off this suspicion, and without any other concern than to preserve the duellist's own reputation and reception in the world."

Every man of experience in the world must be convinced of the truth of this remark. And it is not one of the least evils of this system, that the word *honour*, which, rightly understood, denotes all that is truly noble and virtuous, should be prostituted as a pretext for gratifying the most malignant of human passions, or as a cover for that moral cowardice, the fear of being thought afraid.

"Duels," says Sir George Mackenzie, "are but illustrious murders. It is an imperious crime, which triumphs both over public revenge and private virtue, and tramples boldly upon the laws of the nation and the life of our enemy. Courage thinks law here to be but pedantry, and honour persuades men that obedience here is cowardice." It has been the aim of every moral writer to expose the folly, and of every wise legislature to check the prevalence, of this pernicious practice; yet so powerful is the domineering influence of fashion, that a custom originating in barbarism, and cherished only by pride and selfishness, has for ages stood its ground against all the arguments of reason and religion. Its prevalence is indeed abated in our country, and it is to be hoped there are not many men in the present day who fight for the mere gratification of revenge; but it is to be feared that there are not a few who, condemning the custom in their hearts, are yet compelled to "go as an ox to the slaughter," and to "die as a fool dieth," under the dread of an imputation of cowardice, which they would not otherwise deserve. Nor is it likely that the duel will ever be entirely abolished by the law as at present administered. Death, which the law of honour views as but an adequate reparation for an offensive word, is thought too severe a punishment for what the laws of God and man both declare to be murder. The penalty, therefore, is seldom inflicted; and where many are acquitted, all will hope to escape.

"Death," says Mr Addison, "is not sufficient to deter men who make it their glory to despise it; but if every one who fought a duel were to stand in the pillory, it would quickly diminish the number of these imaginary men of honour, and put an end to so absurd a practice."

DUERO, or Douro, a river of Spain and Portugal. It rises in the Sierra de Urbion, not far from Durcula, in Soria, and empties itself into the ocean at St João da Foz, below Oporto. Its course through Spain is 306 miles, and through Portugal 185. In the latter kingdom it is not navigable more than seventy-four miles, on account of the rapidity of its course. The streams which flow into it are the Pisuerga, the Esla, the Adaja, the Valderaguary, the Yeltes, the Agueda, the Coa, the Sabor, the Tua, and the Tamaga.

DUFF'S GROUP, a range of islands in the South Pacific Ocean, about eleven in number, extending fourteen or fifteen miles in a direction north-west to south-east. These islands were discovered by Captain Wilson in the course of his missionary voyage in the ship Duff. The largest two were covered with wood, the others appeared barren. The natives appeared shy and apprehensive of strangers.

DUGDALE, Sir William, an eminent English antiquary and historian, was born at Shustoke, near Coleshill, in Warwickshire, in 1605. He was introduced into the herald's office by Sir Christopher Hatton, and ascended gradually through all the degrees, until he became garter principal king at arms. His chief work is the *Monasticon Anglicanum*, in 3 vols. folio, containing the charters and descriptions of all the English monasteries, adorned with engravings; a work in which he was assisted by Mr Roger Dodsworth. Nor are his antiquities of Warwickshire less esteemed. He wrote likewise, the *History of St Paul's Cathedral*, London, 1658, folio; a *History of Embanking and Draining*, London, 1662, 1675, 1676, folio; a *Baronage of England;* and he completed the second volume of Sir Henry Spelman's Councils, with a second part of his Glossary. He died on the 10th February 1686, in the eighty-first year of his age. His son, Sir John, was norroy king at arms, and published a Catalogue of the English nobility. His daughter Elizabeth was married to Elias Ashmole.

DUHAMEL, de Vrigny le Monceau, Henri Louis, author of many valuable works on agriculture, natural history, and the arts, son of Alexander du Hamel, lord of Denainvilliers, and of Ann Trottier, was born at Paris in 1700. His family had formerly emigrated to Holland, but returned to France as early as the year 1400, with the Duke of Burgundy.

He was educated at the College d'Harcourt; but the chief advantage which he derived from his residence there, was a taste for the further acquirement of physical knowledge, which he afterwards pursued with ardour at the Jardin du Roi, having for his fellow-students a number of young men, who afterwards acquired a high degree of celebrity, and among the rest Dufay, Geoffroi, Léméri, Jussieu, and Vaillant. At the age of twenty-eight he obtained the title of adjunct botanist in the Academy of Sciences; in 1730 he became an associate, and in 1738 an academician, having previously been elected a fellow of the Royal Society of London, in the beginning of 1734. Upon his first admission into the list of the academy, his assistance was requested in the investigation of a disease which affected the saffron cultivated in the Gâtinois, where his estate was situated; and he found reason to attribute it to a parasitical fungus attached to the roots of the plant. His memoirs and notes communicated to the academy, as well as his separate publications, are so multitudinous, that the shortest possible enumeration of their subjects can barely be brought within the ordinary limits of a biographical article.

1. *A Disease of Plants*, Acad. Paris, 1728. 2. *The Multiplication of Fruits*, 1728. 3. *The Growth of Plants*, 1729. 4. *Grafting*, 1730. 5. *The Pear Tree*, 1730-1-2. 6. *Soluble Tartar*, 1732-3. 7. *Ether*, 1734. 8. *Salt of Sulphur*, 1734. 9. *Sal Ammoniac*, 3 parts, 1735. 10. *The Purple Dye*, 1736. 11. *The Base of Sea Salt*, 1736. 12. *The Strata of Wood*, 1737. 13. *Frosts*, 1737. 14. *Bones Tinged Red*, 1739. 15. *Polygala as a Pectoral*, 1739. 16. *The Misletoe*, 1740. 17. *Botanico-meteorological Observations*, continued annually for forty-two years, 1740—1781. 18. *The Union of Fractured Bones*, 2 parts, 1741. 19. *The Strength of Timber*, 1742. 20. *The Growth of Bones*, 5 parts, 1742-3. 21. *Frobenius's Ether*, 1742. 22. *Anatomy*, 1743. 23. *Slips, Layers, and Offsets*, 1744. 24. *Moisture in Oak Timber*, 1744. 25. *A Magnetic Ore*, 1745. 26. *The Preservation of Seed*, 1745. 27. *Magnetising a Bar*, 1745. 28. *Cordage*, 1746. 29. *The Wounds of Trees*, 1746. 30. *Lime*, 1747. 31. *Calcination of a Stone*, 1748. 32. *Ventilation*, 1748. 33. *Plants raised in Water*, 1748. 34. *Gunpowder*, 1750. 35. *The Weight of Ignited Metals*, 1750. 36. *Tull's Agriculture*, 1750. 37. *The Compass*, 1750. 38. *The Strata of Trees*, 1751. 39. *The Growth of Horns*, 1751. 40. *Bees*, 1754. 41. *Madder*, 1757. 42. *Spontaneous Combustions*, 1757. 43. *Ergot*, 1759. 44. *An Insect Devouring Corn*, 1761; and separately, 12, Paris, 1762. 45. *A Descent of the Barometer*, 1763. 46. *The Tea Plant in Sweden*, 1763. 47. *Inflammable Vapours*, 1763. 48. *Salts in Ashes*, 2 parts, 1767. 49. *Overdriving Animals*, 1768. 50. *Rhubarb*, 1768. 51. *Hair Returning after fifty Years*, 1770. 52. *A Change of the Needle*, 1771. 53. *Variation Compasses*, 1772. 54. *A Monstrous Apple Tree*, 1775. 55. *The Management of Prisons*, 1780.

56. *Observations and Experiments with Madder Root, which has the Faculty of Tinging the Bones of Living Animals of a Red Colour.* *Phil. Trans.* xli. 1740, p. 390.

57. *Traité de la Culture des Terres*, 6 v. 12. Par. 1750. Ac. Par. 1755-7.

58. *Architecture Navale*, 4. Par. 1752, 1758. Ac. Par. 1752. *Avis pour le Transport par Mer des Arbres*, 2d edit. 12. Par. 1753.

59. *Conservation des Grains*, 12. Par. 1753, 1754, 1768. *Supplément.* Par. 1765, 1771. Ac. Par. 1765.

60. *Fabrique des Manœuvres pour les Vaisseaux.* 4. Par. 1757.

61. *Traité des Bois et Forêts.* 8 v. 4. Par. 1755—1767. Arbres et Arbustes, 2 v. 1755. Physique des Arbres, 2 v. 1758. Semis et Plantations, 1760. Exploitation, 2 v. 1764. Transport, Conservation, et Force, 1767. Ac. Par. 1755, 1758, 1760, 1767, 1768.

62. *Moyen de Conserver la Santé aux Equipages.* 12. Par. 1759. Ac. Par. 1755, 1758, 1759, 1760.

63. *Traité des Arbres Fruitiers.* 2 v. 4. Ac. Par. 1768.

64. *Traité des Pêches*, 1769. Jointly with M. de la Marre. Ac. Par. 1769.

65. *Art du Charbonnier.* Par. fol. Noticed Ac. Par. 1761. 66. *De la Fabrique des Ancres*, 1761. 67. *Du Chandelier*, 1761. 68. *De l'Epinglier*, 1761. 69. *De Reduire le Fer en Fil*, 1768. 70. *Du Cirier*, 1762. 71. *De Faire les Enclumes*, 1762. 72. *Du Cartier*, 1762. 73. *De Rafiner le Sucre*, 1764. 74. *Du Drapier*, 1765. 75. *De Faire les Tapis.* 76. *De Friser les Etoffes*, 1766. 77. *Du Couvreur*, 1766. 78. *Du Tuilier Briquetier.* 79. *Du Serrurier*, 1768. 80. *De Préparer le Colle.* 81. *De Faire les Pipes*, 1772. 82. *Du Potier de Terre*, 1774. 83. *Du Savonnier*, 1775.

The earlier part of Mr Duhamel's life was chiefly devoted to the study of vegetable physiology, which he had continued for thirty years before the publication of his principal works. The most original of his observations related to the growth of plants, the formation of the bark and the wood, the effects of grafting, the inversion of a tree, the double motion of the sap, and the influence of light, air, and soil. In agriculture he introduced the practice of drying corn in a particular stove or kiln, with a heat sufficient to destroy the insects which infested it and their larvas. He made many experiments on manures, and he conferred a great benefit on several provinces of France, by introducing the cultivation of potatoes into general practice, as well as by promoting that of rhubarb in different places.

Having obtained from M. Maurepas the appointment of inspector-general of the marine, he undertook to make himself master of every department of nautical knowledge; and setting out with the established doctrines of Euler and Bouguer, where theory was wanted, he collected for his works on these subjects an immense mass of facts and experiments, affording the means of resolving every question on practical grounds. He established a school for ship-builders, which effectually secured to them an education superior to that of simple carpenters. He also made some very valuable improvements in the theory of rope-making, showing especially the disadvantages arising from the excessive twisting of cordage. His conduct in this capacity seems to have been as judicious in a moral as in a mechanical point of view; whilst by his modesty and good nature he silenced the contending passions of those with whom he was obliged to enter into discussion, and was enabled to unite a variety of opposite interests, in the important object of the establishment of an academy for the cultivation of naval science.

His meteorological observations included, besides the usual registers, accounts of the direction of the magnetic needle, of the state of agriculture, of the diseases of the year, and of the times of migration of birds, and of the appearance of their young.

From his experiments on the growth of their bones, he inferred that they are enlarged by means of the ossification of the laminæ of the periosteum, nearly in the same manner as trees are known to grow by the hardening of the cortical layers; although the bones, while they are soft, expand in every direction, as the very young shoots of vegetables are also found to do. Having learned from Sir Hans Sloane that madder possesses the property of giving colour to the bones, he fed animals successively on food mixed and not mixed with madder; and he found that their bones in general exhibited concentric strata of red and white, whilst the softer parts showed in the mean time signs of having been progressively extended. These experiments are still of great importance in illustrating the physiology of ossification, although the actual conversion of the periosteum into bone may justly be disputed.

In trees Mr Duhamel found that the graft was incorporated with the stock, so as to form a single substance completely identical with it; and he showed that animal bodies were capable of a similar union, the vessels of the animals forming communications with those of the parts inserted; the spur of a cock, for instance, grafted into his comb, uniting perfectly with it, and becoming gradually furnished with a bony core, like the horn of a bullock, which either forms a joint with the cranium, or is firmly attached to it, and affords nourishment for the growth of this newly adopted member.

Having demonstrated in 1737 the different natures of soda and potass, he made an interesting experiment on the production of these alkalies by different vegetables. He sowed the head of the salsola kali at Denainvilliers, and it was found by the analysis of Mr Cadet that its ashes produced at first soda, but afterwards more and more potass every year; and after several generations almost entirely potass. His other chemical memoirs were of less permanent importance; and, with respect to the weight of ignited iron, he was unfortunately inaccurate in his mode of conducting the experiment, otherwise it must necessarily have led him to an anticipation of some of the most important discoveries of the last century.

From his extensive correspondence in different countries, he was enabled to communicate to the academy from time to time a number of detached facts, which were both amusing and instructive, and which appear perpetually in the histories of the respective years. His works were in general of an elementary nature, and calculated for the use of such as possessed but little previous information; and hence they may appear to some readers to contain an unnecessary detail of explanation. "Prolixity," says Mr Condorcet, "is injurious to perspicuity, when we are addressing ourselves to persons accustomed to fix their attention firmly on the subject before them, who are able to observe the slightest shades of difference, and to receive at once a variety of ideas; supplying, where there is occasion, any connecting links of the chain which may have been omitted. If we are too diffuse, the attention of such persons droops for want of excitement; their memory is fatigued with the attempt to retain impressions which have not been communicated to them with sufficient force; and when they are compelled to travel slowly, the delay exhausts them, from having been in the constant habit of a more rapid motion. But it was not for this very limited class of readers that Mr Duhamel's works were calculated. He wrote for the use of those who seldom go beyond the bare expressions of the author, who find all close attention toilsome, and who read rather for simple information than for the cultivation of the mind; and an author may always be said to write well when his style is appropriate to his subject, and to the capacity of his readers."

Mr Duhamel was economical in his habits of life, and disinterested in his views, sacrificing his own pecuniary advantage, and that of his family, to the desire of serving the public by his experiments and his writings. Having once established a certain scale for his expenses, he never troubled himself with keeping a minute account of them. His integrity sometimes wore the appearance of severity, and his vivacity that of harshness; but no imputation was ever cast on the goodness of his heart. He was averse to all changes, both in political and scientific institutions, which were not connected with obvious improvement. He was punctual in his attention to the duties which his religion imposed on him, but he did not sacrifice to unnecessary parade such of his hours as he thought might be more conscientiously employed in studies of general utility. His application, though assiduous, was seldom severely laborious. He never entered into any matrimonial engagements. On some occasions he felt himself neglected by the public; but he was little disposed to lament this injustice, except from reflecting on the effect which it would have had on an individual less zealous or less independent than himself. Besides his election as a fellow of the Royal Society of London, he obtained the honour of diplomas from the academies of St Petersburg, Palermo, Bologna, Edinburgh, and Padua, and from several agricultural societies; and his name has acquired a celebrity commensurate to the extent of his varied researches.

Few persons have ever passed through life with greater tranquillity of mind, or with a greater desire of rendering themselves useful to mankind, than Mr Duhamel. He was one of the most active promoters of the kind of revolution which took place in the cultivation of science during the last century, and of which the characteristic distinction was, to endeavour to turn its chief course towards the grand objects of public utility and domestic convenience. Upon this modification of the pursuits of natural philosophy, Mr Condorcet very judiciously remarks, that "if the sciences have sometimes raised themselves too high towards heaven, and if it has been of advantage to recall them towards the earth, we must still shun the opposite error of condemning them to creep on it for ever." And when we see the paths of discovery open before us, we must follow boldly wherever they lead us, confident that, sooner or later, all theoretical knowledge may eventually confer some material benefit on society, even with regard to the more practical purposes of life. Mr Duhamel indeed well knew the necessity of previous study and of extensive inquiry for the success of his experimental investigations; and the former half of a long life he spent chiefly in qualifying himself for making the observations which he recorded, and deriving from them the instructions which he published, in the latter. At a very advanced age his memory began to fail; he still continued his pursuits, but without reaping any advantage from his application; he attended the meetings of the academy, but took little or no interest in any thing that passed at them; and after having been present at one of these meetings, on the 22d of July 1782, he had an attack of apoplexy, which wholly deprived him of his remaining faculties, and on the 13th of August put an end to his life.

A few years before his death he had felt very severely the loss of his brother, who had lived constantly at Denainvilliers, and had assisted him in many of his agricultural researches and meteorological observations, though he had always remained anonymous. His nephew, Mr Fougeroux, had also been useful to him on several occasions in his literary pursuits; and this gentleman became heir to the principal part of the property of both his uncles. *Eloge*, by Condorcet, *Hist. Ac. Par.* 1782, p. 131. (L. L.)

DUILLIUS NEPOS, C., a Roman consul, the first who obtained a victory over the naval power of Carthage, in the year of Rome 492. He captured fifty of the enemy's ships, and was honoured with a naval triumph, the first of the kind ever granted at Rome. The senate rewarded his valour by permitting him to have music playing and torches lighted at the public expense every day while he was at supper. Some medals were struck in commemoration of his victory; and there exists a column at Rome which was erected on the occasion.

DUISBURG, a city of the Prussian province of Westphalia, on the river Ruhr. It is an active manufacturing place, and carries on a regular trade by weekly passage vessels with Arnheim, Dort, and other places in Holland. There was formerly a university here, which is now reduced to a gymnasium. In 1817 it contained 4510 inhabitants, but their number has since increased.

DUKE (*Dux*), a sovereign prince, without the title or quality of king. The word is borrowed from the Latin through the medium of the modern Greek. Some sovereigns have the title of *grand duke*, as the Grand Duke of Tuscany and the Grand Duke of Muscovy. The title of grand duke belongs to the heir apparent of Russia; and the title of archduke is given to all the sons of the house of Austria, and that of archduchess to all the daughters.

DUKE is also a title of honour or nobility, the next below princes.

The dukedom, or dignity of duke, is a Roman dignity, so denominated *a ducendo*, from leading or commanding. Accordingly the first dukes, *duces*, were the *ductores exercituum*, leaders or commanders of armies. Under the later emperors, the governors of provinces in time of war were entitled *duces*. In after times the same denomination was also given to the governors of provinces in time of peace. The first governor under the name of *duke* was a duke of the Marchia Rhætica, or Grisons, of which mention is made in Cassiodorus; and there were afterwards thirteen dukes in the eastern empire, and twelve in the western. The Goths and Vandals, upon their overrunning the provinces of the western empire, abolished the Roman dignities wherever they settled; but the Franks, in order to humour the Gauls, who had long been used to that form of government, made it a point of policy not to make any change therein; and accordingly they divided all Gaul into duchies and counties, giving to the governors of these sometimes the names of dukes, and sometimes that of counts, or *comites*.

In England, during the Saxon times, Camden observes, the officers and commanders of armies were called dukes, *duces*, in the ancient Roman manner, without any addition. But after the conqueror came in, the title lay dormant till the reign of Edward III., who created his son Edward, called the Black Prince, first duke of Cornwall; a title which has ever since been the peculiar inheritance of the king's eldest son during the lifetime of his father, so that he is *dux natus, non creatus*. After this more dukes were made, in such a manner that their titles descended to their posterity. They were created with much solemnity, *per cincturam gladii, cappæque, et circuli aurei in capite impositionem*. In the reign of Queen Elizabeth, however, that is, in 1572, the whole order became utterly extinct; but it was revived about fifty years afterwards by her successor, in the person of George Villiers, duke of Buckingham.

Though the French retained the names and forms of the ducal government, yet under their second race of kings there was scarcely any such dignity as that of duke. All the great lords were called *counts*, *peers*, or *barons*, excepting, however, the Dukes of Burgundy and Aquitain, and the Duke of France, which was a dignity held by Hugh Capet himself, and corresponded to the modern dignity of maire de palais, or the king's lieutenant. By the weakness of the kings, the dukes or governors sometimes made themselves sovereigns of the provinces entrusted to their administration. This change happened chiefly about the time of Hugh Capet, when the great lords began to dismember the kingdom; so that this prince found more competitors among them than subjects. It was even with great difficulty that they could be brought to own him as their superior, or to consent to hold of him by faith and homage. What with force, and what by marriages, these provinces, both duchies and counties, which had been severed from the crown, were again gradually united to it. But the title of duke was no longer given to the governors of provinces. From that time duke became a mere title of dignity, annexed to a person and his heirs male, without giving him any domain, territory, or jurisdiction over the place of which he was duke. All the advantages of the title now consist in the name, and in the precedence which it gives.

The dukes of our days retain nothing of their ancient splendour except the coronet on their escutcheon, which is the only mark of their departed sovereignty. They are created by patent, cincture of the sword, mantle of state, imposition of a cap and coronet of gold on the head, and a verge or rod of gold in their hand.

The eldest sons of dukes are by the courtesy of England styled *marquises*, though they are usually distinguished by their father's second title, whether it be that of marquis or earl; and the younger sons are *lords*, with the addition of their Christian name, as Lord James, Lord Thomas, Lord Charles, and they take place of viscounts, though not so privileged by the laws of the land.

DUKE-Duke, a quality given in Spain to a grandee of the house of Sylva, on account of his having several duchies from the union of two considerable houses in his person. Don Roderigo de Sylva, eldest son of Don Ruy Gomez de Sylva, and heir of his duchies and principalities, having married the eldest daughter of the Duke de l'Infantado, the Duke de Pastrana, who was descended from her, added to his other great titles that of duke-duke, to distinguish himself from the other dukes, some of whom might enjoy several duchies, but none so considerable ones.

DUKLA, a city in the circle of Jaslow, of the Austrian kingdom or province of Galicia. It stands on the river Jasielka, on the great road to Hungary, in a fertile district, in which are manufactories for cloth, flannels, and baizes.

DULVERTON, a market-town in the hundred of Willerton and Freemanners, in the county of Somerset, 168 miles from London. The town is well built, and clean, having two streams of water running through it. It was formerly a manufacturing town for coarse woollen goods, but the trade has greatly declined. The market is held on Saturday. The inhabitants amounted in 1801 to 1049, in 1811 to 1035, in 1821 to 1127, and in 1831 to 1285.

DUMARSAIS, Cesar Chesnau, a French writer, who distinguished himself as a philosophical grammarian, was born at Marseilles on the 7th of July 1676. His life consisted of a succession of misfortunes; and his merits, considerable as they were, seem to have been entirely overlooked and neglected by his contemporaries. His father died while he was yet an infant; and his mother, by her extravagance, dissipated his patrimony. He was educated in his native town by the Fathers of the Oratory, into whose congregation he entered, but left them at the age of twenty-five, and repaired to Paris, where he married, and was admitted an advocate in 1704. He soon, however, quitted the bar; separated from his wife, to whom he gave up the little he possessed, and went to reside with the President de Maisons, in the capacity of tutor to his son. But his prospects in this quarter were blasted by the death of his patron, by whose family he was not treated with that respect and gratitude which were due to his talents and his services. He was afterwards successively tutor to the son of Law, the famous projector, and of the Marquis de Beaufremont. It was during this last period that he published the results of his grammatical investigations, which were received with great coldness. At a subsequent period he opened an establishment for education in the suburb St Victor, which scarcely afforded him the means of subsistence; and he expired, at length, under the accumulated pressure of years, infirmities, poverty, and neglect, on the 11th of June 1756, at the age of eighty.

Dumarsais possessed no ordinary talents. His researches are distinguished alike by their accuracy, ingenuity, and depth. As a man, he combined the greatest purity of morals and simplicity of character with a rare degree of manly fortitude in the midst of his misfortunes; yet during the greater part of his life he was left to languish in obscurity, and his merits scarcely attracted any notice until nearly half a century after his death. His works on philosophy and general grammar, however, are worthy of attention. Of these, the best is his *Treatise on Tropes or Figures.* D'Alembert and Voltaire have both paid a just and discriminating tribute to the merits of Dumarsais. An edition of his works was collected by Duchosal and Millon, and published at Paris in 1797, in seven vols. 8vo.

In the year 1804, the French Institute proposed a prize for an *Eloge* on Dumarsais, which was gained by M. Degerando, whose work was published at Paris, 1805, in 8vo. A previous and well-written *Eloge* on the same author, by D'Alembert, is to be found in the *Mélanges de Littérature,* and prefixed to the above-mentioned edition of the *Works of Dumarsais.* See also *Biographie Universelle.*

DUMBARTON, a county in Scotland, situated between 55. 53. and 56. 25. north latitude, and between 3. 55. and 4. 53. west longitude from Greenwich, consists of two districts, six miles distant from each other, part of Lanarkshire running between them. The western, which is much the larger, is about forty miles long and twelve broad, and is bounded by Perthshire on the north; by Argyleshire, from which it is separated by an arm of the sea called Loch Long, on the west; by the river Clyde and Lanarkshire on the south-west and south; and by Stirlingshire on the east. The eastern district is completely enclosed by Stirlingshire and Lanarkshire. The whole county contains 298 square miles, or 190,848 English acres, of which the smaller division contains about forty-two miles, or 28,000 acres. It is divided into twelve parishes, of which there are only two in the eastern district, Kirkintilloch and Cumbernauld. This last belonged to Stirlingshire. till the Earl of Wigton, whose property it was, became heritable sheriff of Dumbartonshire, when he procured it to be annexed to this county.

The prevailing winds are from the west and south-west, but easterly winds are frequent in the spring months. Showers are very common, but heavy and continued rains of rare occurrence. Frosts are seldom severe, and, except on the mountains, snow never lies long. The climate is upon the whole salubrious. The range of the barometer is about 2·80, and of the thermometer from 6° to 80°. The soils of the lower grounds are schistoze clay mixed with small stones, rich black loam on the banks of the Clyde, and gravelly soil on the river Leven; but about two thirds of the county consist of lofty mountains, some of them 3000 feet high, part of the ridge which crosses the island from Forfarshire to the Frith of Clyde, known in the districts to the eastward by the names of the Siedlaw, Ochil, and Campsie Hills.

Coal, iron ore, limestone, freestone, and slate, are its most valuable fossil productions. There are pits for working coals at Langfauld and Lawmuir in East Kilpatrick, and at Duntocher in West Kilpatrick, where great quantities are raised for the consumption of the cotton works at Duntocher, and for calcining lime at the neighbouring lime works. Ironstone is raised in considerable quantities in the parishes of Kirkintilloch and Cumbernauld, which meets with a ready market at Carron foundery.

Limestone is found in the higher grounds at Kilpatrick, Dumbarton, and Row; but it is only wrought at Langfauld, Lawmuir, and Duntocher, where coal is quarried along with it, and also at Row, Netherwood, and Cumbernauld. White and red freestone are met with in several places; the finest quarries are at Garscube, on the banks of the Forth and Clyde Canal; and at Levengrove and Dalreoch, in the immediate neighbourhood of Dumbarton.

Several slate quarries have been wrought with success, at Luss and Camstradden on the estates of Sir James Colquhoun, and at Roseneath on the estates of the Duke of Argyll. The principal markets are at Glasgow, Greenock, &c. to which the slates are conveyed in lighters by the Leven and the Clyde.

The only river of any note which can be said to belong to this county is the Leven, the outlet of Lochlomond, which, flowing for about five miles through a fine valley, joins the Clyde at Dumbarton Castle. Its waters, which are singularly pure and soft, are well adapted to the business of bleaching and printing cottons, branches which are established to a great extent along its course. The other streams are Luss, Froon, Finlays, Douglas, Falloch, and Luggie. Clyde, Endrick, and Kelvin, flow along its borders. Lochlong and Gareloch are arms of the sea, the first of which separates this county from Argyleshire; and the other, penetrating the land for about seven miles, nearly detaches the peninsula of Roseneath from the mainland. Whilst this extent of sea-coast affords the benefit of water carriage to so large a portion of the county, the inland tracts are benefited in almost an equal degree by the Forth and Clyde Canal, which passes through it for more than sixteen miles. This canal is about thirty-five miles in length, and it rises and falls about 160 feet, by means of forty locks. It is carried over the valley where the Kelvin flows, by an aqueduct sixty-five feet in height and 420 feet in length. The only remarkable lake is Lochlomond, which is about twenty-four miles long, and in its greatest breadth, towards the south, above six. About two thirds of the shore, and most of its islands, thirty in all, are in Dumbartonshire; the rest belong to Stirlingshire. It is probably not to be equalled by any lake in Britain for the variety and magnificence of its scenery; the picturesque beauty of its wooded banks and islands affording a striking contrast to the rugged and lofty mountains that rise in its vicinity. It covers about 20,000 acres, and its surface is supposed to be increasing. The best view of the lake is from a promontory above Luss, a village on the western shore.

The landed property of this county is divided among about a hundred and fifty individuals, exclusive of feuars in towns and villages. One third of the estates are of considerable extent, and the remainder are small. The valued rent is L.33,327. 19s. Scots, of which about a third is held under the fetters of strict entails. In 1811 the actual rent of the lands was L.56,972. 15s., and of the houses L.5791. 15s., total L.62,764. 10s.; and the annual value of real property in 1815 was L.71,587 sterling. There are a number of beautiful seats belonging to the larger proprietors, among which Roseneath, the splendid mansion of the Duke of Argyll, and Garscube, the residence of Sir Archibald Campbell of Succoth, are by far the finest specimens of architecture. There are also a great many fine villas, the property of manufacturers and merchants.

The county sends one member to parliament, who, prior to the passing of the reform act in 1832, was elected by about seventy voters upon superiorities; but by the reform measure the constituency has been increased to 924.

The arable lands of Dumbartonshire are divided into farms ranging in extent from 50 to 250 acres: and of late years great improvements have been made in agriculture, and in the breed of all kinds of stock. The land is generally laboured and manured according to the improved system of husbandry; two crops of grain seldom or never being taken without the intervention of a green crop properly tilled and manured. The usual rotation is, first, oats; secondly, potatoes or other green crop; thirdly, wheat or barley sown with rye-grass and clover; fourthly, hay; and, lastly, pasture. Wheat, oats, and potatoes, are the principal crops. The land is well inclosed and subdivided, principally by hedge and ditch, and partially by stone-walls. The tenants generally hold leases for nineteen years. Within the last twelve or fifteen years the breed of draught or farm horses has been greatly improved; a circumstance which is ascribed partly to the emulation excited among the tenantry to ride good horses at the yeomanry drills, and partly to the annual competition for prizes given by the landlords of this district. The dairy stock is principally of the Ayrshire breed; and great improvements have also been made in this department, which is a source of much profit to the farmers nearest to the city of Glasgow. The accommodation to the tenantry has kept pace with these improvements. Many excellent steadings have been erected, generally in the form of a square, having in front the dwelling-house, which communicates with the offices, forming the other three sides of a square.

There are in this county many excellent tracts of pasture land. Sheep of the black-faced breed, and a limited number of black cattle, are reared with great success. The sheep are disposed of in Glasgow, where there is a weekly sale; and the cattle are sold at the Carman market, held in the Moor of Carman on the first Tuesday of June. From 12,000 to 17,000 head of cattle, principally of the Argyleshire breed, are generally disposed of at that market, for the purpose of being fattened on the rich pastures of the south. In the highland district, farms for grazing are necessarily of great extent. But it is not uncommon for fishermen and mechanics to hold pendicles, or "poffles" as they are called, below L.12 of rent; and the cottars, who are usually employed as labourers on the larger farms, possess small patches of arable ground for raising potatoes, with hill pasture for a cow, at a rent of L.5, and sometimes less.

Great improvements have been made on the roads intersecting this county. A new road along the upper part of Lochlomond, and passing through Glenfalloch, communicates with the great military road through Perthshire, Argyleshire, &c. and renders all parts of this county of easy access.

The woods and plantations of this county are extensive and valuable. According to the agricultural survey in 1810, their extent appears to be near 7000 English acres, of which about the half is coppice; yielding to the proprietors a yearly income almost equal to the rent of the arable lands. On spots unfavourable to oak, these coppice woods consist of ash, yew, holly, mountain-ash, birch, hazel, aspen, alder, crab, thorn, and willow. The age at which they are cut is from twenty-two to twenty-four years, when they are worth from L.40 to L.45 an acre; but there are instances of woods, of considerable extent, selling at much more, where proper attention has been paid to inclosing them, and afterwards thickening them by means of layers, or thinning them, as may be necessary. It is the usual practice to reserve a certain number of young trees at each cutting, the greater part of which are cut down at the second fall, when they are nearly fifty years old, and the rest left to grow up to timber trees. The soil and climate of this county are particularly favourable to plantations, which begin to make a return to their owner in ten or twelve years, and in thirty years afford supplies to the carpenter. The most extensive plantations are on the estates of Luss and Bonhill. There is a very fine ash in Bonhill church-yard, the branches of which cover an area one hundred feet in diameter. Its trunk is about nine feet high, the smallest diameter is six feet, and its three principal branches are from ten to twelve feet in circumference. On the banks and islands of Lochlomond there is a considerable number of yew trees, some of them of great size.

The manufactures of this county are various and extensive. The cotton works at Duntocher, belonging to Mr Dunn of Duntocher, are the most extensive works of that description in Scotland. He gives employment to a population of 2500, and he is the second landed proprietor in the county. There are two paper-mills at Dalmuir; two extensive ship-building yards, three large glass manufactories, and two tan-works, at Dumbarton; a manufacture of alkali at Burnfoot of Dalmuir; and a distillery of pyroligneous acid at Milburn. On the short course of the river Leven, not much exceeding three miles in a direct line, there are twelve large print-fields and bleachfields. The extent of the whole, in 1810, is thus stated:

Ground occupied, about (Scotch acres)	350
Value of buildings and machinery	L.250,000
Coals consumed annually, tons	32,000
Yearly expense in fuel	L.19,000
Number of persons employed, of both sexes and all ages	3,000
Average earnings about 2s. a day.	
Total yearly wages, allowing for interruptions from sickness and other causes	L.90,000
Excise duties annually	L.140,000

Besides these large establishments, there is a number of lint-mills, two woollen-mills, chiefly employed in carding, and several fulling-mills.

The gross produce of the salmon-fisheries of this county may be about L.1000 a year; the principal are upon the rivers Leven and Clyde. Those on Lochlomond are comparatively of little importance. About fifty boats are employed in the herring fishery, of which the annual value may be about L.4500.

The rates of wages are higher in this than in most of the Scottish counties. In 1810, farm servants, who are for the most part unmarried, had from L.35 to L.42 a year; and when manufactures are prosperous, many of the workmen in them earn nearly twice as much. Provisions are also dear; and fuel, which consists principally of coal, the greater part of it brought from the adjoining counties, is in many parts higher priced than in our largest cities. There were about 274 paupers in the county in 1811; but few of them were maintained solely on parochial charity. Such as are able to gain their subsistence in part by their own industry, receive only what is necessary to support them in addition to their own earnings; and those who are altogether incapable of work are in most cases relieved by the charity of individuals, the parish paying only for clothes and house rent. The whole sum expended by the parishes does not much exceed L.1000 a year, of which a small part is raised by assessment. The rent of land and interest of capital amount to L.200, incidental funds to L.120, and the collections at the churches to L.390.

The following is a tabular view of the population of this county:—

	1801.	1811.	1821.	1831.
Arrochar parish	470	420	376	559
Bonhill ditto	2,460	2,791	3,003	3,874
Cardross ditto	2,549	2,859	3,105	3,596
Cumbernauld ditto	1,795	2,334	2,864	3,080
Dumbarton burgh and parish	2,541	3,121	3,481	3,623
Kilmaronock parish	879	898	1,008	999
Kilpatrick, New or East, parish	1,404	1,643	1,545	1,675
Kilpatrick, Old or West, parish	2,844	3,428	3,692	5,879
Kirkintilloch parish	3,210	3,740	4,580	5,888
Luss ditto	953	965	1,150	1,181
Roseneath ditto	632	747	754	825
Row ditto	970	1,243	1,759	2,032
County of Dumbarton	20,710	24,189	27,317	33,200

DUMBARTON, the capital of Dumbartonshire, in Scotland, is situated at the confluence of the rivers Clyde and Leven. It is a very ancient place, and is said to have been once the capital of a kingdom of the Britons, established in the vale of the Clyde. Alcluyd was the name of this ancient capital of the Strathclydenses; but whether it was situated on the site of the present town, or confined within the precincts of the castle, cannot be exactly ascertained. Dumbarton is built upon the eastern bank of the Leven, which almost encircles it. The greater part of the town is composed of one main street, lying in a semicircular form round the head or west end of the peninsula. At the height of the tides it is flooded by the waters of the Leven. It was erected into a royal burgh by Alexander II. in the year 1221, and declared to be free of all imposts and burgh taxes; it afterwards received other charters from succeeding monarchs; and, finally, it obtained a confirmation of the whole from James VI. The subsequent history of the burgh is destitute of interest. It naturally partook of the fortunes and misfortunes of the adjacent part, of which it was in reality a dependency. Besides the main street, there are some bye thoroughfares, lanes, and detached houses, and a suburb on the western side of the Leven, leading to Renton. It is connected with the latter by a good stone bridge of five arches, 300 feet long. The waters of the Leven form a commodious harbour, and, for the benefit of trade, an excellent quay and capacious dock have been formed. Ship-building is carried on to some extent. The principal article of manufacture and export is glass. The glass-works, which are situated to the north-west of the town, give employment to a great number of individuals; and the article made is considered as equal to any manufactured in Britain. The other and inferior manufactures of Dumbarton are leather, glue, some linen, beer, &c. with a considerable quantity of goods for the Glasgow market. In recent years the intercourse and trade with Glasgow have been much extended by means of steam navigation. Dumbarton has an important cattle market every year on the 4th of June. There are two other fairs throughout the year, and the town has a large weekly market on Tuesdays. The burgal government of the town consists of a provost, an elder and younger bailie, a dean of guild, a treasurer, five merchant councillors, and five trades councillors from the same number of incorporated trades. The town has an excellent grammar-school, and a good subscription library. A branch of the Commercial Bank is settled here, and there are a number of agents of insurance offices. A very excellent jail has recently been erected. The church of the burgh and parish is a handsome modern structure with a spire and clock. There are also in the town and its vicinity a burgher and relief meeting house, and a Roman Catholic chapel. The town is the seat of a presbytery in the synod of Glasgow. By the late reform act Dumbarton joins with Kilmarnock, Rutherglen, Renfrew, and Port Glasgow in returning a member to parliament. The situation of Dumbarton Castle is eminently picturesque. The buildings composing the fort are perched on the summit of a rocky mount, shooting up to the height of 206 feet sheer out of the alluvial plain on the east side of the debouche of the river Leven. To the west of the castle there are rocky eminences on the verge of the Clyde, of a similar fabric, though less detached. The rock of Dumbarton measures a mile in circumference at the base. It diminishes in breadth near the top, which is cloven into two summits, of different heights. The rock is basalt, and has a tendency to the columnar formation. Some parts of it have a magnetic quality. The fortress, naturally strong, possesses several batteries, which command a most extensive range. The defences are kept in constant repair, and it is garrisoned by a limited body of soldiers and functionaries. The rock of Dumbarton has been occupied by works of a warlike character during the successive dynasties of 1800 years, and, as such, it is the most ancient stronghold in the country of which any record or tradition is preserved; nor is it necessary to observe, that it was the scene of many a gallant exploit to be found recorded in the annals of the country. Dumbarton is fifteen miles north-west of Glasgow, and fifty-nine west of Edinburgh. The population of the burgh and parish amounted in 1821 to 3481, and in 1831 to 3623.

DUMBLANE, a town of Scotland, in the south-western portion of Perthshire. It is delightfully situated on the eastern bank of the river Allan, at the distance of forty-one miles from Edinburgh. In the middle ages this place was distinguished as being the seat of a convent of Culdees, and continued to be so till about the twelfth century. Dumblane was constituted the seat of a bishop by David I. Amongst those who, subsequently to the reformation, filled the chair, was the celebrated philanthropist Robert Leighton, who bequeathed his valuable library to the cathedral and diocese. It is still in existence, and has been augmented by several donations. Dumblane is at present only a village, consisting of a single street of an old-fashioned character, with various diverging lanes. A mineral well in the neighbourhood causes an influx of visitors during the summer months. The chief attraction of Dumblane is what was once the cathedral of the bishop, the choir of which is now the parish church. It is a large Gothic edifice, with a steeple of modern erection of 128 feet in height. Besides the parish church, there is a dissenting meeting-house. There is here a weekly market, and there are also four annual fairs. The population of the town and parish amounted in 1821 to 3135, and in 1831 to 3228.

DUMBNESS, the privation of speech. See DEAF AND DUMB.

DUMBOWITSKA, a circle in the western part of Wallachia, between the rivers Ardfisch and Aluta. It is watered by the streams of the Ardfisch, Jalomitza, and Dumbowitska, and contains one city, Tergovst, and 164 villages.

DUMFRIES, a county in the south of Scotland, is situated between 55. 2. and 55. 31. north latitude, and 3. 53. west longitude. Its greatest length is nearly sixty miles, and its greatest breadth from thirty to thirty-one. The boundaries are Galloway and part of Ayrshire on the south-west; Roxburgh, Selkirk, and Peebles, on the north-east; Lanark on the north-west; and on the south-east the Solway Frith and the county of Cumberland. The principal rivers are the Nith, the Annan, and the Esk, all of which discharge themselves into the Solway Frith. These rivers are fed by numerous tributaries, and the whole of them abound in salmon. The square miles of the county are calculated at 1006, and the acres at 644,385. Like many other Scottish counties, Dumfriesshire is popularly divided into districts. Of these there are three principal; Eskdale on the east, Annandale in the middle, and Nithsdale on the west, each taking its name from the river which traverses it. From these larger divisions diverge smaller vales, which likewise derive their titles from the streams that flow through them, such as Moffatdale, Dryfesdale, and Ewesdale. From various circumstances, the limits of these great divisions are but imperfectly defined, and have recently been abandoned. The Solway Frith waters the base of the county for twenty-four miles, and along its margin the land is generally flat for about ten miles. Beyond this the county expands into a series of hills and valleys, which rise gradually northward till they reach the mountain chain which bounds it in that quarter. The principal elevations are, Lowthers near Wanlockhead, which rises 3150 feet, and Hartfell in Annandale, which rises 2629 feet above the level of the sea. In former times it was said that 86 miles were in general low arable land, lying on the sea-coast, 322 miles chiefly hilly, and 598 mountainous. But the calculation has been disturbed by the steady progress of bone manure and green crop husbandry. Steeps which it was impossible to sharpen by common manure, from the expense and difficulty of transporting it thither, have been brought into excellent heart by ground bones, and improved by at least a hundred per cent. both as crop and pasture land. Many hills which were nearly bare have been covered to their tops with thriving plantations. In the spring of 1833 the Duke of Buccleuch inclosed and planted nearly three hundred acres, on which are now growing more than a million and a half of trees; and it is his grace's intention to prosecute these improvements a great way further. Still a large proportion of the county is mountainous, and is devoted almost exclusively to sheep farming, which, since the mortality of 1829, has again become very profitable. Judging from the map, nearly a third of the land in the county belongs to the nobleman above mentioned, who possesses a rental of one hundred and fifty thousand pounds yearly, two thirds of which are drawn from Dumfries-shire. In 1811, when the property-tax pressed on the energies of the country, the whole rental of the county was estimated at L.246,001. 12s. 6d.; and although rents have fallen greatly since that period, so marked has been the progress of improvement, that at present (1833) it in all probability exceeds L.300,000 sterling. The principal proprietors are the Duke of Buccleuch, the Marquis of Queensberry, and the Earl of Mansfield; Mr Hope Johnstone of Annandale, General Sharpe of Hoddam, Mr Rogerson of Dumcrieff, Mr Mentcath of Closeburn, and Mr M'Alpine Leny of Dalswinton.

The climate of Dumfriesshire is mild and salubrious; much of the land has a southern exposure, and, excepting in very severe winters, the snow speedily disappears. The soils are gravel or sand loam, and clay, with moor and moss in some places, particularly along the bed of the Lochar, with alluvial tracts on the banks of the rivers and the Solway Frith. The farms vary greatly in size; but for years there has been a tendency to uproot almost entirely the pendicle system. On the Buccleuch estates the farms are generally extensive. Many excellent steadings of houses have been built, and subdivisions formed over waste tracts, which for centuries remained uninclosed. Since the war the wages of rural labour have been pretty stationary. The usual rate of wages for a ploughman is six pounds per half year, with board and lodging in the case of unmarried men, and a proportionate allowance of meal, potato-land, &c. for hinds with families. House and dairymaids receive from L.2 to L.2. 10s. per half year; day labourers 1s. 2d. a day in winter, and 1s. 6d. in summer.

At one time the quantity of lime used, or at least worked, in Dumfriesshire, was very great, and it is still far from being inconsiderable. The principal pits are those of Kilhead, Closeburn, and Barjarg; and within the last fifteen years the supply was estimated at 1,200,000 Winchester bushels, valued at L.54,000. The capabilities of the pits are still excellent, but the demand for lime has diminished somewhat, owing to the continued progress of bone dust, a manure which unites to a certain extent the qualities of lime and common dung. Annandale and Nithsdale have profited greatly by this valuable mineral. Mr Menteath of Closeburn is a great land improver, and has converted bogs which were hardly worth five shillings an acre into some of the finest pasture land in the county, by the combined effects of pairing, careful selection of seed, the application of lime, and irrigation. Cattle and sheep are bought at the Falkirk trysts, and fattened during winter and the early part of spring. The latter branch of traffic is yearly extending. The indigenous breed of cattle is still the Galloway, although not always pure and unmixed. Of heavy or drove cattle, about 20,000 head are driven south annually, and their value in good years amounts to nearly L.200,000. Of the sheep fattened no census has yet been given, from the circumstance that they are mostly conveyed in steam-boats. Mutton has risen in price in the home markets; and there can be no doubt that steam navigation is rapidly equalizing prices in town and country. The sheep are of three kinds; black-faced, Cheviots, and half-breds, the latter being a cross between the Leicester and the

Cheviot. Until 1820, hardly a single half-bred appeared at Lockerby Hill; now, however, they are quite common, and appear to be gaining as fast on the Cheviots as the latter are gaining on the black-faced. Pig husbandry is much cultivated in Dumfries-shire and Galloway; and a large proportion of the hogs reared in the stewartry are sold in Dumfries, and cured in Annandale and Cumberland. The curing trade lasts for about three months, commencing in December and ending in February. The sales are all paid in ready money, and instances have occurred in which green pork to the amount of L.6000 has been sold before breakfast on a Wednesday morning. The curers have good and bad seasons; but the capital required induces caution, and it is a fact that bankruptcy is nearly unknown among the bacon traders of the district. The hams of Dumfriesshire are so much esteemed that they are frequently sold in London under the name of Westphalian. Those who farm pendicles trust mainly to their pigs when rent-day comes round; and the trade every year brings L.3000 into Johnstone, which is equal to the landed rental of the parish. Its annual value to the district, including the curer's profit, must be very nearly L.100,000 sterling.

The manufactures of the county are dressed leather, hosiery, clogs, and carpets. The cotton mill at Langholm has ceased to work, and such weavers as remain there are supplied with webs by the manufacturers of Carlisle. In Dumfries and other parts of the district the same class of persons derives employment from the city of Glasgow. The hosiery trade exceeds L.20,000 per annum, and that of dressed leather is probably double this amount. The carpet and spinning and dyeing manufactory at Crawick Mill, in the neighbourhood of Sanquhar, employs 150 persons, young and middle aged. It consumes nearly 5000 stones of wool, and produces 70,000 yards of carpeting yearly. The wages average from L.180 to L.200 monthly.

Although, as we have already remarked, Dumfriesshire is mountainous, its lakes are inferior to those of Galloway, both as to number and extent. We must make an exception, however, in favour of the Castle Loch of Lochmaben. Bruce's castle stood on a promontory on the farther side of the loch; but it is so much dilapidated that such artists as sketch it contrive to hide the nakedness of bare unashlared walls by the enlivening screen of green trees. In some of the lakes a singular fish is found, which naturalists term the vendace, and which is supposed to be peculiar to this place, if we except, perhaps, the lake of Geneva. At the "four towns of Hightae," in the neighbourhood, King Robert granted feus to a class of persons who were known as "the king's kindly tenants." Their possessions are small, but the land is rich, and they sit at almost a nominal rent. They are a peculiar race, who live in a little world of their own, and are beginning to feel the effects of continued isolation and intermarriage among the members of their own tribe. Loch Skene, about ten miles from Moffat, is the only other lake of consequence. It is 1300 feet above the level of the sea; the scenery around is stern and savage in a high degree; and its superfluous waters, in escaping to the strath or valley below, foam and leap from the dizzying heights above, and form the fine cascade called the *gray mare's tail.*

Considerable quantities of salmon are caught in the Nith, and in the stake-nets at Caerlaverock and Annan Water Foot. The finny tribes push into other streams, such as the Milk, the Esk, the Ewes, and the Wauchope; and in former times were speared in Moffat water. The supply of red fish is augmented by importations from Galloway.

The lower parts of Dumfriesshire consist of various varieties of sandstone, the layers of which generally dip to the Solway. There is a considerable body of limestone, as we have already observed. Iron in different forms is also found in the strata. Marl abounds in various parts, and of freestone and whinstone there is abundance everywhere. Marble is also procured, and employed for some purposes; a little slate is likewise found. Coal in considerable quantities exists at the two extremities of the county, Sanquhar and Langholm; and, with one or two exceptions, all the pits belong to the Duke of Buccleuch. Lengthened land-carriage prevents the tacksmen from competing with the coal miners of England; and consequently the town of Dumfries and many parts of the county are supplied with fuel from Workington and Maryport. The trade employs a considerable amount of tonnage. The lead mines at Wanlockhead and Leadhills belong to the Duke of Buccleuch and the Earl of Hopetoun. Their capabilities at present are nearly equal, but both have declined greatly, from the importation of Spanish lead, the increased difficulty of working the shafts, and the poverty of the ore. For thirty years previously to 1828 each of the places mentioned produced about 700 tons of smelted lead annually; the price was L.23 per ton, and the gross revenue L.20,700. The Duke of Buccleuch and the Earl of Hopetoun received a sixth part each of the produce as rent, and netted respectively L.3450 per annum. Both have reduced the rent; the first to one twelfth, and the second to one eighth of the produce; and their incomes from this source have fallen to L.700 and L.1000 annually. Neither mine at present produces more than 650 tons of smelted lead annually, and the price has fallen to L.13 per ton. The consequences may be anticipated. Wanlockhead and Leadhills are no longer what they were, whether as regards the numbers, the comfort, or the intelligence of the mining population.

The mineral waters of Moffat are well known, but the spas in other parts of the county are too obscure to require special notice. The chalybeate at Hartfell acts as a powerful tonic, and contains, of sulphate of iron eighty-four grains, sulphate of alumina twelve, oxide of iron fifteen, and five inches of azotic gas, in a wine gallon. This spring was discovered about eighty years ago, but is too remote from the village to be of much use. The other spring, which is much more accessible, is strongest and best at the fountain-head, and probably the walk or ride (about a mile and a half) does as much good to invalids as the water. The Moffat Spa contains, muriate of soda thirty-six grains, sulphuretted hydrogen gas ten cubic inches, azotic gas four inches, carbonic acid gas five inches. More than two centuries have elapsed since this spring was discovered. A few years ago baths, with a pump and reading-room, were erected by subscription in Moffat, at an expense of L.2000; an immense improvement, which has greatly increased the annual number of visitors. Annan, Lockerby, and Langholm, are all thriving, well-built towns. The scenery of the latter place is much admired, particularly the ride along the banks of the Esk to Longtown.

The county sends one member to parliament, and the united burghs of Dumfries, Annan, Lochmaben, Sanquhar, and Kirkcudbright, a second. The population amounted in 1821 to 70,878, and in 1831 to 73,770, increase 2892.

Dumfries, the capital of the above county, is a royal burgh of considerable antiquity, although the period at which it became incorporated is not exactly known. During the border wars it was frequently stormed, and the public records were destroyed. The current belief, however, is, that it received its charter before the middle of the eleventh century, as a gravestone was discovered a number of years ago, bearing the date 1079, and mentioning that the individual whose ashes it covered had been conspicuous as a merchant and burgess of the town. From this time it gradually increased in importance; and in the year 1307, Edward the Second appointed the estates of Scotland to assemble on the banks of the Nith. In certain chronicles the ancient name of the town is said to have been *Cotiac*, but this we suspect is mere fancy. It seems much more probable that, like many other places, it derived its name from its physical appearances and character. In remote times the Gaelic was spoken on both sides of the Frith of Forth; and we concur in the etymology of Mr George Chalmers, who conceives the word to be composed of *dun* a castle, and *fries* a ridge. Dumfries, which may be regarded as the capital of the south of Scotland, is beautifully situated on the left bank of the river Nith, thirty-five miles below its source, and upwards of ten above the point where its waters mingle with and are lost in the Solway. The Nith in point of size ranks fifth among the rivers of Scotland, and is navigable from Carsethorn to Glencaple quay, even for vessels of considerable burthen. In consequence of the extraordinary manner in which the tides ebb and flow in the Solway during the winter months, the river is similarly affected.

The origin of the town appears to have been owing to a strong castle, which flourished as a border fortress during the twelfth century, and frequently became an object of contention, both prior and subsequent to the times of Wallace and Bruce. Of this stronghold not a vestige remains; but the street occupying the ground on which it stood retains the name, and is likely to do so till the latest ages. In razing what remained of this place of strength, the local authorities, more than a century ago, found materials for building the new church. The Gray Friars, like the castle, attracted settlers; and, as early as the thirteenth century, the old bridge was planned and built at the expense of the Lady Devorgilla, third daughter of Alan, lord of Galloway, and grandmother to John Cumin, who was slain by Robert Bruce in the above-mentioned cathedral in the beginning of the year 1305. Originally it consisted of thirteen arches, and was guarded at the middle by a gate or port, which was removed in 1769, to lessen the central pressure when the structure became frail. This bridge, which still remains, and is crossed every day by foot passengers, was certainly a wonderful erection for the time; and, accordingly, the writer of a work entitled *A Journey through Scotland*, published by J. Pemberton, London, in 1723, says, "I passed the river Nith from Galloway to Dumfries over a fair stone bridge of thirteen arches, the finest I saw in Britain next to London and Rochester." A right of toll was attached to the bridge, which in 1789, according to Captain Grose, yielded a yearly rental of three hundred pounds, and which at the present day, a little higher up the river, produces to the town five hundred pounds sterling. The new bridge was commenced in 1793, and finished in 1795. The original contract price was L.4500, but as no rock could be found at one point, the landstool on the Dumfries side was founded on piles of wood, and for this the commissioners of supply allowed an additional sum of L.500.

After Bruce had committed the crime already mentioned, and commenced that career which terminated at last in the redemption of his country from a foreign yoke, he became a mark for the vengeance of Edward of England. His friends and adherents also suffered along with him. Amongst these, Sir Christopher Seaton was betrayed by a pretended friend of the name of Macnab, apprehended at the Castle of Lochore in Fifeshire, marched to Dumfries, and barbarously executed on the Gallows-Hill, a slight eminence on the north-eastern side of the town, better known by the name of the Christell Chapel. Bruce sincerely regretted his fate, and, in the words of Sir Richard Maitland of Lethington, said, "'It is ane pity that sa noble ane knight should die sa cruel ane dead.' And incontinent in the same place where he was standing when the tidings came to him, garred found a chapel in honour of the Virgin Mary; and, in remembrance of the said Sir Christell, founded a priest to devine service therein perpetually, and pray for the said Sir Christell; and gave to the said priest and his successors the sum of L.5 sterling, to be taken of the barony of Carlaverock, for their sustenation." The ruins of the Christell Chapel were visible in the beginning of 1715; but when the Jacobite rebellion broke out in Scotland, the inhabitants of Dumfries hastily constructed a rampart, and during the operation the ruins of the old chapel disappeared, the line of fortification having passed close by their site. It is evident, from the traces of the foundation, that the building must have been very small. When Lord Scroop made an excursion in 1570 for the purpose of plunder, the chief magistrate of Dumfries, at the head of the burgesses, joined Lord Maxwell in opposing the invaders. They fought gallantly, but were unfortunately defeated. Dumfries suffered considerably during the reigns of Charles the First and Second. In 1617 it was visited by James the Sixth whilst returning to England. It was at this period that the incorporated trades received from James what is called the "siller gun," which was ordered to be shot for at stated periods, with the view of fostering their martial spirit, and skill in the exercises performed at the wappinshaw. This relic is still in existence, and the custom is yet observed at the distance of seven or nine years, more as a holiday exercise than for any other purpose. The trades muster in great strength, borrow guns far and wide, spend three fourths of the day in shooting, return to an entertainment in their hall in the evening; and the "siller gun," after being won, is worn for a short period by the best marksman. This festival forms the subject of a poem, written by Mr John Mayne, and which is praised for its humour and spirit in the notes appended to the *Lady of the Lake*.

Almost no town in Scotland stood forward half so prominently as Dumfries did at the period of the union in 1707. On the 20th of November of the preceding year, according to Chalmers, two hundred Cameronians entered the burgh, issued a manifesto against the great pending measure, and burnt the articles at the market-cross. The last commotion of any consequence occurred in 1715, when the Viscount Kenmure hung on the heights of Tenwald, willing to do mischief, and yet timid as to the means and manner of attack. By a well-managed stratagem he was induced to depart; and this is believed to have been the last occasion on which the ancient war-cry of the town, "Lereburn," or "A Lereburn," was heard.

Dumfries is the seat of a presbytery, synod, sheriff's court, record of sasines, and four banks, branches of the principal companies of Scotland. There are two churches in connection with the establishment, an episcopalian, a catholic, and a number of other chapels supported by dissenters.

In 1745, the Pretender and his rebel army, whilst retreating from England, paid a domiciliary visit to the town of Dumfries; and for a misdemeanour committed against some of his followers on their march southward, the town was compelled to pay a fine, which amounted altogether to L.4000 sterling. In 1750, however, the crown granted to Dumfries L.2800 out of a forfeited estate.

Hosiery, leather, hats, wooden shoes, and baskets, are the only manufactures worth naming in Dumfries. Cotton checks at one time were woven on speculation in considerable quantities; but the trade has declined. The stocking trade gives employment to about 300 persons, and produces annually not less than L.20,000 sterling. The tanning trade, as regards money, is also considerable. An extensive grazing district is fertile in hides, notwithstanding the great number of bullocks that are driven south; and in good years dressed leather brings a return amounting to about L.30,000. Wooden shoes or clogs were long peculiar to Dumfriesshire and the lower part of Galloway; but the trade is increasing, and promotes greatly the health of such as are exposed to outdoor labour. Of these shoes more than L.1000 worth are annually disposed of in Dumfries alone.

In the year 1831 the tonnage of Dumfries stood as follows: Foreign vessels inwards 1071 tons, coasting do. 20,463, goods 6320, coal 11,461, and lime 219; income to the commissioners of navigation L.870. 12s. 8d. In the same year vessels that cleared outwards paid duty on 5123 tons register, and on goods 2735 tons. Foreign vessels are charged at the rate of sixpence per ton, coasters twopence; goods one shilling and twopence, and lime and coal sixpence. The united income of the commissioners in the year above mentioned amounted to L.1072. 17s. 4d. The exports consist chiefly of grain, bark, wool, and hosiery; and the imports of coal, timber, and goods.

The infirmary was built more than fifty years ago, and the hospital or poor-house in 1753. Both are well endowed, though supported partly by subscriptions; and the former expends fully L.1000 annually on medicine and other necessary outlays. The infirmary, since the time it was founded, has received in the shape of donations L.18,000, and the hospital L.6000; and the expenditure of the latter is about L.600 annually. In connection with such institutions, it may be noticed that the town was some time since left nearly L.100,000 to be employed for charitable purposes. Dumfries possesses an excellent academy, where Greek, Latin, French, English, mathematics, geography, drawing, &c. are taught. It has also a very handsome theatre. In 1826 a gas-work was erected in Dumfries, and has since flourished well. There is a weekly market, which is held on Wednesday, when a great deal of business is transacted.

Since the year 1817, Dumfries has improved rapidly in appearance, although nearly stationary as to population. The High Street, which is broad and spacious, is one continued series of shops, which are nearly as handsome as the same description of buildings in Edinburgh or Glasgow.

St Michael's church-yard attracts the notice of all strangers. It is to a great extent a city of tombs, and has been frequently referred to as the Westminster of Scotland. Many of the monuments are very beautiful; and amongst these there is a sumptuous one over the ashes of the celebrated poet Burns.

The situation of Dumfries is admired by all tourists. With the exception of the point where it dips to the ocean, it is surrounded by a chain of hills, many of which are green to the top, and undulate in a very pleasing manner. In point of latitude, Dumfries is nearly a degree farther south than Edinburgh, and considerably more than a degree in climate. The chilling east winds which prevail so much on the east coast of Scotland are but little felt on the banks of the Nith; and pulmonary complaints, though not unknown, are comparatively unfrequent.

In 1831 the population of Dumfries, burgh and parish, was returned at 11,606 souls, being an increase on the preceding census of 554. Apart from the landward part of the parish, Dumfries contains about 9500 inhabitants. In Troqueer, on the opposite side of the river, the present population is 4665; but here again there is a distinction between the burgh and the parish, Maxwelltown containing above 3000 inhabitants, and the country part of Troqueer little more than 1000. Both localities are recognized in law, the one being a royal, and the other a burgh of barony of some standing; and as they are merely divided by a running stream spanned by two stone bridges, they may be considered as forming parts of the same town. The population in round numbers is 13,000.

DUMONT, Etienne, or Stephen, the friend, and often the Mentor, of Mirabeau, the redacteur of the principal works of Jeremy Bentham, and one of the most remarkable men of his time, was born in the month of July 1759 at Geneva, of which his family had been citizens of good repute from the days of Calvin. Shortly after his birth his father died, leaving a widow and five children wholly unprovided for. But the good widow, though placed in such destitute circumstances, and supported by little except the courage inspired by maternal affection, found means to educate her children in a place where necessary knowledge was accessible, and poverty not disgraceful. Induced by an anticipation of future eminence, seldom more happily realized, she accordingly contrived to send Stephen to the College of Geneva, where he justified her determination and the sacrifices necessary to carry it into effect, not only by his ability and proficiency, but by the virtuous purpose to which he turned his earliest attainments; for ere long, he not only defrayed the cost of his own education, but even contributed to the support of the family, by assisting the private studies of his comrades in the capacity of *répétiteur;* an office somewhat resembling that of a private tutor in our academical system, and having for its object to prepare the students for examination in the public class, by "grinding" them on the contents of the preceding lecture. Having completed his academical course, he took clerical orders; and in the year 1781 he was chosen one of the pastors of the city, where his talents as a preacher soon attracted general notice, and gave promise of his becoming one of the most brilliant and persuasive of pulpit orators. But the political troubles which disturbed Geneva in 1782 suddenly turned the course of his life into a different channel.

Two parties of opposite principles, one being attached to the authority of the magistrates, and the other anxious to extend the privileges of the people, but most widely separated as to the extension or limitation of the right of suffrage, had long divided that republic; and the disputes of these parties gained lustre from Jean-Jacques Rousseau, the most wayward, moody, and perverse of all the men of genius who have approached the borders of insanity, which, indeed, he appears more than once to have overpassed. The more liberal party received the name of *représentans,* or *petitioners,* from a representation presented by them against the legality of the proceedings of the magistrates respecting the writings and person of that celebrated but unhappy man; whilst, on the other hand, the magistrates, who refused the prayer of the petition, and their adherents who supported them in this refusal, were thenceforward called the *negatives.* During twenty years a struggle had been maintained between these parties with various success, but without bloodshed, though certainly not without violence. At length, in the autumn of 1782, when the petitioners had gained the ascendency, the courts of Versailles and Turin, in concert with the canton of Berne, surrounded Geneva with an armed force, and, under pretence of some ancient guarantees, imposed a new constitution on the republic, and at the same time compelled the leaders of the representative party to fly from their country.

Dumont was not included in the proscription. But his heart had been touched with the love of liberty; he could endure chains nowhere patiently, and chains at home, where he was free by birthright, not at all. He therefore became a voluntary exile, and went to join his mother and sisters at St Petersburg, a city to which many Genevese had carried their honourable patrimony of ability and knowledge. In this he was probably influenced in part by the example of his townsman Lefort, who was the first tutor, minister, and general of the Czar At St Petersburg he became pastor of the French church, an office he filled for eighteen months, during which time he obtained the consideration due to his great merit and excellent character. But his views were directed towards Great Britain, where most of the Genevese exiles had taken refuge, and where some of them were actually employed in negociating with government for permission to establish a Swiss colony in Ireland. He left St Petersburg in 1785; and soon after his arrival in London went to reside with Lord Shelburne, then a minister of state, who confided to him the education of his sons. Lord Shelburne, afterwards Marquis of Lansdowne, a man distinguished for his cultivation of the society of men of letters, foreign as well as native, soon discovered the great talents of Dumont, who gradually became a friend, or rather member of the family; and it was at the house of this minister that he became acquainted with some of the most illustrious men of the country, amongst whom may be mentioned Fox, Sheridan, Lord Holland, and Sir Samuel Romilly. His connection with these and other distinguished individuals, founded upon friendship, similarity of opinions and literary occupations, and the pursuit of great objects of public utility, gave them full opportunities of appreciating his worth. He was generally known as a man of profound knowledge, correct judgment, irreproachable character, and brilliant wit, and esteemed for the possession of these high and invaluable qualities, which were exemplified throughout the whole course of his life.

About this time began his close connection with Sir Samuel Romilly, "a man," says Sir James Mackintosh, "whose whole excellence will be little understood by the world, until they see the narrative traced by himself of those noble labours of self-education, by which he taught himself every sort of ability which is necessary to serve mankind, and still more of that self-discipline by which he at length formed a character yet more exalted than his genius, composed of a probably unparalleled union of tender affection with unbending principle, and producing those dispositions towards the magnanimous and heroic which were hidden from the vulgar by the solemn decorums of a formal profession, and are seldom found to be capable of breathing so long under the undisturbed surface of a well-ordered and prosperous community. The habitual or mechanical part of Romilly's life was necessarily governed by those of his profession and country. The higher element, however, secretly and constantly blended itself with every thought and feeling; and there were moments when his moral heroism carried the majesty of virtue into the souls of the perplexed and affrighted vulgar." The friendship which united these two remarkable men increased daily; nor did its ardour or activity cease, until death unexpectedly rent asunder the tie which bound them together, and left Dumont inconsolable for the loss of his departed friend, whom he never mentioned without tears. There was a third in the circle, who is very strikingly described by Sir James Mackintosh.

"Among the closest friends of Romilly and Dumont was George Wilson, a man little known beyond the circle of his friends and that of his contemporaries in the profession of the law, and one whom it would be difficult to make known to others, without the use of that language of vague panegyric, the abuse of which had more lowered it in his own eyes, than even in those of most men of modesty and taste. It might be said by as unaffectedly conscientious a man as himself, if such another there be, that among those who thoroughly knew him, the degree of esteem for him was always considered as exactly indicative of the degree of sagacity and purity of the man who entertained it. Yet even he was not more upright and benevolent than his two friends; though, having less vivacity than the one and less ardour than the other, he was not so liable to be allured by imagination from the rigid observance of the severe maxims of that moral prudence which is the safeguard of virtue. With a keen relish for pleasantry, and perfectly exempt from all gloom and harshness, he yet shunned the amusement of Wilkes's conversation, solely from deference to morality. When Mirabeau visited England about 1786, Wilson did not follow the example of his friends in cultivating the society of that extraordinary man, whose ill-trained fancies were better adapted to sudden felicities than to composition, and whose conversation was animated by an irregular benevolence, neither smothered by the profligacy of his youth, nor altogether extinguished by the intrigues and corruptions of his latter years."

In 1788 Dumont undertook a journey to Paris in company with Romilly; and it was under the auspices of the latter that he first became acquainted with Mirabeau. During a sojourn of two months in the French capital, he saw that extraordinary man almost every day; and a certain affinity of talents and pursuits led to an intimate connection between two persons diametrically opposed to each other in habits and in character. It was after his return from Paris that Dumont commenced his acquaintance with Mr Bentham; a circumstance which exercised a powerful influence over his future opinions, and, as it were, fixed his career as a writer on legislation. Filled with admiration for the genius of Bentham, and profoundly impressed with the truth of his theory, and the important consequences to which it immediately led, Dumont applied all his talents to make the writings of the great English jurist generally known, and devoted the greater part of his life in order to render available to the world at large the inexhaustible store of knowledge which the active mind of Bentham was continually increasing. We may mention here, that the following works are the result of that confraternity of genius, talents, and labour, which was thus established, viz. *Treatises on Legislation*, published in 1822, in 3 vols. 8vo, now (1833) in the third edition; *Theory of Punishments and Rewards*, 2 vols. 8vo, also in the third edition; *Tactics of Legislative Assemblies*, two editions, 1815 and 1822; *Judicial Evidence*, published in 1823, second edition 1830; and *Judicial Organization and Codification*, 1828, 8vo. Of course we make no mention here of the numerous editions published in foreign countries.

In the summer of 1789, that season of promise and of hope, especially to a Genevese exile, Dumont suspended his labours in England in order to proceed to Paris along with his friend Duroverai, ex-attorney-general of the republic of Geneva. The object of the journey was to obtain through M. Necker, who had just returned to office, and by means of the events which were then passing in France, an unrestricted restoration of Genevese liberty, by cancelling the treaty of guarantee between France and Switzerland, which prevented the republic from enacting new laws without the consent of the parties to this treaty. The proceedings and negociations to which this mission gave rise, necessarily brought Dumont into connection with most of the leading men in the Constituent Assembly, and made him an interested spectator, sometimes even a participator, indirectly, in the events of the French revolution. The same cause also led him to renew his acquaintance with Mirabeau, whom he found occupied with his duties as a deputy, and with the composition of his journal, the *Courrier de Provence*, in which he was assisted by Duroverai, Clavière, and other Genevese patriots. For a time Dumont took an active and very efficient part in the conduct of this journal, supplying it with reports as well as original articles, and also furnishing Mirabeau with speeches to be delivered or rather read in the assembly. This is now completely established by his highly instructive and interesting posthumous work entitled *Recollections of Mirabeau.* In fact, his friend George Wilson used to relate, that one day, when they were dining together at a table d'hôte at Versailles, he saw Dumont engaged in writing the most celebrated paragraph of Mirabeau's address to the king for the removal of the troops, which was believed to have been written by the orator himself. He also reported such of Mirabeau's speeches as he did not write, and, with a disinterested sacrifice of his own reputation to the diffusion of what he considered as truth, embellished and strengthened them from his own stores, which were inexhaustible. But this co-operation, so valuable for Mirabeau, and so self-devoted on the part of Dumont, was destined soon to come to an end; for, being attacked in pamphlets as one of Mirabeau's writers, he felt hurt at the notoriety thus given to his name in connection with a man occupying Mirabeau's peculiar position, and resolved to return to England, which he accordingly did in 1791. The reputation of being a subaltern writer was, as he himself states, by no means flattering; and the credit of an influential connection with a man whose character was far from being untainted alarmed his delicacy. He saw that he had no alternative but to put an end to a copartnership of which Mirabeau was certain to reap all the advantage, whilst the odium or discredit would alone fall to the lot of Mirabeau's associate; and he acted upon this conviction with a promptitude and decision worthy of his character.

In the eventful years which followed he continued to live chiefly at Lansdowne House, or at Bowood, where the most remarkable men of Europe as well as of Britain were frequent and welcome guests. Latterly, he began to form an intimate friendship with Lord Holland, whom he had known from childhood; and he became a member of the society of familiar friends, the habitual visitors at Holland House, who, during many years, saw a succession of celebrated guests of every country, party, religion, and of every liberal profession or station, which is likely to continue unmatched until another house be found that boasts such a master. "His mind was at that time in a most perfectly mature state, with much experience of very memorable events, and familiar intercourse with the most eminent men," besides an abundant store of amusing and striking anecdotes. "He had entirely subdued the popular and declamatory propensities which characterize youthful genius, yet without being in the least degree withdrawn from the love of letters and the delights of society by those scientific pursuits which occupied a subsequent period." In 1801 he travelled over various parts of Europe with Lord Henry Petty, now Marquis of Lansdowne, and brought back a fresher acquaintance with the mental occupations of the continental nations, from whom England had for years been separated by a wider and deeper channel than that formed by the hand of nature. But Dumont had then opened a new course of more serious occupations.

"In 1801 he published the *Traités de Législation;* the first fruits of his zealous labours to give order, clearness, and vivacity, to the profound and original meditations of Bentham, hitherto praised only by a very few patient readers, and but little better known, even by name, to the English than to the European public. The extraordinary merit of these writings, manuscript and printed, chiefly attracted his mind towards them; inferior circumstances, however, contributed their part to the fervour with which he devoted himself to them. Trained in the hasty and shallow philosophy which then reigned, metaphysical principles were a novelty, in the contemplation of which he was too agreeably employed to examine the solidity of the foundation on which they rested. Wearied with the common-places of philanthropic declamation, which passed for philosophy, he ran with eagerness into the opposite extreme of new terms, dry definitions, and simple principles. The method of Bentham is undoubtedly a powerful instrument for the discovery of truth, especially in the juridical part of moral science. It is, however, a method which may become more than mischievous, by the very circumstance of its apparent perfection.

"Supposing every other objection to that system to be answered, it will still be evident that the value of its application in every particular instance must be in proportion to the exactness and completeness with which every circumstance is enumerated that can affect the determination of the question. But the enumeration is not *complete,* merely because the names of all such circumstances are enumerated. It is not thus that the philosopher proceeds in those sciences where the success is uncontested. He calculates the *degree* of every force that acts on a body; he ascertains the *proportion* of every element which goes to make up a compound; and an error in either of these respects is, in truth and effect, a want of exact and complete enumeration, which may lead to the most false results. Such mistakes in the physical sciences are easily detected. In the moral sciences it is extremely easy *to seem* to form a complete theory by such general and vague inductions, because the means of quick and palpable detection are wanting. Wherever analysis is *really* exhaustive, it is the most perfect of instruments; but where it only reaches a semblance of exactness, it produces or perpetuates error in the exact proportion of its seeming approach to truth. There is no remedy against this dangerous distemper but the habit of never forgetting that, in each case, the main question always must be, 'How much of each enumerated cause is likely to act in the instance before me?' No show of accuracy, no superiority of method, can dispense with this question, or enable any man to answer it otherwise than by approximation. But with these high and arduous matters we must not deal more largely in this place. The talent with which M. Dumont performed his task is as generally acknowledged as the perfect disinterestedness which led him to employ so much talent in expounding the opinions and enlivening the reasoning of others. It is due to him to say, that he always considered the system as a model, to be always consulted and approached, but never imposed without a cautious regard to circumstances. It must also be observed, that however entirely he adopted the speculations, delighted in the method, and even acquiesced in the language of Bentham, that for which he really felt a warm zeal, and consecrated the labour of his life, was the practical establishment of that grand reformation of law, which owes indeed much to the writings of Bentham, and to the discussions which they daily contribute to spread and keep up, but which, so far from being peculiar to him, is zealously supported by those who dissent from his moral theories, and was common to him, at least in that more obvious part of it which relates to criminal law, with the philosophers of the eighteenth century, who pursued the same object, though with less distinctness of view, less precision of language, and less knowledge of the abuses to be reformed. The mind of Dumont moved onward with that of the reformers of jurisprudence throughout Europe. He does not needlessly question the singularities of his venerable master; but his attachment was to the main stock of reforming principle. Those who knew him need not be reminded, that if his principles have any tendency to a cold and low morality, they were in that respect altogether defeated by the nature of Dumont; a man of the utmost simplicity and frankness, of a most unusually affectionate and generous disposition. A man of so much letters and wit could not have worked into his practical nature any indifference to art and accomplishment, to real learning, or to the only eloquence which deserves the name."

In 1814 the restoration of Geneva to independence induced Dumont to return to his native place, which he loved with that fervour which can only be felt by the citizen of a small republic. He was immediately chosen a member of the supreme council, and by conciliating opponents, moderating partizans, and gaining the confidence and respect of all, he became in time its chief leader and ornament, as he would have been in more conspicuous and powerful assemblies. At the time of his death he had completed a code of law, which, as chairman of a committee appointed for that purpose, it would have been his duty to present to the supreme council on its assembling after its vacation; but at the moment when he was thus about to engrave his name on the annals of his beloved country, and to honour her, by rendering her, as he hoped, an example to Europe, he was cut off in the full vigour of his faculties, and on the eve of their most conspicuous exertion. In the autumn of 1829 he undertook a tour of pleasure, or rather of relaxation, to the north of Italy, in company with one of his friends, M. Bellamy Aubert; and his family were impatiently expecting his return when they received the tidings of his death. He died at Milan, in October 1829, in the seventy-first year of his age.

Dumont was wholly untainted by political or philosophical bigotry, which has corrupted so many of those who inveigh against every form of that vice. His friends at Geneva, at Paris, or in London, were very far from sharing his peculiar opinions. Surrounded by fifty-three nephews or nieces in the first or second degree, the issue or progeny of three sisters, he treated them with a patriarchal tenderness very foreign from the scorn of some Epicureans for "the charities of father, son, and brother." In his will he leaves legacies to all; touchingly assuring them that they must not measure his kindness by his bequests. In every instance of the youngest child, he seems, with the most affectionate solicitude, to have weighed the needs and desires of each, and to have considered all their little claims as worthy of conscientious consideration. His will, which is dated in May 1826, opens with an acknowledgment worthy of him. "I begin this testamentary disposition by an act of gratitude towards God, for having blessed me with a peaceable and independent life, which has owed its chief happiness to the charm of study and the enjoyments of friendship." Such was Dumont, a pattern of wisdom and goodness, the like of which it is seldom indeed given us to contemplate, in the ordinary course of this rude and selfish world. (*Notice of M. Dumont* by Sir James Mackintosh, *Foreign Quarterly Review*, No. ix.; *Recollections of Mirabeau*, preface; *Bibliothèque Universelle*, November 1829; *Revue Encyclopédique*, vol. xiv. p. 258.) (A.)

Dumont, *John*, a well-known publicist, was born in France in the seventeenth century. He followed the profession of arms, but not obtaining promotion so rapidly as he expected, he quitted the service, and travelled through different parts of Europe. He stopped in Holland with the intention of there publishing an account of his travels. But in the interval, at the request of his bookseller, he wrote and published several pamphlets, which were eagerly sought after, by reason of the unceremonious manner in which he treated the ministry of France. This freedom having deprived him of all hope of employment in his own country, he now thought of forming a permanent establishment in that where he resided; and the knowledge which he had already acquired of the relations and interests of different nations having led him to entertain the idea of opening a course of lectures on public law, he lost no time in carrying it into effect. The project succeeded far beyond his expectations; and some useful compilations which he published about the same period made him favourably known in foreign countries. The emperor of Germany appointed him his historiographer, and some time afterwards conferred on him the title of Baron de Carlscroun. He died at Vienna in 1726, at an advanced age. Dumont wrote with facility, but his style is deficient in vigour and correctness; nevertheless, his works are esteemed as containing a great number of documents valuable for history. The following is a list of the works published by Dumont: 1. *Nouveau Voyage au Lévant*, Hague, 1694, reprinted under the title of *Voyages en France, en Italie, en Allemagne, à Malte et en Turquie*, Hague, 1699, 4 vols. 12mo; 2. *Mémoires Politiques pour servir à la parfaite intelligence de l'Histoire de la Paix de Ryswick*, Hague, 1699, 4 vols. 12mo; 3. *Mémoires sur la Guerre présente* (1700), Hague, 1703, 12mo, reprinted under the title of *Recherches modestes des Causes de la présente Guerre, en ce qui concerne les Provinces Unies*, 1713, 12mo; 4. *Récueil de Traités d'alliance, de paix, et de commerce entre les Rois, Princes, et Etats, depuis la paix de Munster*, Amsterdam, 1710, 2 vols. 12mo; 5. *Soupirs de l'Europe à la vue du projet de paix contenu dans la harangue de la reine de la Grande-Bretagne*, 1712, 12mo; 6. *Corps Universel Diplomatique du Droit des Gens, contenant un Récueil des Traités de paix, d'alliance, etc. faits en Europe, depuis Charlemagne jusqu'à présent*, Amsterdam, 1626, and following years, 8 vols. fol. continued after Dumont's death by J. Rousset; and 7. *Battailles gagnées par le Prince Eugène de Savoie*, Hague, 1723. To the *Corps Universel Diplomatique du Droit des Gens* ought to be subjoined, 1. *L'Histoire des anciens Traités jusqu'à Charlemagne*, by Barbeyrac, 1739, in 2 vols. folio; 2. *Supplément au Corps Diplomatique, avec le cérémonial des Cours de l'Europe*, collected by Dumont, and arranged by Rousset, 1739, in 3 vols. fol.; 3. *Histoire des Traités de Paix du dix-septième Siècle*, by St Priest, 1725, in 4 vols. folio. Dumont was also the author of *Lettres Historiques contenant ce qui se passe de plus important en Europe*, 12mo. This periodical, which was commenced in 1692, and two volumes of which appeared annually, Dumont conducted till 1710, from which time it was continued by Basnage, with the aid of several collaborateurs, until 1728. The earlier volumes are much esteemed. (A.)

DUMPALIS, a spacious bay on the west coast of the island of Celebes, into which flow two considerable rivers. Good anchorage is found here, and the bay is much resorted to on account of the great quantity of fish which are found in it. At the bottom of this bay is situated the town of Dumpalis, which has a considerable trade. The inland merchants bring gold dust and a particular drug, which they dispose of to the inhabitants in the town, receiving in return tobacco, opium, white cloths, iron knives, and creeses. The natives here fight with poisoned barbed arrows, blown out of black ebony tubes; and are sure to kill at the distance of twenty yards.

DUN, or Burgh, the name of an ancient species of building, of a circular form, common in the Orkney and Zetland Islands, the Hebrides, and the northern parts of Scotland. The latter term points out the founders, who at the same time bestowed on them their native name of *borg*, a Sueo-Gothic word signifying a defence or castle; and the Highlanders universally apply to these places the Celtic name *dun*, signifying a hill defended by a tower, which plainly points out their use. They are confined to the countries once subject to the crown of Norway. With few exceptions, they are built within sight of the sea, and several of them within sight of each other; so that, on a signal by fire, by flag, or by trumpet, they could give notice of approaching danger, and afford mutual support. In the Orkney and Zetland Islands they are most frequently called *wart* or *ward hills*, which shows that they were garrisoned. They had their wardmadher, or watchman, a sort of sentinel, who stood on the top, and challenged all who came in sight. The gackman was an officer of the same kind, who not only had to watch against surprise, but was also bound to give notice if he saw any ships in distress. He was allowed a large horn of generous liquor, which he had always by him, to keep up his spirits. Along the Orkney and Zetland shores they almost formed a chain, and by that means not only kept the natives in subjection, but were situated commodiously for covering the landing of their countrymen, who were perpetually roving on piratical expeditions. These towers were even made use of as state prisons; for we learn from Torfæus, that after Sueno had surprised Paul, count of Caithness, he carried him into Sutherland, and confined him there in a Norwegian tower. Out of this kingdom no buildings similar to these are to be found anywhere, except in Scandinavia. On the mountain of Swalberg in Norway is one; on the Stir-biskop, at Upsal, in Sweden, is another; and on Umsborg, in the same kingdom, is a third.

These towers vary in their inner structure, but externally they are universally the same, though some have an addition of strength on the outside. The burgh of Culswick, in Zetland, notwithstanding it is built on the top of a hill, is surrounded with a dry ditch thirteen feet broad; that of Snaburgh, in Unst, has both a wet and a dry ditch, the first being cut with great labour through the solid rock. The burgh of Moura is surrounded by a wall, now reduced to a heap of stones, and the inside is cylindrical, not tapering, as is usual with others. The burgh of Hogster, upon an isle in a loch of the same name, has also the addition of a wall; a peculiarity in a causeway to join it to the main land, and a singular internal structure. Numbers of little burghs, with single cells, are scattered about these islands, in the neighbourhood of the greater, and were probably built by the poorer sort of people, in order to enjoy their protection. A multitude of places in these islands have the addition of burgh to their names, notwithstanding there is not a vestige of a tower near them, the materials having long since been carried away and applied to various uses.

DUNABURG, a circle in the Russian government of Witebsk or Witepsk, formerly a part of Lithuania. It is bounded on the north by Livonia, on the east by Resitka, on the south-east by Wilna, and on the west by Courland. It is watered by the Düna, which is joined by other streams, and fertilizes the land, which is highly productive of rye and flax, and maintains a large stock of cattle. It contains three cities, one town, and 1078 villages, with a population in 1797 of 47,785, in 1827 of 61,500 inhabitants. The extent is 328 square miles, or 190,000 acres. The chief city, of the same name, is situated on the Düna. It was formerly fortified. It contains a Greek and a Catholic church, and 4000 inhabitants.

DUNBAR, a royal burgh, post, and market town of Scotland, in the county of Haddington, is pleasantly situated on a gentle acclivity rising from the shores of the German Ocean, near the mouth of the Frith of Forth. It consists of one main street, which runs the length of the town, with several others of smaller dimensions which intersect it. The whole has a neat and commodious appearance. Dunbar is a place of considerable antiquity, and, there is reason to believe, was built by the Picts. It originated in a castle, once of great strength and importance as a bulwark for the defence of this route into Scotland, against the invasion of the English. The site of the fortress was well chosen both for defence and convenience. The coast is here bold, and studded with rocky islets along and within the margin of the sea; and these in early times afforded room for the battlemented walls of a fort, which gradually increased by connection with the adjoining land, and with the islets by walls of great strength. It was thus admirably adapted to receive succour by sea, or allow the escape of its keepers with impunity. We find it mentioned as early as the year 856, and subsequently it stands conspicuously prominent in the various conflicts in which Scotland was embroiled. It endured several memorable sieges, the most remarkable of which was that by the English in 1337, when it was defended by a female member of the Douglas family. The place is now a total ruin. The harbour and quay of Dunbar are on a confined plan, and the usual depth of water is scarcely sufficient to float vessels of 250 or 300 tons burden. The main evil of the port arises from the existence of various craggy islets and sunken rocks near the entrance, which renders the navigation somewhat dangerous. Contiguous to the inner parts of the harbour are some large granaries and storehouses, a small graving dock, and other conveniences for shipping, which, however, exists here to a very limited extent. There is a market on Tuesday, and there are two fairs annually. Formerly Dunbar was famous for its herring fishery, but that branch of trade has now almost totally disappeared. The manufactories of the town are a soap-work, an iron foundery, and a manufactory of steam engines. There is also here some small trade in corn. The most remarkable house in Dunbar is a large plain mansion, situated at the west end of the town, the property and residence of the family of Lauderdale. In 1819 a handsome new church was erected upon the old site, which was founded in the fourteenth century. The new building is in the semi-gothic style, and is internally commodiously and elegantly fitted up. Besides this place of worship, there are two Seceder meeting-houses and a Methodist chapel. There are two public besides several private seminaries of education in the town; and the charitable and other institutions are also extensive. The town is governed by a provost and three bailies, a treasurer, town-clerk, and chamberlain, with fifteen members of council. The annual revenue of the burgh is about L.1300. Dunbar lies twenty-eight miles almost due east from Edinburgh. The population, including the country part of the parish, amounted in 1831 to 4735.

DUNBAR, WILLIAM, the most eminent of all the early Scotish poets, appears to have been born about the middle of the fifteenth century. Notwithstanding the high reputation which he enjoyed among his contemporaries, the records of his personal history and character are extremely scanty; and although he belonged to the church, his progress is not to be traced by successive preferments. He describes himself as a native of Lothian. Kennedy represents him as related to the earl of March; but this perhaps is only to be considered as a poetical fiction, introduced for the purpose of heightening his invective. His latest biographer however supposes that he may have been the grandson of Sir Patrick Dunbar of Beill in the county of Haddington, a younger son of George the tenth earl of March. "This Sir Patrick," we are informed, "signalized himself on many occasions, and was one of the hostages for James the First in 1426; and it also appears from an original charter, dated August 10th, 1440, that one of his sons was named William, who in all probability was either the father or uncle of the poet. No other person of the same baptismal name can be traced during the whole of that century; and as such names generally run in families, the circumstance of our author's alleged descent from the earls of March, in connection with his own avowal respecting his birth-place, adds some strength to the conjecture of his being the grandson of Sir Patrick Dunbar of Beill."[1] During the present age, the births, marriages, and deaths of persons possessing little property and less distinction may in a great variety of instances be very easily traced; but as the same diurnal records did not exist in the fifteenth century, it is only where names are connected with property, rank, or office, that in most cases we can succeed in an attempt to discover the outlines of private or domestic history. Neither the name nor the surname was uncommon: at that period Scotland certainly contained many Williams and many Dunbars; and if numerous instances of this combination of name and surname have not been detected, it is not difficult to assign a reason.

In the year 1477, William Dunbar of St Salvator's College took the degree of A. B. in the university of St Andrews; and as the statutes required the candidate to be of three years standing, he must have been matriculated in 1474. In 1479 he took the degree of A. M.[2] Whether this was the poet, or another individual of the same name, we have no means of ascertaining: but there is an apparent coincidence in the time; and the supposition that he studied at St Andrews, is highly probable in itself. There is likewise some reason to suppose that he studied in the university of Oxford: "Quod Dunbar at Oxenfurde," is the colophon of one of his poems; and we need scarcely remark that Oxenford was once the current name of this seat of the Muses. But it is also to be recollected that the poet might visit Oxford in some other capacity than that of a student. In his youth he appears to have been a novice of the order of St Francis. His sentiments with regard to this profession we are enabled to glean from one of his poems; and those sentiments we shall here endeavour to exhibit in plain prose. "Before the dawn of day," says Dunbar, "methought St Francis appeared to me with a religious habit in his hand, and said, go, my servant, clothe thee in these vestments, and renounce the world. But at the sight of him and his habit I was scared like one who sees a ghost. And why art thou terrified at the sight of the holy weed? St Francis, reverence attend thee, and thanks for this intended benefit; but with regard to those garments of which thou art so liberal, it has never entered into my mind to wear them: sweet confessor, take it not in evil part. In holy legends have I heard it alleged that bishops are more frequently canonized than friars; if therefore thou wouldst guide my soul towards heaven, invest me with the robes of a bishop. Had it ever been my fortune to become a friar, the season is now long past: between Berwick and Calais, in every flourishing town of the English dominions, have I made good cheer in the habit of thy order; in friar's weeds have I mounted the pulpit at Dernton and Canterbury, in them have I also crossed the sea at Dover, and instructed the inhabitants of Picardy; but this mode of life compelled me to have recourse to many a pious fraud, from the guilt of which no holy water could cleanse me. What had thus appeared to me as St Francis, was a fiend in the likeness of a friar: he vanished away with stench and fiery smoke; methought he carried one end of the house along with him, and I awoke like a wight in perplexity."[3]

From this and some other passages of his works, it is evident that Dunbar had in some degree imbibed the spirit of a reformer; and it is obvious that in all countries which have in any measure been extricated from the superstitions and delusions of the Romish church, the poets have contributed to prepare the way for the theologians. Wit and satire, when thus directed, are formidable weapons; and although ridicule is no test of truth, it has often been found a powerful instrument for exposing inveterate error. The best arguments may be employed in vain, and force commonly interposes in behalf of established opinions: but poets have in all ages claimed and exercised considerable freedom of animadversion; and, as light troops are sometimes more serviceable than the heavy-armed soldiery, the gay satirist is sometimes more successful in his attacks than the learned controversialist. Another inference to be drawn from this poem is equally obvious: as the author had preached in England and France, he must have been familiarly acquainted with the languages of both countries; or, if we suppose him to have preached at Canterbury in his native tongue, we must at least conclude that he spoke French when he instructed the inhabitants of Picardy. His travels are likewise mentioned in Kennedy's Flyting, where we must however make some allowance for satirical exaggeration.

Fra Atrik Forrest furth ward to Drumfreiss
  Thow beggit with ane pardoun in all kirkis,
Collapis, crudis, meill, grottis, gryce, and geiss,
  And undir nycht quhylis thow stall staigis and stirkis.
  Becauss that Scotland of thy begging irkis,
Thow schaipis in France to be a knycht of the feild;
Thow hes thy clamschellis, and thy burdoun keild,
  Unhonest wayis all, wolroun, that thow wirkis.[4]

Dunbar, in one of his invectives against Kennedy, has furnished us with some further information respecting his own adventures.

Or thow durst move thy mynd malitius,
  Thow saw the saill abone my heid updraw;
But Eolus full woid and Neptunus,
  Mirk and moneless, wes met with wind and waw,
  And mony hundreth myle hyne cowd us blaw
By Holland, Seland, Zetland, and Northway coist,
  In desert [place] quhair we wer famist aw;
Yit come I hame, fals baird, to lay thy boist.

After the period of his travelling noviciate, Dunbar appears in the character of a court poet, and of a candidate for preferment in the church. On one occasion he speaks of his dancing "in the quenis chalmer."

Than cam in Dunbar the makkar,
On all the flure thair was nane frakkar,
And thair he daunsit the Dirrye dantoun;
He hoppet lyk a fillie wantoun,
  For luiff of Musgraiffe, men tellis me;
He trippet quhill he tint his pantoun:
  A mirrear dance mycht na man see.

Than cam in Maistriss Musgraiffe;
Scho mycht haiff lernit all the laiffe.
Quhen I saw hir sa trimlye dance,
Hir guid convoy and countenance,
  Than, for hir saik, I wissit to be
The grytast erle or duik in France:
  A mirrear dance mycht na man see.

But neither his dancing nor his solicitations seem to have procured him any considerable preferment. From the strain of his earlier compositions, it is evident that his first hopes were sufficiently sanguine, and from that of his later compositions, that those hopes had been completely frustrated. "Why shouldst thou," says the desponding poet, "be induced to hope for preferment, when an Italian impostor finds means to thrust himself into the chair of an abbot? How the affairs of the church are managed, I know not; but assuredly its benefices are not distributed with an impartial hand. While some enjoy seven, I am not possessed of one; and some, unworthy as they are to fill a stall, would fain climb to the rank of cardinal, a bishopric being too mean an object for their ambition." He addressed some stanzas to the king when many benefices were vacant; he frequently renewed his petition, and frequently complained that his life was suffered to wear away in fruitless expectation. From the wish which he expresses "To the King, that he war Johne Thomsounis Man," it may be inferred that Queen Margaret was anxious to promote his interest: the tenor of his prayer is, that the king were more subservient to the wishes of his consort.

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[1] Laing's Memoirs of Dunbar, p. 8.
[2] Ibid. p. 9.
[3] Dunbar's Poems, vol. i. p. 28.
[4] Ibid. vol. ii. p. 81.

> My advocat, bayth fair and sweit,
> The hale rejosing of my spreit,
> Wald speid in to my errandis than,
> And ye war anis Johne Thomsounis man.

Whether Dunbar's advancement was in any degree retarded by his own imprudence, can only be conjectured. The clergy of that age do not appear to have been generally promoted for their piety or learning; and so very moderate was the ordinary standard of external decency, that it must only have been the most gross and flagrant profligacy that could operate as a disqualification for preferment. It must however be acknowledged that some of his strains are highly reprehensible: his compositions are occasionally tinctured with expressions which we cannot but regard as grossly indecent and profane; one of his addresses to the queen is such as might offend a modern courtezan; the more solemn observances of the church he has converted into topics of ridicule; the litanies are burlesqued in a parody which is not easily to be paralleled for its profanity. But it is more than probable that such indecent levities excited little or no disgust in his contemporaries: the age was not distinguished by any uncommon share of piety, nor had it attained to that degree of refinement which frequently secures a certain ostensible decorum, a decent appearance of virtue, where virtue itself is not to be found. To whatever cause his failure may be attributed, there is reason to suspect that he never obtained a benefice. But we learn from the public records that he was indebted to the king for a regular pension, as well as for occasional grants of money. The register of the privy seal, 15th August 1500, mentions a yearly pension of ten pounds, payable at Whitsuntide and Martinmas, to "Maister William Dunbar for all the dayis of his life," or until he should be promoted by the king to a benefice of the yearly value of forty pounds or upwards. It appears from the treasurer's accounts that the payment due at Martinmas 1501, was deferred on account of his being then in England; and it has been considered as "probable that he accompanied the ambassadors who were sent to England to conclude the negociations for the king's marriage in October 1501; and that he remained to witness the ceremony of affiancing the princess Margaret, which took place at St Paul's cross, with great solemnity and splendour, on the 25th of January 1502. Under this supposition, we can have little hesitation in believing that Dunbar was the person then styled *the Rhymer of Scotland*, who received L.6. 13s. 4d. in reward from Henry VII. on the 31st of December 1501, and a similar sum on the 7th of January following."[1] He speaks of his long and faithful services to the king, and of his having been employed in many foreign countries, in England, Ireland, France, Spain, Italy, and Germany. Mr Laing conjectures, perhaps with sufficient probability, that in these extensive peregrinations he was attached to diplomatic missions, in which his knowledge of Latin and French might be available to persons of higher rank and inferior learning.

On the 17th of March 1504, or, according to our present computation, 1505, Dunbar for the first time said mass in the king's presence; and on that occasion he received a gratuity of seven French crowns, which was a larger sum than the king usually allotted for a priest's first mass. At the term of Martinmas 1507 his pension was encreased to twenty pounds; and on the 26th of August 1510 it was encreased to eighty pounds, to be paid during his life, or until he should be promoted to a benefice of the yearly value of one hundred pounds or upwards. How long he enjoyed this pension, and whether he ever exchanged it for a benefice, no research has yet ascertained.[2] On the 9th of September 1513 the king perished at Flodden-field; and there may be some reason to apprehend that his interest was not unaffected by that fatal event. From one of his poems, written "quhen the Governour past into France," it is evident that he must have survived for several years. John duke of Albany, regent of the kingdom, sailed for France in June 1517, again in October 1522, and finally in May 1524; nor can we safely decide to which of those three voyages the poet refers. It is at least certain that he was dead in the year 1530, when Sir David Lindsay composed his Complaynt of the Papingo.[3] He describes himself as having attained to an advanced age; nor does he appear to have been so unwise as to continue his levities to the utmost verge of life; several of his poems are written in a moral and religious strain, not unbecoming an aged priest.

The poems of Dunbar are numerous and miscellaneous, but none of them extends to any considerable length. He evidently unites a brilliant imagination with an elegant taste; nor is he less conspicuous for his skill in the mechanical part of poetry. The elasticity of his mind and the versatility of his talents enabled him to arrive at eminence in different departments of composition: his allegorical poems display a rich and fertile invention; and he is equally distinguished for his powers of description and satirical humour. His diction is often remarkable for its terseness and forcible simplicity; but it is not always free from the vicious and pedantic phraseology with which the English poetry of that period is so deeply infected. Dr Nott observes that Dunbar, "a poet of a rich and lively fancy, and possessing great natural command of language," was nevertheless induced to use such pedantic diction as occurs in the opening of his beautiful moral poem, entitled the Goldyn Targe.[1] He has employed a great variety of measures; and his versification, when compared with that of his most eminent contemporaries in both kingdoms, will in general appear highly ornamented and poetical.

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[1] Laing's Memoirs of Dunbar, p. 20.

[2] "The treasurer's accounts from the 8th of August 1513 (a month previous to the battle of Floddon) to the 25th of January 1515, which might have thrown some light on the subject, have not been preserved; and in those from that date to the 4th of September 1518 (from which time to the 5th of June 1522 there is another blank in the series) there is no mention of Dunbar's name. We cannot therefore discover the date of the last payment of his pension; but although we now lose all trace of his name, it by no means follows that his pension was entirely withdrawn: it might either have been transferred to some other branch of the royal revenue, or the poet might at last have been promoted to a benefice, when consequently his pension would cease." (Laing's Memoirs of Dunbar, p. 34.) The treasurer's accounts, 1st April 1513, mention a payment to Dunbar of so small a sum as forty-two shillings.

[3] Lindsay's Works, vol. i. p. 285.

Mr Ellis, after having quoted three of his shorter poems, subjoins the following remarks: "In these specimens we see much good sense and sound morality, expressed with force and conciseness. This indeed is Dunbar's peculiar excellence. His style, whether grave or humorous, whether simple or ornamented, is always energetic; and though all his compositions cannot be expected to possess equal merit, we seldom find in them a weak or redundant stanza."[2] The accomplished historian of English poetry likewise mentions him with no faint approbation. "I am of opinion," says Mr Warton, "that the imagination of Dunbar is not less suited to satirical than to sublime allegory; and that he is the first poet who has appeared with any degree of spirit in this way since Pierce Plowman. His Thistle and Rose and Golden Terge are generally and justly mentioned as his capital works: but the natural complexion of his genius is of the moral and didactic cast."[3] But, subjoins Mr Pinkerton, "this remark must not be taken too strictly. The Goldin Terge is moral, and so are many of his small pieces; but humour, description, allegory, great poetical genius, and a vast wealth of words, all unite to form the complexion of Dunbar's poetry. He unites in himself, and generally surpasses, the qualities of the chief old English poets; the morals and satire of Langland, Chaucer's humour, poetry, and knowledge of life, the allegory of Gower, the description of Lydgate."[4]

But the most striking proofs of his genius are certainly to be found in his two allegorical poems. The Thrissill and the Rois was composed in celebration of the nuptials of James the Fourth and Margaret Tudor; an event productive of very important consequences to both kingdoms, inasmuch as it ultimately led to that happy union which the nature of the territory and the kindred origin of the people rendered so suitable and so desirable. In the plan of this poem Dunbar displays boldness of invention and beauty of arrangement; and some particular passages are remarkable for their strength and even beauty of colouring. The Goldyn Targe, which is written in a different stanza, is another allegorical poem of nearly equal merit. The golden targe, or the shield of reason, is found an insufficient protection against the assaults of the train of love.

Some of his short poems, of a serious character, are likewise to be distinguished from the ordinary compositions of that period. The stanzas bearing the title of Learning vain without guid Lyfe possess superior merit as a moral descant. His Meditatioun in Wyntir is also to be classed among the best of his serious pieces: some of the stanzas are beautiful and pathetic; and they may all be perused with more than common interest as the solitary musings of neglected genius.

Nor are his satirical less remarkable than his serious productions. His poem entitled the Dance of the sevin Deidly Synnis presents many admirable strokes of comic and grotesque description. On the eve of Lent, the poet falls into a trance, and is presented with a glimpse of heaven and hell. Mahoun, or the devil, proclaims a dance of those wretches who have died without absolution; he commands them to prepare a mummery, and to "kast up gamountis" according to the newest French fashion. The seven Deadly Sins immediately present themselves, and are each accompanied by a select band of votaries. Pride is with evident propriety represented as leading the dance, and is dressed in the first fashion of that period: his hair is thrown back, his bonnet is placed on one side of the head, and his gown flows to his heels in ample folds.

Lat se, quoth he, now quha begynnis:
With that the fowll sevin Deidly Synnis
  Begowth to leip at anis.
And first of all in dance was Pryd,
With hair wyld back, and bonet on syd,
  Lyk to mak vaistie wanis;
And round abowt him, as a quheill,
Hang all in rumpillis to the heill
  His kethat for the nanis.
Mony prowd trumpour with him trippit;
Throw skaldand fyre ay as thay skippit,
  Thay gyrnd with hyddouss granis.

This group is succeeded by holy harlots; but Mahoun and the other fiends are not much entertained till a company of priests present their shaven crowns.

Heilie harlottis on hawtane wyiss
Come in with mony sindrie gyiss,
  Bot yit luche nevir Mahoun,
Quhill priestis come in with bair schevin nekkis:
Than all the feyndis lewche and maid gekkis,
  Black-belly and Bawsy-Broun.

Anger, who next makes his appearance, is very forcibly described in a single distich.

Than Yre come in with sturt and stryfe,
His hand wes ay upoun his knyfe.

He is attended by a band of ruffians, who follow in pairs, all equipped for war; and, as they move along, they frequently wound each other with swords and knives. The train of Anger is followed by that of Envy. He is attended by many a dissembler, flatterer, and back-biter, with "rownaris of fals lesingis," or whisperers of lies; from whom the poet cannot avoid expressing his regret that the courts of princes are never free. The next prominent figure in the dance is Covetousness, who is accompanied by catives, wretches, usurers, and hoarders of wealth. From their throats they discharge at each other torrents of molten gold; and when this ammunition is exhausted, the fiends replenish them with the same metal.

Nixt him in dans come Cuvatyce,
Rute of all evill, and grund of vyce,
  That nevir cowd be content:
Catyvis, wrechis, and ockeraris,
Hud-pykis, hurdaris, and gadderaris,
  All with that warlo went.
Out of thair throttis thay schot on udder
Hett moltin gold me thocht a fudder,
  As fyre-flawcht maist fervent;
Ay as thay tumit thame of schot,
Feyndis fild thame new up to the thrott
  With gold of allkin prent.

Sloth, after being twice called, joins unwillingly in the dance, attended by many suitable companions. He drags them along with a chain, and Belial lashes them on the loins; but their motion is nevertheless so tardy, that they are occasionally roused by being scorched in fire. The succeeding group consists of Lust and his loathsome train; he snorts like a stallion, is led by Idleness, and is attended by many foul associates who have died in their sins. When they engage in the dance, their visages become as red as the turkis stone. The foul monster Gluttony next presents himself, followed by many a drunkard and prodigal. When they become clamorous for drink, the fiends drench them with melted lead. All these terrific exhibitions might have been expected to satisfy Mahoun himself; but he is nevertheless pleased to close the entertainment with a Highland pageant.

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[1] Nott's Dissertation on the State of English Poetry before the Sixteenth Century, p. cxci.

[2] Ellis's Specimens of the Early English Poets, vol. i. p. 385.

[3] Warton's History of English Poetry, vol. iii. p. 109.

[4] Pinkerton's List of the Scotish Poets, p. xciv.—"It is evident," says Dr Drake, "that a union of talents of this wide range must necessarily be of rare occurrence; nor can we wonder that a century should elapse before a poet in any high degree approaching the genius of Chaucer made his appearance in our island. Not indeed until Dunbar arose in the sister kingdom, had we another instance of the combination of first-rate abilities for humour and comic painting, with an equally powerful command over the higher regions of fiction and imagination." (Mornings in Spring, vol. ii. p. 4. Lond. 1828, 2 vols. 8vo.)

Than cryd Mahoun for a Heleand padyane,
Syne ran a feynd to feche Makfadyane,
  Far northwart in a nuke:
Be he the correnoch had done schout,
Ersche men so gadderit him abowt,
  In hell grit roume thay tuke.
Thae tarmegantis, with tag and tatter,
Full lowd in Ersche begowth to clatter,
  And rowp lyk revin and ruke.
The devill sa devit wes with thair yell,
That in the depest pot of hell
  He smorit thame with smuke.

Dunbar's tale of "The twa maryit Wemen and the Wedo" presents us with the only specimen of blank verse which the ancient Scotish language affords. The rhythm is of that species which the author of Piers Plowman, or some of his predecessors, borrowed from the Anglo-Saxon poets, and which appears to have derived its origin from a remote era. It was employed by the Islandic as well as by the Anglo-Saxon poets, and was constructed with some degree of nicety.[1] Their lines are generally short, and they do not rigorously confine themselves to a definite number of syllables. Here alliteration supplies the place of rhyme; the corresponding sounds are at the commencement, not at the termination of words. In two contiguous and connected lines there must be three words beginning with the same letter; and, according to the strictest rule, two of those words ought to occur in the first, and the other ought to begin the second line. It was on such a model that Dunbar and the author of Piers Plowman constructed their verses, though they have not observed all the niceties of their predecessors. In the editions, and indeed in the manuscripts of their respective poems, what is exhibited as a single verse is in reality a distich, and admits of a division without any degree of violence.

This work of Dunbar presents us with a lively though indelicate picture of ancient manners, and is a very curious relique of ancient poetry. Bishop Percy considers it as equal to one of the most humorous productions of Chaucer. The peculiarity of the versification has compelled the author to adopt many uncouth terms; and accordingly the language of this tale is more difficult to be understood, and appears more obsolete, than that of his other poems; but his shrewdness of remark and strength of description shine through the mist of obscure phraseology in which they are sometimes involved. Soon after midnight in a morning of June, the poet walks by a goodly garden, and, on hearing the sound of voices, is induced to look through the lofty hedge, when he perceives three ladies seated in a green arbour, and regaling themselves with wine: he secretly listens to their conversation, of which he professes to give a faithful report. As the wine circulates, they become more communicative, and, at the suggestion of the widow, they successively detail their experience of a married life. The sentiments which they utter, are as profligate as can well be imagined; and it is to be hoped that Dunbar did not intend this as a general representation of the ladies of his own age and nation.

Two of his satirical poems relate to a certain Italian, named John Damian, on whom James the Fourth had bestowed the abbacy of Tungland in Galloway. This adventurer appears to have been an empiric and an impostor, and to have persuaded the king that he had discovered the secret of converting baser metals into gold; nor is it surprising that Dunbar should feel some degree of indignation on seeing high preferment bestowed upon such a person. The abbot having failed to produce the promised gold, made a still more desperate attempt to maintain his reputation as an adept in science and art: he provided himself with a pair of wings, and appointed a particular day for taking his flight from the walls of Stirling castle; when the day arrived, he indeed plunged from the rampart, but instead of mounting in the air, he fell to the ground, and broke his thigh-bone. These anecdotes do not rest on the authority of a satirical poet, for this must commonly be regarded as a very dubious authority; but they are circumstantially related by Bishop Lesley in his history of that reign;[2] and the one account may so far be considered as a confirmation of the other, although the poet has added many particulars of ludicrous exaggeration. Thus, according to Dunbar's dream, he slew a friar in Lombardy, in order to obtain possession of his habit; and having fled to France, he began to practise physic, and in this way committed many new murders. The course of his adventures at length conducted him to Scotland, where he followed his leechcraft with similar success. When raised to the dignity of a prelate, he was not to be seen at mass; he did not appear at matins in his stole and scarf, but was generally to be found in his laboratory, as sooty as a blacksmith.

In lechecraft he was homocide;
He wald haf for a nycht to byd,
Ane haknay and the hurt mannis hyd,
  So mekle he was of myans.
His irnis was rude as ony rauchtir,
Quhar he leit blude it was no lauchtir,[3]
Full mony instrumentis for slauchtir
  Was in his gardyvians.

He couth gif cure of laxatif,
To gar a wicht horse want his lyf;
Quha evir assay wald, man or wyf,
  Thar hippis yeid hiddy-giddy.
His praktikis nevir war put to preif
Bot sudand deid, or gret mischeif;
He had purgacioun to mak a theif
  To de without a wedye.

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[1] Wormii Literatura Runica, p. 178. Hafniæ, 1636, 4to. Olafsen om Nordens gamle Digtekonst, dens Grundregler, Versarter, Sprog og Foredragsmaade, S. 57. Kiöbenhavn, 1786, 4to. Rasks Vejledning til det Islandske eller gamle Nordiske Sprog, S. 211. Kiöbenh. 1811, 8vo. Rasks Angelsaksisk Sproglære, S. 108. Stokholm, 1817, 8vo. Hickesii Grammatica Anglo-Saxonica, p. 195. 217. Bosworth's Elements of Anglo-Saxon Grammar, p. 215. Conybeare's Illustrations of Anglo-Saxon Poetry, p. lxv. Percy's Essay on the Metre of Pierce Plowman's Vision: Reliques, vol. ii. p. 298. Whitaker's Introductory Discourse on P. Ploughman, p. x.

[2] Leslæus de Rebus gestis Scotorum, p. 345. Romæ, 1578, 4to.—" Eadem tempestate rex (ut hoc quoque, quod vulgo non sine risu hucusque memoratur, dicam) Italum quendam, cujus faceto sermone ingenioque delectatus erat, abbatem Tunglandiæ creavit." See likewise Lesley's History of Scotland, p. 76. Edinb. 1830, 4to.

[3] " Lors que mon frere fut en Escosse, il n'y avoit qu'un medecin, qui estoit medecin de la reyne, et de mon temps en Angleterre, il n'y avoit gueres de medecins. En Escosse un menuisier saignoit, et il y avoit des barbiers qui tondoient seulement." (Scaligerana, p. 223.)

Unto no mess preissit the prelat,
For sound of sacrying bell nor skellat;
As blak smyth brukit was his pellat,
For battiring at the study.
Thocht he come hame a newe maid channoun,
He had dispensit with matinnis cannoun;
On him come nothir stole nor fannoun,
For smwking of the smedye.

His unfortunate flight is afterwards related in a very ludicrous manner. The abbot of Tungland has furnished Dunbar with the subject of another poetical dream, which contains one passage remarkable for the strength of its satirical conception.

He sall ascend as ane horrible griphoun,
Him meit sall in the air ane scho dragoun;
Thir terrible monsteris sall togidder thrist,
And in the cludis gett the Antechrist,
Quhill all the air infeck of thair puysoun.

Many of the comic and satirical compositions of Dunbar are valuable memorials of ancient manners; and, if incapable of gratifying the reader of taste, they are at least objects of curiosity to the antiquary. Of this description are the stanzas entitled the Devill's Inquest; which strongly evince that our ancestors were grossly addicted to profane swearing. "It might," as Dr Ogden remarks, "puzzle a philosopher to trace the *love of swearing* to its original principle, and assign its place in the constitution of man." This vice is now regarded as a characteristic of the vulgar, of those who are truly vulgar in their habits and associations, whatever may be their external circumstances; but during the age of Dunbar, it seems to have been practised by all ranks and denominations. To swear like a Scot, was once a proverbial expression.[1] In this general muster of swearers, the priest takes precedence.

Me thocht as he went throw the way,
Ane priest sweirit braid, be God verey,
Quhilk at the alter ressavit he.
Thou art my clerk, the devill can say,
Renunce thy God, and cum to me.

Bishop Douglas, who certainly did not fall below the common standard of clerical decorum, has not scrupled to bedeck his compositions with abundance of oaths. The vice of profane swearing at length arrived at so scandalous a height as to require the interference of the legislature, and it was found necessary to extend the penalties to the clergy as well as the laity: by an act of Q. Mary in 1551, a "prelate of kirk," earl, or lord, was to be fined in twelve pence for the first offence committed within the next three months; different penalties were apportioned to different ranks during the first year; and for the fourth offence committed after the expiration of that period, a prelate, earl, or lord was to be banished or imprisoned for the space of a year and a day.[2]

Dunbar has left some examples of a motley species of composition, which at that period was not uncommon, and in which shreds of different languages are fantastically combined. It does not strictly come under the denomination of macaronic poetry, in which Latin are mingled with vernacular words of Latin terminations, and in which the rules of prosody are observed with at least some degree of care.[3] The earliest macaronic poet is sometimes supposed to have been Teofilo Folengo, a Benedictine monk, better known by the name of Merlinus Cocaius, who was born near Mantua in the year 1491.[4] Of his Macaronics the first edition bears the date of 1518; but during the preceding century a work had appeared under the title of "Typhis Odaxii Patavini Carmen Macaronicum de Patavinis quibusdam Arte magica delusis."[5] This model was followed by Folengo, and by Antonius Arena, or Antoine du Sablon, a French lawyer; and these two are the most celebrated poets of this fantastic school. Among the Scottish poets they have found a few imitators, particularly Drummond and Dr Geddes. Dunbar has not adhered to the same model; without regarding the rules of prosody, he intermingles Latin with Scottish lines, and produces an effect sufficiently ludicrous. Of this particular mode of composition, much earlier specimens are to be found; and Dante himself has written a *canzone* which contains a mixture of three languages, Latin, Romance, and Italian. It concludes with the following lines:

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[1] "I have never been able to discover," says Lord Hailes, "from what cause our ancestors became so monstrously addicted to profane swearing. I remember Tom Brown some where uses, 'swear like a Scotsman,' as a proverbial expression. There certainly must be a tradition on the continent, that the inhabitants of the whole island were apt to swear in common conversation; for in Holland, the children, when they see any British people, say, 'there come the G—dams;' and the Portuguese, when they acquire a smattering of English, say, 'How do you do Jack, G— damn you?'—Queen Elizabeth was a common swearer." (Notes on Ancient Scottish Poems, p. 241.) Of the truth of one of these remarks we find a curious confirmation in the collection of Norman *chansons* subjoined to the "Vaux-de-Vire d'Olivier Basselin." Caen, 1821, 8vo.

Mauldicte en soyt trestoute la lignye!
Ils ont chargé l'artellerye sus mer,
Force bisquit et chascun ung bydon,
Et par la mer jusq' en Bisquaye aller
Pour couronner leur petit roy *Godon*.

Their little king *G— damn* was Henry the Sixth, who succeeded his father at a very tender age. The subsequent passage occurs in the works of Cretin, a Norman poet who wrote about the beginning of the sixteenth century. (Les Poesies de Guillaume Cretin, p. 168. Paris, 1723, 8vo.)

Cryant qui vive aux *Godons* d'Angleterre.

[2] Acts of the Parliaments of Scotland, vol. ii. p. 485. See likewise p. 482.

[3] Dr Good has made the following remarks in reference to the English translators of Blainville's Travels through Italy: "When they tell us that macaronic poetry, which is a mixture of Italian and Latin words, possessing a Latin termination, 'is so called from its being supposed to resemble (as being a mixture) the Italian maccheroni, these being composed of flour, cheese, and butter'—they display a woeful ignorance of the subject they attempt to elucidate. Maccherone is a term in the Italian language, significative of a blockhead, an ignoramus, or in equivalent English a *pudding-pated* fellow: and Maccheronéa (Macaronics) are obviously, therefore, burlesque imitations of the unclassical style of such writers." (Memoirs of the Rev. Alexander Geddes, LL. D. p. 256. Lond. 1803, 8vo.) The style of blockheads must generally be unclassical; but the origin of the term macaronic, as applied to this motley species of composition, is nevertheless very truly explained by the translators. For this explanation we have the authority of Folengo himself, who in the *Apologetica* prefixed to his *Opus Macaronicorum* speaks in the following manner: "Ars ista poetica nuncupatur ars macaronica, a macaronibus derivata, qui macarones sunt quoddam pulmentum, farina, caseo, botiro compaginatum, grossum, rude, et rusticanum; ideo macaronice nil nisi grassedinem, ruditatem, et vocabulazzos debet in se continere." See likewise Menage's Origini della Lingua Italiana, p. 301.

[4] Tiraboschi, Storia della Letteratura Italiana, tom. vii. p. 1469.

[5] Morellii Bibliotheca Pinelliana, tom. ii. p. 456. Tiraboschi, tom. vii. p. 1468. Specimens of Macaronic Poetry, p. xi. Lond. 1831, 8vo.

> Chanson, vos pogues ir per tot le mond;
> Namque locutus sum in lingua trina,
> Ut gravis mea spina
> Si saccia per lo mondo, ogn' uomo il senta:
> Forse pietà n' avrà chi mi tormenta.[1]

Skelton, the contemporary of Dunbar, has occasionally indulged in this vein of humour; and a poem of the same description occurs among the works of Dr Arbuthnot, though it has likewise been attributed to Meston. The following stanza, which forms the conclusion of Dunbar's Testament of Kennedy, may be considered as a sufficient specimen.

> I will na priestis for me sing
> Dies illa, dies iræ,[2]
> Na yit na bellis for me ring,
> Sicut semper solet fieri;
> Bot a bag-pipe to play a spryng,
> Et unum ail wosp ante me;
> In stayd of baneris for to bring
> Quatuor lagenas cervisiæ,
> Within the graif to set sic thing
> In modum crucis juxta me,
> To fle the feyndis, than hardely sing
> De terra plasmasti me.

The Flyting of Dunbar and Kennedy is an extraordinary effort of unrefined wit; and is at least sufficient to evince that the ancient Scotish tongue was not deficient in terms of abuse.[3] Lord Hailes is inclined to believe that this altercation may have been a mere play of illiberal fancy, without any real quarrel between the antagonists; and this opinion he supposes to be confirmed by the affectionate manner in which Dunbar afterwards speaks of Kennedy, and of Quintin Shaw, who in this literary duel seems to have acted the part of Kennedy's second. A similar altercation was maintained by Luigi Pulci and Matteo Franco: although for the amusement of their readers they loaded each other with the grossest abuse, yet the intimacy of their friendship is said to have continued without interruption.[4] The example of Dunbar and Kennedy was followed by James the Fifth and Sir David Lindsay, and at a later period by Montgomery and Hume. It is not to be imagined that a king and one of his courtiers were engaged in actual hostilities; and in the verses prefixed to the "Flyting betwixt Montgomery and Polwart," it is expressly stated that their altercation was not the result of a real quarrel, but of what is there described as generous emulation.

A comic tale, entitled the Freiris of Berwik, and possessing a large fund of genuine humour, seems to have been composed about the period to which our attention is now directed. Mr Pinkerton supposes it to have been written by Dunbar; but this opinion is founded on no historical evidence, nor can the internal evidence of style and manner be considered as very striking or satisfactory. "But this tale," he remarks, "cannot at any rate be above thirteen years later than Dunbar, who must have died about 1525. In 1482, Berwick was wrested from Scotland, and was ever after in the possession of the English. Now this poem speaks of all the monasteries as actually standing and flourishing while it was written; and it is well known that in 1535 Henry VIII. suppressed the lesser monasteries, and in 1539 the greater. It follows that this tale must, at all events, have been written before 1539."[5] But the poet, whoever he may have been, does not speak of the monasteries of Berwick as actually flourishing; he merely avers, that when the adventures took place, friars of the different orders were not to seek, but were dwelling in the town. It is therefore evident that this chronological argument is by no means satisfactory, and that the tale may have been written after the suppression of the English monasteries.

In the Freiris of Berwik, every reader acquainted with the poems of Allan Ramsay must recognize the original of the Monk and the Miller's Wife; and we will venture to add that the ancient is greatly superior to the modern tale. Ramsay's tale, says Lord Woodhouselee, "would of itself be his passport to immortality, as a comic poet. In this capacity he might enter the lists with Chaucer and Boccaccio, with no great risk of discomfiture. Though far their inferior in acquired address, his native strength was perhaps not widely disproportionate. Of this admirable tale, I conceive he has the merit of the invention; as the story is not to be found in any of the older writers, as Sachetti, Boccaccio, or in the *Cento Novelle antiche.* In a few circumstances there is indeed a small resemblance to the 73d of the *Cent nouvelles Nouvelles,* entitled 'L'Oiseau en la Cage,' which barely affords a presumption that Ramsay may have read that story; but in all the material circumstances, his Monk and the Miller's Wife is original. A story of more festive humour could not have been devised. The characters are sustained with consummate propriety; the manners are true to nature; and poetic justice is most strictly observed in the winding up of the piece."[6] But whatever merit this comic tale may possess, it is evident that the praise of invention does not belong to Ramsay: he had doubtless read the old Scotish tale in Bannatyne's MS. from which he transcribed other poems less capable of arresting his attention. It may scarcely be worth while to remark that the ecclesiastic whom he introduces is a secular, a parish-priest, and is therefore most improperly described as a monk. That the author of the Freiris of Berwik was likewise indebted to some preceding poet, may perhaps be considered as highly probable. In the collection of Le Grand d'Aussy there is a *fabliau* which exhibits some lineaments of the story. A poor clerk, after having studied at Paris, is returning homeward without any money in his pocket, and, on the approach of night, calls at a solitary house to entreat a lodging; but the farmer's wife very unceremoniously refuses to shelter him during the absence of her husband. As he is leaving the house, he observes a servant bringing some wine in a basket; and at the same time the maid places in a cupboard a cake which she has just made, together with a piece of fresh pork which she has taken out of the pot. A priest, wrapped in his cope, soon afterwards passes the clerk in silence, and glides into the house. The wayfaring scholar, overwhelmed with fatigue, and dying of hunger, seats himself by the road-side: there he is found by the farmer, who happens to return sooner than he is expected; and they procure admittance, after the priest has found a place of refuge in the stable, which seems to be the ground-floor under the family-dwelling. While the maid is preparing some refreshment, the *laboureur* proposes that the clerk should either sing a song or tell a story: he declares that he knows neither song nor story, but offers to relate an adventure which happened to him in the morning; and by detailing this supposed adventure, he very dexterously contrives to take his revenge on the farmer's wife. As he was traversing a wood, he saw a numerous herd of swine: some of them were large, others small, some white, others black, in a word, they were of all sizes and of all colours; but above all he admired the leader of this herd; he was fat, shining, plump—in a word, just such another as must have been that, of which Catherine lately took a morsel from the pot. The clerk prosecutes his tale with the same arch simplicity, and contrives to reveal the secret of the wine, the cake, and finally of the priest concealed in the stable. The enraged farmer, having seized a cudgel, chastises his wife; and the priest, anticipating the same discipline, makes an attempt to escape, but is unmercifully beaten, stripped naked, and in this condition turned out of the house, leaving the clerk to enjoy his joke, together with the supper and wine provided for another guest.[1] This is certainly not the identical story of the Freiris of Berwik: several of the incidents are essentially the same, but the comic scene of the pretended conjuration is wanting. Still however the Scotish tale may have been borrowed from some preceding writer. A story not materially different occurs in a French collection published in 1665, and probably in many others: the scene is laid in Granada; the unfortunate gallant is an advocate, and the pretended magician a soldier.[2] This publication is indeed of a recent date; but such a tale is too pungent and characteristic to have been devised by the obscure compiler of the collection; and it is sufficiently probable that this tale and the Freiris of Berwik were both derived from one common source.[3] Many stories, both tragic and humorous, seem to have passed with rapidity from language to language, even at a period when the different nations of Europe are generally supposed to have maintained but little intercourse with each other. In many instances it is by no means easy to account for this speedy transmission; but there were some peculiar circumstances which may be conceived to have had considerable influence; as, for example, pilgrimages to remote countries; the various missions and visitations of the clergy; the extensive journeys of merchants and their attendants; and the associations of people of different nations in the same military service, particularly in the successive crusades. The original stock of materials is much more scanty than is commonly imagined;[4] and the most distinguished writers of tales, whether in prose or verse, have very frequently contented themselves with borrowing the entire skeleton of a story, but from them it still derives its flesh and blood, its life and spirit; for in most instances the chief merit consists in the mode of telling the story, and not in the story itself. (x.)

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[1] Opere di Dante Alighieri, tom. iv. p. 342. ed. Venezia, 1758, 4 tom. 4to.—Rodrigo de Valdes, a Jesuit, has written a long and extraordinary poem, containing a mixture of Latin and Spanish, and entitled "Poema heroyco Hispano-Latino panegyrico de la Fundacion y Grandezas de la muy noble y leal Ciudad de Lima." Madrid, 1687, 4to.

[2] This is an allusion to an ancient sequence, known to many English readers from the translations of Drummond and the earl of Roscommon. It begins in the following manner:

> Dies iræ, dies illa
> Solvet seclum in favilla,
> Teste David cum Sybilla.

[3] The Poems of William Dunbar, with notes, and a memoir of his life, by David Laing: to which are added Poems by Walter Kennedy, and other contemporaries. Edinb. 1833, 2 vols. 8vo.—Of the poems of Dunbar this is the first collective edition that has yet been undertaken; and it is fortunate that the task was reserved for so industrious and so skilful an editor.

[4] Roscoe's Life of Lorenzo de' Medici, vol. i. p. 252.

[5] Ancient Scotish Poems, vol. ii. p. 394. Lond. 1786, 2 vols. 8vo.

[6] Woodhouselee's Remarks on the Genius and Writings of Ramsay (p. cvii.) prefixed to his Poems. Lond. 1800. 2 vols. 8vo.

DUNCAN, ADAM, LORD VISCOUNT, an illustrious naval commander, the second son of Alexander Duncan, of Lundie, in the county of Angus, Scotland, by Helen, daughter of Haldane of Gleneagles, in the county of Perth, was born in the month of July 1731. He received the rudiments of his education at Dundee, which is only about four miles distant from the family residence; and as his elder brother Alexander was designed for the army (in which he died lieutenant-colonel in 1771), Adam appears to have been early intended for the naval service. Accordingly, about the year 1746, he was placed under Captain Haldane, who then commanded the Shoreham frigate, and he remained two or three years with that officer. In 1749 he was entered as midshipman on board the Centurion of fifty guns, which then bore the broad pendant of Commodore Keppel, commander-in-chief on the Mediterranean station. In the beginning of 1755 he was promoted to the rank of lieutenant, and appointed to the Norwich, a fourth rate, one of the squadron under Keppel, destined to convoy to America the transports having on board the land forces commanded by General Braddock. After the debarkation of this armament he was transferred to the Centurion, where he continued until that ship returned to England; when Captain Keppel, who had for a short time commanded the Swiftsure, procured his appointment as second lieutenant of the Torbay seventy-four, to which he himself had just been appointed. Having remained on the home station for three years, he proceeded with the expedition sent against the French settlement of Goree, on the coast of Africa, and was slightly wounded in the attack of the fort, after which he became first lieutenant of the Torbay, and in this capacity returned to England. His promotion was now rapid. In September 1759 he was raised to the rank of commander; in February 1761 he was advanced to that of post-captain; and having been appointed to the Vaillant, of seventy-four guns, he again became connected in service with his original friend and patron Keppel, who, having received the command of the naval part of the expedition against Belleisle, now hoisted his broad pendant on board the Vaillant. After this affair Captain Duncan accompanied the commodore in the same ship to the attack of the Havanna, and commanded the boats in which the troops were landed, the commodore covering the disembarkation. He was afterwards very actively employed in the siege, during which he greatly distinguished himself; and when the town surrendered, he was dispatched to take possession of the Spanish ships in the harbour, being five of seventy and four of sixty guns.

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[1] Fabliaux ou Contes du XII^{e}. et du XIII^{e}. Siecle, tom. iv. p. 1. edit. Paris, 1781, 5 tom. 12mo.

[2] Les Recreations Françoises; ou nouveau Recueil de Contes à rire; pour servir de divertissement aux melancholiques, et de joyeux entretien dans les cours, les cercles, et les ruelles, part. i. p. 178. A Rouen, chés David Berthelin, dans la Cour du Palais, 1665, 2 part. 8vo.—The compiler, whose name is Nipe, professes to have gleaned from all the ancient and modern books of tales, and to have added new stories of his own invention, "plus capables de faire mourir de rire, que de faire dormir de bout."

[3] A similar incident occurs in Ravenscroft's London Cuckolds, a Comedy, act ii. sc. ii. Lond. 1683, 4to. In reference to this scene, Langbaine has remarked that "Loveday's discovering Eugenia's intrigue, and pretending to conjure for a supper, is borrowed from *Les Contes d'Ouville*, part ii. pag. 235." (Account of the English Dramatick Poets, p. 421. Lond. 1691, 8vo.)

[4] The earl of Orford professes to have derived the dreadful plot of his Mysterious Mother from an English tradition, though he afterwards discovered the supposed origin of this tradition in the novels of the queen of Navarre. A similar story, under the title of *La mayor Confusion*, occurs in the novels of Montalvan. (Sucessos y Prodigios de Amor, en ocho Novelas exemplares, f. 58. Sevilla, 1633, 4to.) The scene is laid in Madrid; and Bishop Taylor has quoted from Comitolus its exact parallel in "a strange and rare case happening in Venice." (*Ductor Dubitantium*, or the Rule of Conscience, vol i. p. 118. Lond. 1660, 2 vols. fol.)

After the capture of the Havanna, he, in the same capacity as formerly, accompanied Admiral Keppel, who had been appointed to the command on the Jamaica station, and continued with him as captain of the flag-ship until the conclusion of the war, when he returned to England.

On the recommencement of war with France in the year 1778, Captain Duncan was appointed to the Suffolk, of seventy-four guns; but before the end of the year he was removed into the Monarch, of the same rate, which, during the summer of 1779, was employed in the Channel fleet under Sir Charles Hardy, who, owing to the junction of the French and Spanish fleets, was now acting upon the defensive. Towards the close of the same year, the Monarch was one of the ships placed under the orders of Sir George Bridges Rodney, who had received instructions to force his way through all impediments into Gibraltar, and to relieve that fortress, then closely invested by a Spanish army on the land side, whilst it was blockaded on the seaward face by a flotilla sufficiently powerful to oppose the entrance of any ordinary force. In the beginning of 1780, the British fleet, when off Cape St Vincent, fell in with a Spanish squadron under Don Juan de Langara, which had been stationed there to intercept Sir George Rodney, who was supposed to have only a squadron of four sail of the line. On this occasion Captain Duncan carried the Monarch into action before any other ship of the fleet; and the St Augustin, of seventy guns, struck to him, after having been so much disabled that he was obliged to abandon her. In this action the disparity of force was great; the British fleet consisting of nineteen ships of the line, and the Spanish of only eleven ships and two frigates. Of the latter, four were taken, one was blown up, three surrendered, but afterwards got away much damaged, one was reduced almost to a wreck, and two others, together with the frigates, made their escape. Soon after his arrival in England Captain Duncan quitted the Monarch, and remained without employment until the beginning of 1780, when he was appointed to the Blenheim, of ninety guns, and continued in command of this ship during nearly the whole remainder of the war. He was constantly employed with the Channel fleet, then under the command of Earl Howe; and in September 1780, having accompanied his lordship to Gibraltar, he was appointed to lead the larboard division of the centre, or squadron of the commander-in-chief, and greatly distinguished himself in the encounter with the combined fleets of France and Spain, which took place off the entrance of the Straits. Soon after the return of the fleet to England Captain Duncan was removed into the Foudroyant, of eighty-four guns; and on the conclusion of the peace in the spring ensuing he passed into the Edgar, of seventy-four guns, one of the guard ships at Portsmouth, where, as is customary in such cases, he continued in command during the three succeeding years.

This was the last commission which he ever held as captain of a ship. In September 1789 he was promoted to the rank of rear-admiral of the blue, and in September 1790 he was made rear-admiral of the white; in February 1793 he was raised to be vice-admiral of the blue, and in April 1794 he became vice-admiral of the white; in June 1795 he was appointed admiral of the blue; and lastly, in February 1799 he received the rank of admiral of the white. But during all these periods, excepting the two last, the merit of Admiral Duncan, which was never of an obtrusive, bustling, or forward kind, seemed to have been wholly overlooked; and though he frequently solicited employment, his applications proved unavailing; in consequence of which he had it in contemplation to retire altogether from the service. This period of obscuration, however, at length passed away. In February 1795 he received an appointment, constituting him commander-in-chief of the North Seas, that is, from the North Foreland to the Ultima Thule; and he accordingly hoisted his flag on board the Prince George, of ninety-eight guns, at Chatham, but afterwards shifted it to the Venerable, of seventy-four guns, the Prince George being considered as too large for the particular quarter in which he was destined to act. Having thus attained the object of his wishes, Admiral Duncan lost no time in proceeding to carry into execution the important trust which had been confided to him; and during the whole time he held the command, he exhibited that inexhaustible patience and unwearied constancy, which, with cool judgment and determined gallantry, formed the great attributes of his professional character. In the midst of many discouragements, and on a station exposed to peculiar dangers from the shoals and sand-banks which cover the coasts of the United Provinces, and the storms with which the North Sea is frequently visited, he never shrunk from the duty which had been assigned him, or failed at any season, however tempestuous, to show his squadron off the coast which it domineered over and insulted.

For more than two years, however, nothing occurred beyond the ordinary routine of such a service; namely, occasional captures, and smart affairs with the coast batteries and the craft which took shelter under their guns. The Dutch trade, however, was nearly annihilated; their merchant-vessels were frequently captured in sight of their own ports; and the whole coast was so completely blockaded that few vessels could venture out to sea, and escape the vigilance of the British fleet or its cruisers. The Batavian fleet, though consisting of five sail of the line, six frigates, and five sloops, was also obliged to remain quietly in port, or to confine itself to short cruises, at times when want of water or provisions compelled the British ships to repair for a few days to their own coasts; and in the beginning of June 1797, it even suffered itself to be blocked up in port, although for several days Admiral Duncan's force was limited to his own ship the Venerable, of seventy-four guns, and the Adamant, of fifty. This was owing to the unhappy and dangerous spirit of mutiny which at that period had infected in succession almost every portion of the British navy. It first broke out amongst the ships at Portsmouth, then extended itself to the fleet at the Nore, and afterwards reached the North-Sea fleet, in which almost every ship hoisted the flag of defiance. At this alarming and unprecedented crisis, the conduct of Admiral Duncan proved him to be equal to the fearful exigencies of the occasion, and perhaps contributed more to the safety and true glory of the country than even his subsequent victory. Although by the secession of the disaffected ships his fleet had been so thinned that, towards the end of May 1797, he found himself at sea with only his own ship and another, he nevertheless proceeded to his usual station off the Texel,[1] where there lay at anchor the Dutch fleet of fifteen sail of the line, under the command of Vice-Admiral de Winter; and in order to detain the latter in port until a reinforcement should arrive, he caused repeated signals to be made, as if to the main body of his fleet in the offing; a stratagem which, it was supposed, had the desired effect. At length, about the middle of June, several line-of-battle ships, in detached portions, joined the British admiral, and in a short time thereafter the two fleets were again placed on an equal footing.

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[1] On the 3d of June 1797, Admiral Duncan having assembled the officers, seamen, and marines of his own ship (the Venerable), addressed them from the quarter-deck as follows:—"My lads, I once more call you together with a sorrowful heart, from what I have lately seen of the disaffection of the fleets; I call it *disaffection*, for the crews have no *grievances*. To be deserted by my fleet in the face of an enemy, is a disgrace which I believe never before happened to a British admiral; nor could I have supposed it. My greatest comfort, under God, is, that I have been supported by the officers, seamen, and marines of this ship; for which, with a heart overflowing with gratitude, I request you to accept my sincere thanks. I flatter myself, much good may result from your example, by bringing those deluded people to a sense of the duty which they owe, not only to their king and country, but to themselves. The

But the Venerable having been upwards of eighteen weeks at sea, and during part of that time exposed to boisterous weather, was now in want of almost every description of stores; whilst others of the ships had also suffered by the recent gales, and were besides short of provisions. In these circumstances, the admiral, on the 3d of October, put into Yarmouth roads in order to refit and revictual; having left off the Dutch coast a small squadron of observation under the orders of Captain Trollope of the Russell. But early on the morning of the 9th, the Black Joke hired armed lugger showed herself at the back of Yarmouth sands with the signal for an enemy flying at her mast-head. Immediately all was bustle and preparation, and, by incredible exertions, Admiral Duncan, with eleven sail of the line, was enabled, a little before noon, to weigh and put to sea; directing his course with a fair wind right across to his old station. On the following day, the Powerful, Agincourt, and Isis joined, and on the afternoon of the 11th the advanced ships were near enough to count twenty-two sail of square-rigged vessels at anchor in the Texel. Meanwhile the admiral having received from Captain Trollope information of the course the enemy's fleet was steering, now stood along shore to the southward. At about seven on the morning of the 12th, the Russell, Adamant, and Beaulieu were descried in the south-west, bearing at their mast-heads the signal of an enemy in sight to the leeward; and about half-past eight, a strange fleet, consisting of twenty-one ships and four brigs, made its appearance in the quarter pointed out by the signal.

This was the Dutch fleet, under Vice-Admiral de Winter, consisting of four seventy-fours, seven sixty-fours, four fifty gun ships, two forty-four gun frigates, two of thirty-two guns, two corvettes, four brigs, sloops, and two adviceboats, all which had quitted the Texel at ten o'clock in the morning of the 10th, with a light breeze at east and by north. As soon as Admiral de Winter had learned that the British fleet was approaching, he recalled some ships which he had previously detached, and edged away with the wind at north-west, towards Camperdown, the appointed place of rendezvous. At daylight on the 11th, the Dutch fleet was about nine leagues off the village of Schevenningen, in loose order; but on receiving additional information, Admiral de Winter ordered his captains to their respective stations, and, to facilitate the junction of the ships to leeward, stood towards the land. On the Wykerdens bearing east, distant about four leagues, the Dutch fleet hauled to the wind on the starboard tack, and shortly afterwards discovered the British fleet in the north-north-west; upon which it put about, and as soon as a close line was formed, with frigates and other smaller vessels opposite the openings, the Dutch ships throwing their main-top-sails aback, resolutely awaited the approach of the British.

When the Dutch appeared in sight, the British fleet was, owing to the inequality of the ships in point of sailing, in very loose order. To connect the squadron, therefore, and enable the heavy-sailing ships to take their allotted stations, the admiral made the signal to shorten sail, and bring to on the starboard tack; but observing, soon afterwards, that the Dutch ships were drawing fast in shore, and finding there was no time to be lost in making the attack, he made the signals to bear up, break the enemy's line, and engage them to leeward, each ship her opponent, and also for the van to attack the enemy's rear. In his dispatch the admiral states that his signals were obeyed with the greatest promptitude; but it has been asserted that, owing to the thickness of the weather, the signal to pass through the enemy's line and engage him to leeward was not generally understood during the short time it was displayed, and that hence some uncertainty prevailed in the fleet as to the precise mode of attack. In fact, the admiral perceived that if he waited to form line, there would be no action; and, with equal judgment and boldness, he dispensed with this preliminary arrangement, and notwithstanding the still disunited state of the ships, he hurried them into action as fast as possible. The signal above mentioned was replaced by that for close action, which continued flying for an hour and a half, until it was shot away by the enemy. This signal could not possibly be mistaken.[1]

About forty minutes past twelve o'clock (12th October)

British navy has ever been the support of that liberty which has been handed down to us by our ancestors, and which, I trust, we shall maintain to the latest posterity, and that can only be done by unanimity and obedience. The ship's company, and others who have distinguished themselves by their loyalty and good order, deserve to be, and doubtless will be, the favourites of a grateful country; they will also have, from their individual feelings, a comfort which must be lasting, and not like the fleeting and false confidence of those who have swerved from their duty. It has often been my pride with you to look into the Texel, and see a foe which dreaded coming out to meet us. My pride is now humble indeed. My feelings are not easily to be expressed. Our cup has overflowed, and made us wanton. The all-wise Providence has given us this check as a warning, and I hope we shall improve by it. On Him, then, let us trust, where our only security can be found. I find there are many good men among us: for my own part, I have had full confidence of all in this ship, and once more beg to express my admiration of your conduct. May God, who has thus far conducted you, continue to do so; and may the British navy, the glory and support of our country, be restored to its wonted splendour, and be not only the bulwark of Britain, but the terror of the world. But this can only be effected by a strict adherence to our duty and obedience; and let us pray that the Almighty God may keep us in the right way of thinking. God bless you all." If this speech has but little to recommend it on the score of rhetoric, it has qualities of a nobler kind to compensate for the want of the graces of diction or oratory: it is indeed affecting and impressive in a very high degree; and it is recorded that, among the crew of the Venerable who listened to it, there was not a dry eye when the good admiral had concluded his address.

[1] The following anecdote, which is told by Admiral Sir Charles Ekins (*Naval Battles*, p. 236), shows that the instinct of true valour sometimes supplies the place of knowledge, if not of genius. Captain Inglis of the Belliqueux, sixty-four guns, owing either to long absence from active service, or an inaptitude for the subject sometimes apparent in naval officers, had neglected to make himself competently master of the signal-book; and hence, on the morning of the day of battle, when it became necessary to act with promptitude, in obedience to the signals, he found himself more puzzled than enlightened by it; so, throwing it with contempt upon the deck, he exclaimed in broad Scotch, "Damn me, up wi' the hellem, an' into the middle o't." In this manner he bravely anticipated the remedy in such cases provided by the illustrious Nelson, who, in his celebrated *Memorandum* on the eve of the battle of Trafalgar, observed, that "if a captain should be at a loss, he would not do *very wrong* if he laid his ship alongside of the enemy." In strict conformity with this doctrine, the Belliqueux was carried by her brave and honest captain into the very thickest of the fight, and got very roughly handled by the van of the enemy.

the action commenced, when Vice-Admiral Onslow in the Monarch, which led the advanced or larboard division of the British fleet, cut through the Dutch line between the Haerlem and Jupiter, pouring into each in passing a well-directed broadside; and then leaving the Haerlem to the Powerful, luffed up alongside of the Jupiter, upon which the two ships became warmly engaged. In rounding, the Monarch received the raking fire of the Monnikendam frigate and the Atalanta brig, stationed in the rear or second line. The remaining ships of the larboard division, particularly the Monmouth and Russell, were soon in action with those of the enemy's rear; amongst which the last to surrender was the Jupiter, which had been first engaged. About twenty minutes after the Monarch had passed through the Dutch line, the Venerable, frustrated in her attempt to pass astern of the Vryheid, by the promptness of the States-General in closing up the interval, ran under the stern of the latter, and soon compelled her to bear up; whilst the Triumph, the Venerable's second astern, found immediate employment for the Wassemaer, the second astern of the States-General. In the meanwhile the Venerable had ranged up close on the lee-side of the Vryheid, with which, on the opposite side, the Ardent was also warmly engaged, and, in front, the Bedford, as she cut through the enemy's line astern of the Gelykheid. The Brutus, Leyden, and Mars, not being pressed by opponents, advanced to the assistance of their admiral, and did considerable damage to the Venerable, Ardent, and other ships of the British van. At this time the Hercules, having caught fire on the poop, bore up out of the line, and came drifting near the Venerable to leeward; but although the Dutch crew contrived to extinguish the flames, yet having thrown their powder overboard, they were compelled to surrender their ship to the nearest opponent. The Venerable, which had sustained serious damage, was now obliged to haul off, and to wear round on the starboard tack. As soon as this was observed, the Triumph, which had compelled the Wassemaer to strike her colours, approached to give the finishing blow to the Vryheid, which still persisted in defending herself. At length, from the united fire of the Venerable, Triumph, Ardent, and Director, the three masts of the gallant ship fell over her side, and disabled her starboard guns; upon which the Vryheid dropped out of the line an ungovernable hulk, and then struck her colours. With the surrender of De Winter's ship the action ceased, and the British found themselves in possession of the Vryheid and Jupiter, seventy-fours; Devries, Gelykheid, Haerlem, Hercules, and Wassemaer, sixty-fours; Alkmaar and Delft, fifties; and the frigates Monnikendam and Ambuscade. The victors then hastened to secure their prizes, in order that, before night-fall, they might get clear of the shore.

This battle presented on both sides the singular spectacle of heroic courage and determined perseverance, contrasted with conduct little, if at all, short of downright cowardice or disaffection; and from first to last the opposing forces were, from various causes, pretty nearly equal. Seven Dutch line-of-battle ships quitted the action in order to return home, and nearly as many British seem scarcely to have entered it. The actual combatants, however, maintained the strife with fierce, unflinching valour; and hence the loss on both sides was proportionally severe. That of the British amounted to 203 killed and 622 wounded, while the Dutch had 540 killed and 620 wounded. During the action the latter directed their shot solely at the hulls of their adversaries, and this not until they were so near that scarcely any aim could miss; which accounts for the unusual severity of the loss sustained. On the other hand, the captured ships were all either dismasted outright, or so injured in their masts that most of these fell in the passage home; whilst as to their hulls, they were completely riddled, and only worth bringing into port as trophies of the victory.

If any proof were wanting of the superior efficacy of Admiral Duncan's mode of attack, it would be found, first, in a manly declaration made by the gallant Dutchman, and, secondly, in the practical testimony to its excellence borne by Lord Nelson. "Your not waiting to form a line," said De Winter to Admiral Duncan, "ruined me; if I had got nearer the shore, and you had attacked, I should probably have drawn both fleets on it, and it would have been a victory to me, being on my own coast." And after the battle of the Nile, Nelson, although unacquainted with Lord Duncan, wrote his lordship to tell him how he, Nelson, "had profited by his example." Besides, the British squadron was composed of very indifferent and inadequate ships; many of them having been intended for Indiamen, and otherwise ill conditioned and deficient. Had Lord Duncan's fleet been composed of the same materials as Lord St Vincent's, every Dutch ship would have been taken; and had all the ships imitated the example of their chief, the same result must have followed. Few people are aware of the merits of the chief on that memorable day. When the action ceased, the ships were in nine fathoms water, within five miles of a lee shore, with every appearance of the gale which followed; a situation as critical as it is possible to imagine. And it should also be recollected, that when the Dutch put to sea, the admiral had only been two days in port, after a blockade of nineteen weeks. It was the opinion of Lord Duncan that, upon such occasions, the commander-in-chief should hoist his flag on board of a frigate; and he stated that, if he should ever fight another battle, he would certainly do so. He was often heard to declare that, if his flag had been flying on board of a frigate in this action, not one of the Dutch fleet would have escaped.

No victory was ever more seasonable, none more gratifying to the nation, than that of Camperdown. Politicians beheld in it the annihilation of the marine of Holland, long our most formidable rival on the seas; naval men admired the promptitude, decision, and address displayed by the admiral in approaching to the attack, in circumstances altogether unprecedented; and the people at large were transported with admiration and delight, though they did not very well know why. Hence the honours which were immediately conferred on the admiral received the approbation of all parties. On the 21st of October he was created Lord Viscount Duncan of Camperdown, and Baron Duncan of Lundie, in the county of Angus; his second in command, Vice-Admiral Onslow, was made a baronet; gold medals were struck and presented to the flag officers and captains; and the thanks of parliament were voted to the fleet. A pension of L.2000 per annum was likewise granted to Lord Duncan for his own life, with remainder to the two next heirs of the peerage.

After the victory of Camperdown, Lord Duncan continued to hold the same command until the commencement of 1800, when, being advanced in years, he withdrew from the service, and passed the remainder of his life in retirement, chiefly at his patrimonial residence. At the period of his death, however, which happened on the 4th August 1804, he was, we believe, about to be recalled into active service; and he had signified his determination to obey the call of his country at a season of unexampled difficulty and danger, when his career was terminated for ever by a sudden and fatal illness. In June 1777 he had married Henrietta, daughter of the Right Honourable Robert Dundas, lord president of the Court of Session in Scotland, and father of Lord Viscount Melville; and by this lady he had a large family. Lord Duncan was succeeded in his titles and estate by his second son, Robert, now Earl of Camperdown.

Lord Duncan was a man as remarkable in appearance as he was distinguished for character and worth. In person he was of a colossal and athletic form, six feet four inches in height, erect in his carriage, and, notwithstanding his great size, graceful in his movements, with a countenance strongly expressive of intelligence and benevolence. In him, singular meekness of disposition, extreme modesty in all that concerned himself, and the most unaffected dignity of mind, were blended with genuine spirit, high professional genius, vigorous and active wisdom, singular alacrity and ability for performing great achievements, and a decided indifference about success, excepting in as far as it might contribute to advance the good of his country. His private character was that of a man most exemplary in all the social relations of life; an affectionate relative, a steady friend, and a pattern of virtue and true piety. Lord Duncan was a most sincere and devout Christian, nor did he ever lose sight of the duties belonging to that character. He encouraged religion by his own practice, and, wherever he held a command, caused the public observance of it to be maintained. Immediately after the victory, which has immortalized his name, was decided, he ordered the crew of his ship to be called together, and, at their head, upon his bended knees, in the presence of the Dutch admiral, who was greatly affected with the scene, he solemnly offered up praise and thanksgiving to the God of battles for having crowned with success the arms of his country. In like manner, when all eyes were upon him, in the cathedral of St Paul's, on the day of general thanksgiving, in December following, his demeanour was so humble and devout, as not only to increase the admiration which his services had otherwise gained him, but to impress on all present a sense of the real dignity as well as importance of religion. In a word, Lord Duncan afforded a conspicuous instance of the truth of the remark, that piety and true courage are naturally allied, and that death loses its terrors to those who have placed their hope beyond it. (Collins's *Peerage*, by Sir E. Brydes; *Naval Chronicle*, vol. iv.; Charnock's *Biographia Navalis;* Chalmers's *Biographical Dictionary*, art. *Duncan;* James's *Naval History of Great Britain*, vol. ii.; Ekins's *Naval Battles*, p. 231.) (A.)

DUNCAN'S SUGAR LOAF, an island in the Mergui Archipelago, of a triangular form, about six miles in circuit, near the south coast of the island of St Matthew. Lat. 9. 42. N.

DUNCHURCH, a small town of the hundred of Knightlow, in the county of Warwick, eighty-one miles from London. It is situated on what was once a heath, celebrated for an ancient legend of the Dun Cow, some of whose bones are still affirmed to be preserved there. The inhabitants amounted in 1801 to 1087, in 1811 to 789, in 1821 to 947, and in 1831 to 1029.

DUNCOMBE, WILLIAM, younger, son of John Duncombe of Stocks, in Hertfordshire, was born in London in January 1690. He published in 1722 a translation of Racine's *Athalie*, which was well received by the public, and has gone through three editions. In 1724 he was editor of the works of Mr Needler; in 1735, of the poems of his deceased brother-in-law Mr Hughes, two vols. 12mo; in 1737, of the miscellanies of his younger brother Mr Jabez Hughes, for the benefit of his widow, in one volume 8vo; and in 1745, of the works of the Rev. Samuel Say, in one vol. 4to. In 1726 he married the only sister of Mr John Hughes, whom he long survived. In 1734 his tragedy of Lucius Junius Brutus was acted at Drury Lane Theatre. It was published in 1735, and again in 1747. The works of Horace, in English verse, by several hands, were published by him in two vols. 8vo, with notes, in 1757; and a second edition, in four vols. 12mo, with many imitations, appeared in 1762. In 1763 he collected and republished "Seven Sermons by Archbishop Herring, on public occasions, with a biographical preface." He died in February 1769, at the age of eighty.

DUNDALK, a seaport town of Ireland, in the county of Louth, about forty miles from Dublin. It is a large and thriving town, with a wide street nearly a mile in length, and a very fine market-house near the entrance from Dublin. In the reign of Edward II. it was a royal city, the last we read of where a monarch of all Ireland was actually crowned and resided. It was formerly very strong, and had many towers and small castles in it. The bay has good moorings at all times, and from four to above eight fathoms water, with very good landmarks, either for bringing up to or making the harbour. In crossing the bar at high water, or ordinary neap tides, there is from fifteen to eighteen feet water. The manufacture of cambric was established in this town in 1737, for the first time in Ireland, and it has ever since flourished. Muslin is also made here, and corn is exported. It is the assize town of the county. The population amounts to 10,078.

DUNDAS, HENRY, VISCOUNT MELVILLE, a late eminent British statesman, was born about the year 1741. He was a younger son of the Right Honourable Robert Dundas, lord president of the Court of Session in Scotland, by Miss Gordon, a daughter of Sir William Gordon of Gordonston, Bart. He was educated at the High School and University of Edinburgh, and having been brought up to the profession of the law, was admitted a member of the Faculty of Advocates in the year 1763. He soon distinguished himself at the bar, and rapidly attained to extensive practice. The first promotion he obtained was the situation of one of the assessors to the magistrates of Edinburgh; after which he became successively an advocate-depute and solicitor-general. In 1775, when Sir James Montgomery was appointed lord chief baron, Mr Dundas succeeded him in the office of lord advocate, which situation he continued to occupy until 1783. In the month of March 1777, he was appointed joint keeper of the Signet for Scotland.

From the period of his appointment to the office of lord advocate, Mr Dundas in a great measure abandoned the ordinary practice of the bar, and devoted himself to public business. In 1774 he became a member of parliament, having been elected representative for the county of Edinburgh. Some years afterwards he resigned the representation of the county in favour of the late lord chief baron of the Court of Exchequer, and was chosen member for the city of Edinburgh, which he continued to represent until his advancement to the peerage. Although originally returned to parliament in opposition to the ministerial interest, he soon joined the party in power, and became a strenuous supporter of Lord North's measures during the American war. He frequently spoke in the House of Commons, and, notwithstanding the disadvantages of an ungraceful manner and a provincial dialect, he was always listened to with great attention, on account of the clearness of his statements and the weight of his arguments.

In the year 1782, Mr Dundas was admitted a member of the Privy Council, and appointed treasurer of the navy, under the administration of the late Marquis of Lansdowne, then Earl of Shelburne; and he continued to fill that office, and to support the measures of government, until the dissolution of that ministry. During the short coalition administration he was out of place, and made a conspicuous figure in opposing the memorable East India bill, a measure which occasioned the overthrow of the ruling party. Upon that occasion he displayed a knowledge of the affairs of the East India Company, which was evidently the result of much study and laborious investigation. In the month of December 1783, when Mr Pitt became prime minister, Mr Dundas was restored to the same office which he had previously held; and was appointed president of the board of control, under the new East India system. In 1791 he became a member of the cabinet, in consequence of his appointment to the office of principal secretary of state for the home department. The duties of this office he discharged with energy and ability. The volunteer system, which, undoubtedly, contributed much to rouse the spirit of the country during a period of peculiar difficulty and danger, has been ascribed to Mr Dundas. On the accession of the Duke of Portland to the administration of Mr Pitt, he resigned the home department, and became secretary at war. At this time he also held the offices of lord privy seal, and governor of the Bank of Scotland, and enjoyed an extent of patronage in his native country, which has seldom or never fallen to the share of any individual, and has been considered by many as more exclusive than can be safely confided to the hands of any one man. For many years he was the intimate friend and coadjutor of Mr Pitt, and took a leading part in all the important measures of his administration. The details of these measures, and Lord Melville's conduct in regard to them, belong to history. In the present article we must restrict ourselves to a general outline of the events of his life, and a short summary of the leading traits of his character.

Upon the resignation of Mr Pitt in 1801, Mr Dundas also resigned his political offices; and in 1802, under the administration of Mr Addington, afterwards Lord Sidmouth, he was elevated to the peerage, by the titles of Viscount Melville and Baron Dunira. The last public situation which he held in the government was that of first lord of the admiralty, to which he was appointed, on Mr Pitt's return to power, in the room of Lord St Vincent. It was in his administration of the affairs of the naval department that his lordship incurred that irregularity relative to the balances of public money remaining in his hands, which produced his celebrated impeachment. We conceive it unnecessary to dwell upon the proceedings of that well-known trial. It is sufficient to say that the House of Lords finally acquitted him of all the charges brought forward in the articles of impeachment exhibited by the Commons; but he had previously resigned all his offices in the administration.

Subsequently to his acquittal, Lord Melville was restored to his seat in the privy council; but he did not return to office. He sometimes took a share in the debates in the House of Lords; and, in 1810, he brought forward a motion, the object of which was to recommend the employment of armed troop-ships, instead of hired transports, for the accommodation of such troops as it might be found expedient to embark in furtherance of the public service. But the greater part of his time was spent in Scotland, where he died suddenly, at the house of his nephew, the Right Honourable Robert Dundas, lord chief baron of the Exchequer, on the 27th of May 1811, at the age of seventy-one. He appeared in his usual health for some time preceding, and his death is supposed to have been hastened by the affection he felt for the loss of his old and valued friend the Lord President Blair, who died a few days before.

In his person Lord Melville was tall, stout, and well formed. In public life he was principally distinguished by his great capacity for business, by the unwearied attention which he paid to the details of all official measures, and by the manliness and decision of his conduct. For many years, as we have already observed, he was the steady friend and firm supporter of the measures of Mr Pitt, to whom he proved a very powerful auxiliary. Whilst he held the offices of treasurer of the navy, and first lord of the admiralty, his exertions are admitted to have been attended with great advantage to the public service. He devised several improvements in the details of that department, which have been found of great utility; and, in particular, the regulations with regard to the payment of seamen's wages, transmission of letters, and other matters connected with that branch of the public service, contributed much to the comfort of that class of men, and are highly honourable to the character of their author. In parliament he was a clear, acute, and argumentative speaker. His eloquence, however, was that of a man possessed of strong natural talents, wholly unadorned by literary taste or acquirements; and his speeches produced their effect from the solidity of his arguments, and the fearlessness with which he delivered his opinions, not from any powers of oratory or graces of style. The ornamental parts of eloquence, indeed, he seemed to despise, and was satisfied to bring his audience at once to the object he had in view. Political power was his passion, and the bustle of official life was the element in which he loved to move.

In private life his lordship was a most agreeable companion; easy, frank, and convivial; careless of money, even to a fault; always disposed to do kind offices; affectionate in his domestic relations, and greatly beloved by the numerous circle of his friends.

Lord Melville was twice married: first, to Miss Rannie, daughter of Captain Rannie of Melville, by whom he had one son, Robert, now Lord Melville; and three daughters. His second wife was Lady Jean Hope, sister of the late Earl of Hopetoun, by whom he left no issue.

Although not, strictly speaking, a literary man, Lord Melville is the author of several pamphlets on political subjects, which are distinguished by his usual sense and knowledge of business. These are, 1. *The Substance of a Speech in the House of Commons, on the British Government and Trade in the East Indies, April* 23, 1793. London, 1813, 8vo. 2. *Letter to the Chairman of the Court of Directors of the East India Company, upon an open Trade to India.* London, 1813, 8vo. 3. *Letters to the Right Honourable Spencer Percival, relative to the Establishment of a Naval Arsenal at Northfleet.* London, 1810, 4to.

DUNDEE, a seaport town in Forfarshire, situated on the north bank of the river Tay, about twelve miles from its mouth. It is forty-two miles from Edinburgh, twenty-two miles from Perth, and eighteen south-west from Arbroath, being in latitude 56. 2. 23. north, and longitude 3. 2. 55. west. The history of Scotland narrates many sackings and burnings of this town. The last of these was by General Monck; and such was its wealth at that time, that every soldier in Monck's army is said to have received L.60 sterling as his share of the plunder. Dundee was erected into a royal burgh by William the Lion in 1165. The town is governed by a provost, four bailies, a dean of guild, and thirteen councillors, and sends a member to parliament. In 1831 the government, at the solicitation of the inhabitants, granted them a resident sheriff-substitute. The market-place, or High Street, is a spacious square, 360 feet long by 100 broad, from which diverge the Nethergate, Seagate, Overgate, and Murraygate, the principal streets, which run from east to west, parallel to the river. These streets, till within the last forty years, formed the chief part of the town; and the access from it to the harbour being through narrow lanes, it had a very hampered and crowded appearance. This defect has been remedied by the opening up of several spacious streets

Dundee.

leading from north to south, with houses built in a modern style. Castle Street leads from the south-east end of the High Street to the new docks on the south, and contains, among other neat buildings, an episcopal chapel and a theatre. At the south-east corner is an elegant building in the Grecian style, erected for an exchange and reading-room. On the south side of the market-place or square stands the town-hall, surmounted by a steeple, and having piazzas below; it was built in 1743. Opposite to this building is a spacious new street, named Reform Street; at the north end of which, and fronting the town-hall, an elegant edifice has lately been erected, in the Grecian style of architecture, for an academy and public schools. At the east end of the High Street, and rather obstructing the entrance to the Murraygate, stands the trades' hall, a plain edifice, with pilasters of the Ionic order, the principal apartment of which is used as a reading-room, and it contains, besides, apartments for each of the nine incorporated trades. A little to the west of the High Street is the Nethergate, a spacious and well-built street, in which are the remains of an old cathedral, containing four places of worship, one of which, the most entire, is built in the finest Gothic style, the groining of the arches being much admired. This structure is said to have been originally built by David earl of Huntingdon as far back as the year 1185. On the west end of these churches stands a magnificent Gothic tower 156 feet high. There are several other churches and chapels connected with the establishment, besides two episcopal chapels, and various other places of worship for dissenters, who form no inconsiderable part of the population. Among the public institutions may be mentioned a lunatic asylum, an infirmary, a dispensary for out-patients, and an orphan institution; a chamber of commerce, the society of writers, incorporated by royal charter, and a mechanics' institution. Dundee has four joint-stock banking establishments, viz. the Dundee Bank, the Union Bank, the New Bank, and the Commercial Bank. Besides these, there are agencies for the British Linen Company, the National Bank of Scotland, and the Bank of Scotland. There is a native establishment for fire insurance, and one for sea insurance. There are two weekly newspapers published in the place. The trade of Dundee has long been extensive, and it has rapidly increased of late years. Its manufactures are chiefly brown and bleached linens for the home and foreign market, great quantities of which are exported directly to North and South America. It also carries on a great trade to the Baltic, and has a number of vessels employed in the whale fishery. In the London trade, besides a number of sailing smacks, there are two splendid steam-vessels, having each two engines of 125 horse power. A railway was opened some years ago between Dundee and Newtyle, a village in Strathmore, about ten miles distant, which lays open the traffic of that extensive agricultural district. This undertaking has been attended with considerable expense, from the nature of the ground. It crosses the Law of Dundee, a high hill, by means of an inclined plane and tunnel, and the Siedlaw range of hills by an inclined plane at Balbeuchly. Two locomotive engines of ten horse power each are employed on it. The difficulties encountered in crossing the mountainous ridges being overcome, it is about to be extended to Coupar Angus, Glammis, Forfar, &c. Among the undertakings either in progress or in prospect may be mentioned a new jail and bridewell, a new custom-house, and an establishment for supplying water to the town. The tonnage of the port in 1832 amounted to 32,868 tons, which employed about 3500 seamen. Its imports in flax and hemp in 1832 amounted to 21,967 tons. There are in the town and neighbourhood about fifty spinning-mills, all worked by steam; and the steam power employed in the different establishments exceeds 1400 horse power. There are several extensive iron founderies, and establishments for the manufacture of steam-engines and machinery. The grandest and most important feature, however, of Dundee is its harbour, upon which nearly L.200,000 has been expended. It consists of magnificent wet docks and a number of spacious quays, graving dock, &c. spreading along the margin of the Tay, and terminated on the west by the Craig Pier, which is exclusively appropriated to the use of the ferry, on which two twin steam-boats are employed, of a construction which admits of horses and carriages being transported across the river, which is here two miles broad, without unloosing the horses from the vehicles to which they are attached. The increase of the trade of Dundee within the last eighteen years has been in a greater ratio than that of any other place in the empire, if we except Liverpool and Glasgow, as will be seen from the following statement: In 1815 it had 157 vessels, registering 15,275 tons; in 1832 it had 274 vessels, registering 32,867 tons. In 1815 sixty-six vessels entered inwards with cargoes from foreign ports, registering 10,620; in 1832 there were 307 vessels, registering 46,539 tons, being an increase of 241 vessels, and four times the amount of tonnage. In 1815 three vessels cleared outwards with cargoes for foreign ports, registering 679 tons; in 1832, fifty-six vessels cleared outwards for foreign ports, registering 11,159 tons, being an increase of fifty-three vessels, and more than sixteen times the amount of tonnage. The population of Dundee in 1821 was 30,575, and by the census of 1831 it was 45,355, exclusive of the seamen belonging to the port. It is now understood to exceed 50,000. This town has become the principal seat of the linen trade of Great Britain, and the great emporium of flax and hemp.

Dunfermline.

DUNFERMLINE, a royal burgh of Scotland, situated in the western district of the county of Fife, fifteen miles north-west of Edinburgh, in longitude 3. 27. 11. west, latitude 56. 5. 3. north. The town is built on an extensive eminence, having a pretty steep and uniform declivity towards the south, and likewise declining into a ravine on the west, which divides the more ancient part of the town from the extensive and extending suburb of Pittencrieff. This ravine is crossed by an earthen mound, on which an excellent street has been built, which equals the second-rate streets of the metropolis, and exceeds in its uniformity, and the splendid appearance of its shops, the principal streets of most country towns. The town is situated about 270 feet above the level of the sea, and about two miles and a half distant from Limekilns, the nearest place on the coast. It may be described as consisting of one principal thoroughfare, stretching from east to west, near the top of the eminence on which the town is built, which is intersected at right angles by streets running up and down the hill, terminating in a plain both at the top and bottom. From its elevated situation, the prospect all around is very extensive. Seen from the south or west, the town has a very noble appearance, principally from its irregular outline, and the many prominent objects, such as steeples and public buildings, with which the whole is adorned; and it is here and there interspersed with gardens and trees, which give it a very pleasing and picturesque appearance, flanked as it is on the east and west by the extensive policies of Viewfield and Pittencrieff. The building most worthy of notice is the Abbey Church, which has been erected on the site of the Church of the Holy Trinity, built by Malcolm Canmore, about the middle of the eleventh century; which was demolished by Edward I. on the 10th February 1304, and subsequently at the Reformation, on the 28th of March 1560. However, at the latter period, the nave escaped

Dunfermline.

destruction, and was used as a place of worship till September 1821, when the new church was opened for divine service. It is a splendid edifice, in the most elegant Gothic style. Over the centre of the cross is erected a square tower ninety feet high, terminating in a flat roof, round the four sides of which, in open hewn work, are the words "King Robert the Bruce," in capital letters four feet in height, surmounted by royal crowns and lofty pinnacles on the four corners, which give an elegant and appropriate finish to the whole. The old church forms a very fine entrance to the new; and, were a little expense laid out in some small repairs, it might be rendered still more impressive. It is of various orders of architecture, accordant with the different ages in which it has been altered and repaired. The interior of the new Abbey Church is even more elegant than its exterior. Its tower and galleries are supported by magnificent pillars, moulded on the solid mason-work with Roman cement, into small columns, which form the aggregate pillar, the capitals of which are adorned with exquisite imitations of foliage. The ribs of the arches composing the different roofs and the central ornaments are in the purest style, and, seen from any point, the effect of the whole is at once magnificent and pleasing. Exactly below the pulpit, which is of wainscot, and in the Gothic style, lie the remains of Robert Bruce; and in the north transept lie seven other kings, two queens, and numbers of the nobility. Besides the old church, all that now remains of the ancient buildings is the south-west wall of the palace, which hangs on the brink of a deep hollow, through which runs a small stream. A building over a gate, probably the principal entrance to the palace yard, the south wall of the Refectory or Fraters Hall, and a large window of elegant workmanship, form the whole antiquities of the abbey and palace. There is likewise some slight traces of Malcolm Ceanmore's tower, which formed the original nucleus of the town. The Guildhall, which was erected in 1808, is a superb edifice of the Grecian order, having a spire a hundred and thirty-two feet in height. It consists of a large hall intended for meetings of guildry; the chamber is occupied as a reading-room, and the rest of the building is fitted up as a hotel. The town-house is a narrow building, with a prison above. The council hall is adorned with some good paintings, and the whole is surmounted by a spire. The Bank of Scotland is an elegant building in the Abbey Park, surrounded with an extensive policy. The High School is a beautiful building in the Grecian style, and is taught by a rector and usher; the Commercial Academy is in the form of a villa, where the several branches of education are taught by two independent teachers, with assistants. A handsome new row of houses has been erected at the eastern entrance to the town.

The linen trade is of considerable antiquity in Dunfermline; it began originally with ticks and checks. The first table-linen manufactured here was a kind called huckabuck; this was followed in course of time by damask, the richest and most ingenious kind of table-linen, which has been for the last century improving in quality and pattern, and is still continuing to be improved. The value of table-linens and covers annually manufactured here is estimated at about L.200,000. Another important branch of industry is the spinning of yarns and threads; there are eight large spinning mills, at some of which the very finest quality of yarns is manufactured.

This town is remarkable as being the theatre in which the principal dissents from the established church have taken their rise; namely, the Seceders under Ralph Erskine, and the Relief under George Gillespie.

The population of the parish in 1821 was 13,690, and of the town 8041; in 1831 the former was 17,068, and the latter 10,624.

DUNGALLY, a town on the western coast of the island of Celebes, situated on the south point of land which forms one side of Parlow Bay, which affords good anchorage. It is defended by a fort, and carries on a considerable trade.

DUNGANNON, a town of Ireland, in the county of Tyrone, situated on a hill. It is of some extent, and contains a charter school liberally endowed, also barracks for a troop of horse. This place is said to have been the chief residence of the O'Neils, monarchs of Ulster. There are coal mines in the neighbourhood of the town. It lies seventy-two miles north-west of Dublin. The population amounts to 3515.

DUNGARVON, a town of Ireland, in the county of Waterford, situated on the south side of a bay of the same name. The principal article of export is potatoes. This place is much resorted to in summer for sea-bathing. It lies twenty-two miles west-south-west of Waterford, and a hundred miles south-south-west of Dublin. The population amounts to 6519.

DUNGYE, a town of Hindustan, province of Bahar, district of Shahabad, sixty-eight miles south-west from Patna. Long. 84. 17. E. Lat. 24. 55. N.

DUNKELD, a town of Scotland, in the county of Perth, situated on the northern bank of the river Tay, in a truly romantic spot, embosomed among lofty crags, now almost wholly covered with wood. It is the chief market-town of the Central Highlands. The immediate vicinity has been greatly improved by the Dukes of Atholl, particularly by the last, under whom much was done not merely to beautify his own residence, but also to enrich the scenery which encloses Dunkeld, particularly on the north. He also commenced building a new mansion, or rather palace, on an extensive and magnificent scale; but the building was interrupted by his death, and has not yet, it seems, been resumed.

Dunkeld is of great antiquity. It was the capital of ancient Caledonia. About the dawn of Christianity, a Pictish king made it the seat of religion, by erecting there a monastery of Culdees, which king David I., in 1130, converted into a cathedral, and it ranked as the first in Scotland. Since the Reformation it has in a great measure fallen into ruins. The choir, however, is still entire, and converted into the parish church, which has of late been very elegantly fitted up. On the north side of the choir is the charter-house, built by Bishop Lauder in 1469, the vault of which is now used as the burying-place of the Atholl family. In the porch of the present church is the tomb of Alexander Stuart, earl of Buchan, third son of Robert II., but better known by the name of *The Wolfe of Badenoch*, who died in 1394. The seat of the Atholl family, when the new building is completed, will be one of the finest in the kingdom. There is, almost right opposite, a cascade, on the water of Bran, which, in its way from the western hills, forms a considerable fall called the *Rumbling Brig*, from a narrow bridge made by the fall of two rocks across the stream. The pencil of Rosa never delineated a wilder or more striking scene. The stream has a second fall, which, but for the other, would be deemed superb. Sir James Galloway, master of requests to James VI. and to Charles I. was created Lord Dunkeld in 1645; but his grandson James was attainted at the Revolution, and having died at the beginning of last century, the title became extinct. Besides the parish church, there are two dissenting meeting-houses in Dunkeld. The village has five fairs annually. The population amounted in 1821 to 1915, and in 1831 to 1471.

DUNKIRK, an arrondissement of the department of the

North, in France, extending over 310 square miles, divided into seven cantons, and these subdivided into fifty-nine communes, containing 86,580 inhabitants.

Dunkirk, a city in the department of the North, in France, at the end of a harbour which is nearly dry at low water. It was formerly more flourishing than it is at present, and once created such apprehensions on the part of England, that in several treaties the demolition of the fortifications was stipulated. It now contains 1800 houses and 24,600 inhabitants. There are still the rudiments of a naval arsenal; and it has some trade, and shipping employed in the whale fishery.

DUNMOW, Great, a market-town of the hundred of the same name, in the county of Essex, thirty-seven miles from London, and situated on the river Roding. It is a town of very ancient date, supposed to be the Cæsaromagus of the Romans, and where remains of the road to Colchester, constructed by that people, are still visible. It is governed by a corporation. The market is held on Saturday. The inhabitants amounted in 1801 to 1828, in 1811 to 2015, in 1821 to 2409, and in 1831 to 2462. Near to it is Little Dunmow, remarkable for the ancient right which a happy couple have to demand a flitch of bacon at the end of a year from their marriage.

DUNNING, John, Lord Ashburton, a celebrated English counsellor, was the second son of Mr John Dunning of Ashburton, Devonshire, an attorney. He was born at Ashburton, on the 18th of October 1731, and was educated at the free grammar school of his native place, where he soon distinguished himself by his proficiency in classical literature as well as the mathematics. On leaving school he was taken into his father's office, where he remained until the age of nineteen, when he was sent to the Temple. After he came to the bar he got very slowly into practice. In the year 1762 he was employed to draw up *A Defence of the United Company of Merchants of England trading to the East Indies, and their Servants, particularly those at Bengal, against the Complaints of the Dutch East India Company to his Majesty on that subject;* which was considered as a masterpiece of language and reasoning, and from which he derived not only immediate profit, but such a large share of reputation as secured him extensive practice in his profession.

In 1763 he distinguished himself as counsel in the memorable proceedings in the case of Wilkes, and his professional business, from that period, gradually increased to such an extent that, in 1776, he is said to have been in the receipt of nearly L.10,000 per annum. In 1766 he was chosen recorder of Bristol, and on the 23d of December 1767 he was appointed to the office of solicitor-general, which he held until the month of May 1770, when he retired, along with his friend Lord Shelburne. In 1771 he was presented with the freedom of the city of London. From this period he was considered as a regular member of the opposition party, and distinguished himself by many able speeches in parliament. He was first chosen member for Calne in 1768, and continued to represent that borough until he was promoted to the peerage. In 1782, when the Marquis of Rockingham became prime minister, Mr Dunning was appointed chancellor of the duchy of Lancaster; and about the same time he was advanced to the peerage, by the title of Lord Ashburton. He died while on a visit to Exmouth, on the 18th of August 1783.

The person of Lord Ashburton was by no means agreeable or prepossessing. He was a short, thick man, with a sallow countenance, a constant shake of the head, and a hectic cough, which frequently interrupted the stream of his eloquence. His oratory, however, was at once fluent, elegant, and argumentative, and he possessed a sound knowledge of the laws, and of the theory of our constitution. His language was pure and classical, yet peculiar to himself, and he had a great fund of wit and humour. His disposition was originally timid, but this defect he overcame by practice, as he became more familiar with forensic habits. Of the great extent of his practice some notion may be formed from the fortune he left behind him, which was all earned by his own exertions, and amounted to no less a sum than L.180,000.

Sir William Jones has pronounced a splendid eulogium on the character of Lord Ashburton. "His language," says that accomplished scholar, "was always pure, always elegant; and the best words dropped easily from his lips into the best places, with a fluency at all times astonishing, and, when he had perfect health, really melodious. His style of speaking consisted of all the turns, oppositions, and figures, which the old rhetoricians taught, and which Cicero frequently practised, but which the austere and solemn spirit of Demosthenes refused to adopt from his first master, and seldom admitted into his orations, political or forensic. That faculty, however, in which no mortal ever surpassed him, and which all found irresistible, was his wit. This relieved the weary, calmed the resentful, and animated the drowsy; this drew smiles even from such as were the objects of it; scattered flowers over a desert; and, like sun-beams sparkling on a lake, gave spirit and vivacity to the dullest and least interesting cause. He was endued with an intellect sedate yet penetrating, clear yet profound, subtle yet strong. His knowledge, too, was equal to his imagination, and his memory to his knowledge."

Besides the *Answer to the Dutch Memorial*, Lord Ashburton is supposed to have assisted in writing a pamphlet on the law of libel, and to have been the author of *A Letter to the Proprietors of East India Stock, on the subject of Lord Clive's Jaghire, occasioned by his Lordship's Letter on that Subject*, 1764, 8vo. His lordship was at one time suspected of being the author of the celebrated *Letters of Junius*. (See Chalmers's *Biog. Dict.*, and Sir W. Jones's *Works*, vol. iv.)

DUNS, John, a schoolman of the highest reputation, is said to have been born in the year 1274, but the place of his birth has been long and much disputed. Dempster has asserted the claims of Scotland by twelve arguments;[1] but a less formidable number might perhaps have been sufficient. The designation *Scotus*, which is commonly added to his name, evinces him to have been a native either of Scotland or of Ireland; and the pretensions of the latter country cannot be supported by the authority of a single early writer. Wadding and other Irish authors who claim him as their countryman, persuade themselves that he was born at *Dunum*, or Downpatrick, and must thence have derived the name of Duns;[2] but this is obviously a mere conjecture, unsupported by tradition, and carrying with it no great plausibility. Leland claims him as an Englishman, on the authority of certain manuscript copies of his works, preserved in the library of Merton College, and bearing a colophon which describes him as born at the village of Dunstane in the county of Northumberland.[3] But if this had been the place of his birth, his surname ought to have been Dunstane. It apparently belongs to the class of local surnames, or those derived from places of birth or habitation; and we have little or no hesitation in supposing him to have been a native of Dunse in the county of Berwick. This surname is still to be found in Scotland. He is mentioned as a native of Scotland by Trithemius,[1] and likewise by Paulus Jovius, Sixtus Senensis, Possevin, and many other writers of various countries. We are told that when a boy he became accidentally known to two Franciscan friars, who, finding him to be a youth of very extraordinary capacity, took him to their convent at Newcastle, and afterwards persuaded him to become one of their fraternity. From thence he was sent to Oxford, where he became a fellow of Merton College, and professor of divinity; but it appears that he had likewise studied at Paris. His lectures were frequented by a prodigious concourse of students. His fame was now become so universal, that the general of his order removed him to Paris, that the students of that university might also have the benefit of his lectures. He went to Paris in the year 1304, where he is said to have been honoured first with the degree of bachelor, then of doctor of divinity, and in 1307 to have been appointed regent of the divinity schools; but as he had taught divinity at Oxford, he must previously have taken at least one degree in that faculty. During his residence at Paris, arose the famous controversy about the immaculate conception of the Virgin Mary. Albertus Magnus maintained that she was born in original sin. Scotus advanced two hundred arguments in support of the contrary opinion, and convinced the university of Paris that she was really conceived immaculate. This important nonsense however continued to be disputed till the year 1496, after the council of Basel, when the university of Paris made a decree, that no student who did not believe the immaculate conception should be admitted to a degree. Duns had not been above a year at Paris, when the same general of the Franciscans ordered him to remove to Cologne, where he was received with great pomp and ceremony by the magistrates and nobles of that city, and where he died of an apoplexy soon after his arrival, in the year 1308, in the thirty-fourth year of his age. Some writers have reported that he was buried in an epileptic fit, and that, upon removing his bones, he appeared to have turned himself in his coffin. The genius of this renowned schoolman, who obtained the appellation of *Doctor Subtilis*, or the Subtle Doctor, reflects no inconsiderable lustre on the nation to which he belonged: he maintained a reputation almost unrivalled till the scholastic theology and scholastic philosophy were finally exploded. His followers, who were called Scotists, opposed the opinions of the Thomists, or followers of St Thomas Aquinas. An edition of his works, accompanied by a life of the author by Luke Wadding, was published at Lyon in twelve volumes folio.

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[1] Dempsteri Asserti Scotiæ Cives esse sui; S. Bonifacius rationibus ix. Joannes Duns rationibus xii. Bononiæ, 1621, 4to.

[2] Wadding Scriptores Ordinis Minorum, f. 201. a. Romæ, 1650, fol.

[3] Lelandus de Scriptoribus Britannicis, tom. ii. p. 317.

DUNSE, a market-town of Scotland, in the district of Merse, Berwickshire. It is situated on a rising ground in the middle of the shire, and though not the county town, is by far the largest and most respectable place in Berwickshire. It is a burgh of barony, and is governed by a bailie. The town is of great antiquity, and was frequently destroyed in the Border wars. As seen from any point around, Dunse has the appearance of a city, and on closer inspection it is found to possess a respectable proportion of good houses. In the market-place stands the town-house, an elegant modern building, in the Gothic style. Besides a parish church, Dunse possesses two Seceder meeting-houses and a Relief chapel. There is here a weekly market, and four fairs for sheep and three for horses and cattle annually. Dunse is considered as the birthplace of the famous John Duns Scotus. A mile south of the town is a well of mineral water, which is a powerful chalybeate. The population in 1821 amounted to 3773, and in 1831 to 3469.

DUNSTABLE, a market-town in the hundred of Manshead, in the county of Bedford, thirty-three miles from London. This neighbourhood was celebrated formerly for the size of its larks, and for the great number of straw and chip hats made by the females, a trade which is still extensively carried on. It was a Roman station, the Mageovinium of Antoninus. There is here a weekly market, which is held on Saturday. The inhabitants amounted in 1801 to 1296, in 1811 to 1616, in 1821 to 1831, and in 1831 to 2117.

DUNSTAN, Saint, a famous archbishop of Canterbury. He was descended from a noble family in Wessex, and educated in the abbey of Glastonbury, where he studied so hard that it threw him into a violent fever, which brought him to the very point of death. When the whole family were standing about his bed, dissolved in tears, and expecting every moment to see him expire, an angel came from heaven in a dreadful storm, and gave him a medicine which restored him to perfect health in a moment. Dunstan immediately started from his bed, and ran with all his speed towards the church to return thanks for his recovery; but the devil met him by the way, surrounded by a great multitude of black dogs, and endeavoured to obstruct his passage. This would have frightened ordinary boys, but it had no effect whatever upon Dunstan, who, having pronounced a sacred name, and brandished his stick, put the devil and all his dogs to flight. The church doors being shut, an angel took him up in his arms, conveyed him through an opening in the roof, and set him softly down on the floor, where he performed his devotions. After his recovery, he pursued his studies with the greatest ardour, and soon became a perfect master in philosophy, divinity, and music; painting, writing, and sculpture; besides working in gold, silver, brass, iron, and other metals. Whilst still young he entered into holy orders, and was introduced by his uncle Athelm, archbishop of Canterbury, to King Athelstan, who, being charmed with his person and accomplishments, retained him at his court, and employed him in many great affairs. At leisure hours he used to entertain the king and his courtiers with playing on the harp, or some other musical instrument; and now and then, by way of variety, he wrought a miracle, which gained him great admiration. But his old enemy the devil was much offended at this, and prompted some envious courtiers to persuade the king that his favourite was a magician; a story which that prince too readily believed. Dunstan, however, having discovered by the king's countenance that he had lost his favour, resolved to resign rather than be turned out, and accordingly retired from court to another uncle, who was Bishop of Winchester. This good prelate prevailed upon his nephew to forsake the world and become a monk; after which he retired to a little cell built against the church wall of Glastonbury. Here he slept, studied, prayed, meditated, and sometimes amused himself with forging several useful things in brass and in iron. One evening as he was working very busily at his forge, the devil, putting on the appearance of a man, thrust his head in at the window of his cell, and asked him to make something or other for him. Dunstan was so intent upon his work that he made no answer, upon which the devil began to swear and to talk obscenely. This betrayed the lurking fiend. But the holy blacksmith was prepared for all casualties; so putting up a secret ejaculation, he pulled his tongs, which were red hot, out of the fire, and seizing the devil by the nose, squeezed the Satanic organ of smell with a degree of energy which caused his infernal majesty to bellow and scold at such a rate that he awakened and terrified all the people for many miles around. Thus far the monkish legend.

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[1] Trithemius de Scriptoribus Ecclesiasticis, f. 76. a. Basil. 1494, fol.

However ridiculous these fictions may seem, they served, in those times of ignorance, to procure Dunstan a reputation which has been confirmed by the authority of several succeeding historians. It appears that this extraordinary person was called to court in 941, by King Edmund, who bestowed upon him the rich abbey of Glastonbury, which for his sake he honoured with many peculiar privileges. Dunstan enjoyed in a very high degree the favour of this prince during his short reign of six years; but he stood much higher in the grace of his brother and successor King Edred, to whom he was confessor, chief confidant, and prime minister. During this period of court favour he employed all his influence in promoting the interest of the monks of the Benedictine order, to which he belonged, and of which he was a most active and zealous patron. Having the treasures of these two princes, especially of the last, at his command, he lavished them away in building and endowing monasteries for these monks, because almost all the old monasteries were in the possession of secular canons; and not contented with this, he persuaded Edred, who was a bigoted valetudinary, to bestow, by his last will, such immense treasures on the churches and monasteries, that the crown was stripped of its most valuable possessions, and left in a state of indigence. This conduct of Dunstan, whilst he was in power, rendered him very odious to Edwy, who succeeded his uncle Edred in 955; and his rude behaviour to the king himself, and his beloved queen Elgiva, raised the resentment of that prince to such a height that he deprived Dunstan of all his preferments, and drove him into exile. The banishment of Dunstan, the great patron, or, as Malmsbury calls him, the prince of monks, was a severe blow to that order, who were in consequence expelled from several monasteries. But their sufferings were not of long continuance; for Edgar, the younger brother of Edwy, having raised a successful rebellion against his brother, and usurped all his dominions on the north side of the Thames, recalled Dunstan, and in 957 conferred on him the bishopric of Worcester. From this moment he was the chief confidant and prime minister of King Edgar, who in 959 became sole monarch of England, by the death of his elder brother Edwy. In the following year Dunstan was raised to the archiepiscopal see of Canterbury; and being thus possessed of the primacy and assured of the royal support and assistance, he prepared to execute the grand design which he had long meditated, of compelling the secular canons to put away their wives and become monks, or, in case of resistance on their part, of driving them out, and introducing Benedictine monks in their stead. With this view he procured the promotion of Oswald to the see of Worcester, and of Ethelwald to that of Winchester, two prelates who were monks themselves, and animated with the most ardent zeal for the advancement of their order; and these three great champions of monachism found means, by their arts and intrigues, in the course of a few years, to fill no fewer than forty-eight monasteries with Benedictines. But on the death of Edgar in 975 they received a check. The sufferings of the persecuted canons had excited much compassion, and many of the nobility, who had been overawed by the power and zeal of the late king, now espoused their cause and promoted their restoration. Elferc duke of Mercia drove the monks by force out of all the monasteries in that extensive province, and brought back the canons, with their wives and children; whilst Elfwin duke of East Anglia, and Brithnot duke of Essex, raised troops to protect the monks in these countries. In order to allay these commotions, several councils were summoned, and Dunstan was so hard pushed by the secular canons and their friends, that he was obliged to practise some of his holy stratagems; but finally, by dint of miracles, he overcame all opposition.

St Dunstan died in 988, in the sixty-fourth year of his age, having held the bishopric of London, together with the archbishopric of Canterbury, about twenty-seven years. As this prelate was the great restorer and promoter of the monastic institutions, the grateful monks, who were almost the only historians of those dark ages, have loaded him with the most extravagant praises, and represented him as the greatest wonder-worker and highest favourite of heaven that ever lived.

DUNSTER, a borough-town in the hundred of Carhampton, in Somersetshire, 163 miles from London. It is situated in a beautiful vale at the foot of the Quartoch Hills, about one mile from the Bristol Channel. It has ceased to send members to parliament for many years. The market is held on Friday. The inhabitants amounted in 1801 to 772, in 1811 to 868, in 1821 to 895, and in 1831 to 983.

DUNTEEWARAH, a town of Hindustan, belonging to independent chiefs, in the province of Gujerat. Long. 72. 45. E. Lat. 24. 55. N.

DUNUM, a Celtic term, denoting a hill or eminence, and often concurring to form the names of towns, as well as to indicate their elevated situation as places of strength or citadels; hills or eminences being adapted to such structures. See DUN.

DUNWICH, a small borough-town of the hundred of Blything, in Suffolk, once a city, and remarkable only from having sent two members to parliament, but it is now disfranchised. The inhabitants amounted in 1801 to 184, in 1811 to 208, in 1821 to 200, and in 1831 to 232.

DUPIN, LOUIS ELLIES, doctor of the Sorbonne, and professor of philosophy in the Royal College, one of the greatest critics of his time, especially in ecclesiastical matters, was born at Paris in 1657. When he published the first volume of his *Bibliothèque Universelle des Auteurs Ecclésiastiques*, in 1686, the liberty with which he treated some ecclesiastical writers gave so much offence that M. de Harlay, archbishop of Paris, obliged Dupin to retract many of his propositions, and besides suppressed the work. Nevertheless he was suffered to continue it, by altering the title from *Bibliothèque Universelle* to *Bibliothèque Nouvelle*. This great undertaking, continued in successive volumes till it reached as many as fifty-eight, though sufficient to occupy the life of an ordinary man, did not prevent M. Dupin from obliging the world with other works. He was a man of prodigious reading, and had an easy, happy way of writing, with an uncommon talent for analyzing the works of an author; a quality which renders his *Bibliothèque* so valuable. M. Dupin was banished for a time from his chair in the Royal College, to Chatelherault, on account of the famous *Cas de Conscience*, but he was afterwards restored, and died in 1719.

DUPINASCHA, a city of Turkey in Europe, in the province of Kostendill. It stands at the foot of a mountain of its own name, which is watered by the Isker, and contains about 6000 inhabitants, chiefly employed in the iron mines of the mountains near them.

DUPLE, among mathematicians, denotes the ratio of 2 to 1. Thus the ratio of 8 to 4 is duple, or as 2 to 1.

Sub-duple ratio is just the reverse of the former, or as 1 to 2. Thus the ratio of 4 to 8, or 6 to 12, is sub-duple, or as 1 to 2.

DUPLICATE, among lawyers, denotes a copy of any deed, writing, or account. It is also used for the second letters-patent granted by the Lord Chancellor in a case wherein he had done the same before. A second letter written and sent to the same party, and of the same tenor as a former one, from fear of the first miscarrying, is called a *duplicate.*

DUPLICATION, in general, signifies the doubling of any thing, or multiplying it by 2; also the folding of any thing back again on itself.

DUPLICATURE, among anatomists, is a term used to denote the folds of any membrane or vessel. Thus we say the *duplicatures of the intestines, peritonæum,* and the like.

DUPONDIUS, in *Antiquity,* a weight of two pounds, or money of the value of two asses. See As.

Since the as at first weighed a pondo or libra, the dupondius must have weighed two; and hence the name. Though the weight of the as was afterwards diminished, and consequently that of the dupondius, yet they still retained the denomination. See Pound and Libra.

DUPPA, Brian, a learned English bishop, was born in 1589, at Lewisham, in Kent, of which place his father was then vicar. In 1634 he was constituted chancellor of the church at Sarum, and soon afterwards made chaplain to Charles I. He was appointed tutor to Charles prince of Wales, and his brother James duke of York; and about the same time nominated to the bishopric of Chichester. In 1641 he was translated to the see of Salisbury, but received no benefit from this preferment, owing to the suppression of episcopacy. Charles I. held him in high esteem, and is said to have derived assistance from him in composing the Εικων Βασιλικη. After the restoration he was made bishop of Winchester, and lord high almoner. He died at Richmond in 1662, aged seventy-three.

DUPPAU, or Daupow, a town in the circle of Ellbogen, in the Austrian kingdom of Bohemia. It is situated in a vale watered by the river Auboche, and has a castle, a monastery, and about 1200 inhabitants, chiefly employed in the cloth manufacture.

DUPUIS, Charles Francis, an eminent French writer, and member of the Institute, was born of poor parents, at Trye-Château, between Gisors and Chaumont, on the 26th of October 1742. His father, who was a teacher, instructed him in mathematics and land-surveying. The Duke de la Rochefoucault, who accidentally became acquainted with the youth, took him under his protection, and gave him a bursary or exhibition in the College of Harcourt.

Dupuis made such rapid progress in his studies, that, at the age of twenty-four, he was appointed professor of rhetoric at the college of Lisieux. In his hours of leisure he applied himself to the study of the law, and on the 11th of August 1770 he was admitted an advocate before the parliament. He was charged by the rector of the university with the task of delivering the customary discourse at the distribution of prizes; and he was also employed in the name of the university to compose the funeral oration of the Empress Maria Theresa of Austria. These two works having been printed, were admired on account of their elegant latinity, and laid the foundation of the author's fame as a writer.

The mathematics having been the object of his early studies, he now devoted his more serious attention to that science; and for some years he attended the astronomical lectures of Lalande, with whom he formed an intimate friendship. In 1778 he constructed a telegraph on the principle suggested by Amontons; and he succeeded so well, that he was enabled to correspond with his friend M. Fortin, who, from the village of Bagneux, where he had a country seat, observed with a telescope the signals made by Dupuis at Belleville, and returned his answer on the following day. In this manner they continued to correspond every year, during the fine season, from 1778 to the commencement of the Revolution. Dupuis then destroyed his machine, lest it should render him suspected in those dangerous times.

Much about the same time, Dupuis formed his ingenious theory with respect to the origin of the Greek months. In the course of his investigations upon this subject, he composed a long memoir on the constellations. He had been struck with the singularity of the figures by which the groups of stars called constellations were represented on the most ancient planispheres; and had also remarked that these groups did not present to the eye any form analogous to their representations. Hence he concluded, that the real configurations of these constellations, or asterisms, could not have been the origin of the figures and of the names which had been given to them from the highest antiquity. Dupuis attempted to resolve this enigma, in so far at least as related to the constellations of the zodiac. He conceived that this representation of the heavens during the course of the year must have some reference to the state of the earth, and to the labours of agriculture at the time, and in the country, in which these signs had been invented; so that the zodiac was, for the people who invented it, a sort of calendar at once astronomical and rural. It seemed only necessary, therefore, to discover the clime and the period in which the constellation of *Capricorn* must have arisen with the sun on the day of the summer solstice, and the vernal equinox must have occurred under *Libra.* It appeared to Dupuis that this clime was Egypt, and that the perfect correspondence between the signs and their significations had existed in that country for a period of between fifteen and sixteen thousand years before the present time; that it had existed only there; and that this harmony had been disturbed by the effect of the precession of the equinoxes. He therefore ascribed the invention of the signs of the zodiac to the people who then inhabited Upper Egypt or Ethiopia. This was the basis on which Dupuis established his mythological system, and endeavoured to explain the curious subject of fabulous history, and the whole system of the theogony and theology of the ancients.

Persuaded of the importance of his discoveries, which, however, were by no means entirely original, Dupuis published several detached parts of his system in the *Journal des Savants* for the months of June, October, and December 1777, and of February 1781, which he afterwards collected and published, first in Lalande's *Astronomy,* and then in a separate volume in 4to, 1781, under the title of *Memoire sur l' Origine des Constellations, et sur l'Explication de la Fable par l'Astronomie.* The theory propounded in this memoir was refuted by M. Bailly, in the fifth volume of his *History of Astronomy;* but, at the same time, with a just acknowledgment of the erudition and ingenuity exhibited by the author.

Condorcet proposed Dupuis to Frederick the Great of Prussia as a fit person to succeed Thiebault in the professorship of literature at Berlin; and Dupuis had accepted the invitation, when the death of the king put an end to the engagement. The chair of humanity in the college of France having at the same time become vacant by the death of M. Bejot, it was conferred on Dupuis; and in 1788 he became a member of the Academy of Inscriptions. He now resigned his professorship at Lisieux, and was appointed by the administrators of the department of Paris one of the four commissioners of public instruction.

At the commencement of the revolutionary troubles Dupuis sought an asylum at Evreux; and having been chosen a member of the national convention by the department of the Seine and Oise, he distinguished himself by the moderation of his speeches and public conduct. In the third year of the republic he was elected secretary to the assembly, and in the fourth he was chosen a member of the council of Five Hundred. After the memorable 18th of *Brumaire* he was elected by the department of the Seine and Oise a member of the legislative body, of which he became the president. He was afterwards proposed as a candidate for the senate; and here terminated his political career.

In 1794 he published his large work, entitled *Origine de tous les Cultes, ou la Religion Universelle*, 3 vols. 4to, with an atlas, or 12 vols. 12mo. This work excited considerable sensation at first; it gave umbrage to many, was attacked and defended with warmth, at length ceased to be read, and fell into utter neglect. In 1798 he published an abridgment of this work in one volume 8vo, which met with no better success. Another abridgment of the same work, executed upon a much more methodical plan, was published by M. de Tracy. The other works of Dupuis consist of two memoirs on the *Pelasgi*, inserted in the *Memoirs of the Institute;* a memoir *On the Zodiac of Tentyra*, published in the *Revue Philosophique* for the month of May 1806; and a *Mémoire Explicatif du Zodiaque Chronologique et Mythologique*, published the same year, in one volume 4to. It was from the perusal of the poem of *Nonnus*, which he once thought of translating into French, and of which a fragment was printed in the *Nouvel Almanach des Muses* for the year 1805, that Dupuis caught the first idea of his astronomical system.

Dupuis died at Is-sur-Til, on the 29th of September 1809, leaving behind him several manuscripts on subjects connected with the works which he had published during his life. He was a member of the legion of honour; and his character was that of an honest man and a paradoxical writer. He was born poor, and never acquired any fortune. M. Dacier, secretary to the third class of the Institute, delivered his *Eloge;* and an historical account of his life and writings was published by his widow. (See also *Biographie Universelle.*)

DUQUELLA, a province of Morocco, about seventy-five miles long and sixty broad. It is chiefly remarkable in an agricultural point of view for the production of a species of water melon, which grows to a prodigious size. Grain is also raised, but not in such quantities as in some other parts of the empire. Goats are bred in immense numbers, and their skins form one of the principal articles of export from Mogadore. Honey and wax are in great abundance. The inhabitants are industrious, and much inclined to commerce.

DURADSCH, the ancient Dyrrachium, a sea-port in Greece, in the country of the Arnauts. It is the see of a Greek archbishop and of a Catholic bishop, is fortified, and contains 5000 inhabitants. There is a good harbour, whence both commerce and piracy have long been carried on. The air is most unwholesome.

DURAKAH, a small island in the Red Sea, about sixteen miles from the coast of Arabia. Long. 41. 31. E. Lat. 16. 48. N.

DURANDUS, William, one of the most learned lawyers of the thirteenth century, was born at Puimoission, in Provence. He was a pupil of Henry of Susa, and taught canon law at Modena. He was afterwards made chaplain and auditor of the sacred palace, legate of Gregory X. at the council of Lyons, and bishop of Mende in 1286. His works are, 1. *Speculum Juris*, Rome, 1474, folio, whence he derived the name of *Speculator;* 2. *Rationale Divinorum Officiorum*, Mentz, 1459, folio, scarce; 3. *Repertorium Juris*, Venice, 1496, folio.

DURANGO, a town of Spain, in the province of Biscay. It stands twenty miles south-east of Bilboa, on one of those numerous streams which, when united, form its river. It contains 2800 inhabitants. Manufactories of iron and steel goods are carried on here.

Durango, or New Biscay, an intendancy of Mexico, in North America. According to Humboldt, it extends from long. 104. 40. to 110. 0. W. and from lat. 23. 55. to 29. 5. N.[1] It is bounded on the west by Sonora; on the east it touches on San Luis Potosi; and towards the north and east, for upwards of 200 leagues, it borders on an uncultivated country, inhabited by warlike and independent Indians. It comprehends the northern extremity of the great table-land of Anahuac. Its length from north to south, from the celebrated mines of Guarisamey to the mountains of Carçay, is 232 leagues. Its breadth is very unequal, and near Parrel is scarcely fifty-eight leagues. Its extent of surface is greater than that of the united kingdom of Great Britain and Ireland; and yet its total population, according to Humboldt, was in 1803 rather less than 160,000. Of these, Major Pike thinks, three twentieths might be European whites, five twentieths Creoles, five twentieths Mestizoes and half-castes, and seven twentieths Indians. It comprises, besides the city of Durango, six towns (villas), 199 villages (pueblos), seventy-five parishes (paroquias), 152 haciencias, thirty-seven missions, and 400 cottages (ranchos).

The climate of this intendancy is stated by Major Pike to be dry, and the heat, at that period of the year which precedes the rainy season, to be very great. The rains commence in June, and continue by light showers till September. During the remainder of the year there falls neither rain nor snow to moisten the earth, and the atmosphere becomes highly electrified. The agricultural produce consists of wheat, maize, rice, oats, cotton, flax, indigo, and the fruit of the vine. To the north of Chihuahua, about thirty miles to the right of the main road, there is some pine timber. In one place, near a spring, Major Pike noticed a solitary walnut tree; and in all the small streams there are, he says, shrubby cotton trees. "With these few exceptions, the whole province is a naked, barren plain, which presents to the eye an arid unproductive soil; and, more especially in the neighbourhood of mines, even the herbage appears to be poisoned by the qualities of the land." New Biscay trades with the southern provinces, and also with New Mexico and Sonora, furnishing to the more populous parts of the kingdom a great number of horses, mules, beeves, sheep, and goats, in return for dry goods, European furniture, ammunition, books, and other articles, which are brought from the capital on mules. "Some individuals make large fortunes by being the carriers from Mexico to Chihuahua, the freight being eight dollars per cent.; and they generally put 300 lb. on each mule. The merchants make their remittances twice a year, in bullion. Goods sell at Chihuahua about 200 per cent. higher than the prices in the seaport towns of the Atlantic. This was in 1807. Horses then averaged six dollars; some, however, fetched a hundred dollars; and trained mules twenty dollars. Rice sold for four dollars the hundredweight. They manufacture some few arms, blankets, stamped leather, embroidery, coarse cotton and woollen cloths, and a species of carpeting." This traveller concludes his statistical account of

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[1] According to Major Pike, a more recent traveller in these parts, it is situated between long. 105. and 111. W. and lat. 24. and 33. N. He gives its length from north-west to south-east at 600 miles, its greatest breadth at 400, and its population at 200,000.

Durango.

the province by stating, that law here is merely a shadow, the only laws that can be said to be in force being the military and the ecclesiastical; that the corruption of morals is general, this being the natural concomitant of a great degree of luxury among the rich, and of misery among the poor; and that the Roman Catholic religion is in full force, but the inferior clergy are much dissatisfied.

There are no slaves in this province, nor, according to Humboldt, a single tributary individual; and "all the inhabitants, are either white, or consider themselves as such." Major Pike explains the state of things more specifically. Except the Apadus, who inhabit the Bolson de Mapimi, there are, he says, no uncivilized tribes in this province. "The Christian Indians are so incorporated amongst the lower grades of Mestizoes, that it is scarcely possible to draw the line of distinction, except at the ranchos of some nobleman or large landholder, where they are in a state of vassalage. This class of people laid a conspiracy, which was so well concerted as to baffle the research of the Spaniards for a length of time, and to occasion them the loss of several hundreds of the inhabitants. The Indians used to go out from their villages in small parties; in a short time a part would return with a report that they had been attacked by the Indians. The Spaniards would immediately send out a detachment in pursuit, when they were led into an ambuscade, and every soul cut off. They pursued this course so long that the whole province became alarmed at the rapid manner in which their enemies multiplied; but some circumstances leading to a suspicion, they made use of the superstition of these people for their ruin. Some officers disguised themselves like friars, and went round amongst the Indians, pretending to be possessed of the spirit of prophecy. They preached up to them that the day was approaching when a general deliverance from the Spanish tyranny was about to take place, and invited the Indians to join with them in promoting the work of God. The poor creatures came forward, and in their confessions stated the great hand that had already been put to the work. After they had ascertained the nature and extent of the conspiracy, and obtained a body of troops, they commenced the execution, and put to death about four hundred of them. This struck terror and dismay throughout the Indian villages, and they durst not rise to support their freedom and independence."

Durango or Guadiana, the principal city, is the residence of the intendant and of a bishop. It is situated in the most southern part of the province, in long. 107. W. and lat. 25. N., at 170 leagues distance in a straight line from the city of Mexico, and 289 leagues from the town of Santa Fe, in New Mexico. The elevation of the town above the sea level is 6800 feet. There are frequent falls of snow, and the thermometer descends to 14° Fahrenheit below the freezing point. The city was founded in 1559. The population in 1803 was 12,000, but Major Pike makes it 40,000. He also states that the city is infested in a very remarkable manner by scorpions. "They come out of the walls and crevices in May, and continue for about a fortnight in such numbers that the inhabitants never walk in their houses after dark without a light, and always shift or examine the bed-clothes and beat the curtains previously to going to rest, after which the curtains are secured under the bed."

In the midst of a very level plain, between this city, the plantations Del Ojo and Del Chorro, and the town of Nombre de Dios, which lies in the road to the famous mines of Sombrereto, there arises a singular group of rocks, of a very grotesque form, covered with scoria, called La Breña. They extend twelve leagues from north to south, and rise from east to west, and appear to be a volcanic production, consisting of basaltic amygdaloid. On the summit of one of the neighbouring mountains (the Treayle), is found a crater 300 feet in circumference and 100 feet in perpendicular depth. In the environs of Durango there is also to be found, insulated in the plain, an enormous mass of malleable iron and nickel, said to weigh upwards of 40,000 pounds avoirdupois, and corresponding in its composition to the aëroliths which fell in 1751, near Agram, in Hungary. Major Pike also informs us that there is "a mountain or hill of loadstone" about a hundred miles south of Chihuahua.

DURATION, an idea obtained by attending to the succession of feelings and thoughts in the mind. Duration, as marked by certain periods and measures, is what we most properly call *time*.

DURBUNGAH, a town of Hindustan, province of Bahar, district of Tirhoot, fifty-five miles north-north-east from Patna. The inhabitants are chiefly Mahommedans, who support themselves by breeding horses. Long. 85. 54. E. Lat. 25. 7. N.

DUREN, a circle in the Prussian government of Aix-la-Chapelle, extending over 122 square miles, and containing 38,048 inhabitants, in three cities, one market-town, and twenty-seven villages. The chief place, a city of the same name, is situated on the river Roer, and is a manufacturing place for fine cloths, blankets, paper, and ironmongery. It contains four churches, and 4938 inhabitants.

DURER, ALBERT, descended of an Hungarian family, and born at Nuremberg in May 1471, was one of the best engravers and painters of his age. He was a man of letters and a philosopher, and an intimate friend of Erasmus, who revised some of the pieces which he published. He was a man of business also, and for many years the leading magistrate of Nuremberg. Though not the inventor, he was one of the first improvers of the art of engraving; and he bethought himself of working also in wood, on which he engraved the life and passion of Christ in thirty-six pieces, which were very highly esteemed. In many of those prints which he executed on copper, the engraving is exceedingly elegant. His Hell scene particularly, which was engraved in the year 1513, is as highly finished a print as ever was engraved, and as happily executed. In his wooden prints too we are surprised to see so much meaning in so early a master; the heads being well marked, and every part admirably executed. This artist seems to have understood the principles of design. His composition, too, is often pleasing; and his drawing generally good. But he knew very little of the management of lights, and still less of grace; yet his ideas are purer and more elegant than we could have supposed from the awkward archetypes which his country and education afforded. In a word, he was certainly a man of very extensive genius; and, as Vasari remarks, he would have been an extraordinary artist if he had had an Italian instead of a German education. His prints are very numerous, and were much admired and eagerly bought up in his own lifetime. He was rich, and chose rather to practise his art as an amusement than as a business. This eminent person died at Nuremberg, on the 6th April 1528, and was interred in St John's Church, where an inscription was placed over his remains. Durer wrote several books in German, which were translated into Latin by other persons, and published after his death. Among these we may mention, 1. *De Symmetria Partium in rectis formis Humanorum Corporum*, Nuremberg, 1532, Paris, 1557, fol.; 2. *Institutiones Geometricæ*, Paris, 1532; 3. *De Urbibus, Arcibus, Castellisque condendis et muniendis*, Paris, 1531; 4. *De Varietate Figurarum, et flexuris Partium, et gestibus Imaginum*, Nuremberg, 1534. (See *Reliquien von Albrecht Dürer, seinen Verehrern geweiht, Taschenbuch* *für Deutschland's Kunstfreunde, zu Albrecht Dürer's dritter Secular-feier*, Nürnberg, 1828.)

DURESSE, Hardship, in *Law*, is where a person is kept in prison or restrained of his liberty contrary to order of law; or is threatened to be killed, maimed, or beaten. In which case, if a person so in prison, or in fear of such threats, make any specialty or obligation, by reason of such imprisonment or threats, such deed is void in law; and in an action brought on such specialty, the party may plead that it was brought by duresse.

D'URFEY, Thomas, more generally known by the familiar name of Tom d'Urfey, an English satirist and songster, of whom, though his name was as well known as that of any writer extant, yet few particulars have been collected. He was born in Devonshire; but when, where, or of what family, is uncertain. He was bred to the law, which he forsook for the more agreeable employment of writing plays and songs; and the latter he had so happy a talent both of writing and singing, that he received many favours from persons of quality on that account. Even crowned heads did not disdain his company. A writer of the Guardian (No. 67), tells us, he remembered to have seen Charles II. leaning on Tom d'Urfey's shoulder more than once, and humming over a song with him. This indeed was not extraordinary in so merry a monarch; but even the phlegmatic King William could relax the rigour of his Dutch muscles on hearing Tom sing a song. He was certainly by all accounts a cheerful, honest, good-natured man; but as this character does not include prudence, D'Urfey became poor as he grew old; and having prevailed on the managers of the playhouse to act his comedy of the *Plotting Sisters* for his benefit, Mr Addison wrote the above-mentioned paper in the Guardian, with another (No. 82) representing him in a good-humoured light, in order to procure him a full house. He died at an advanced age, in 1723.

DURHAM, Bishopric of, one of the counties of England. Before the arrival of the Romans it was included in the British principality of the Brigantes, and after their arrival made part of the province of *Maxima Cæsariensis*. During the heptarchy it formed part of the kingdom of Northumberland, the fifth established, which began in 547, and ended in 827, having been governed by thirty-one kings. It was not mentioned by Alfred in his division of counties, being at that time considered as a part of Yorkshire. At present it is included in the northern circuit, in the province of York, and is a diocese and principality under the government of its own bishop, being a county palatine, the second in rank, and the richest in England. It is bounded on the north by Northumberland, on the south by Yorkshire, on the east by the North Sea, and on the west by Cumberland. It extends, according to the view of Mr Rickman, over 1061 square miles, and contains one city of the same name, nine market-towns, and 223 villages. It is divided into four wards. Until the passing of the reform act, it returned two members to the House of Commons for the county, and two for the city. The county has been formed, by that law, into two divisions, for the purpose of parliamentary elections; each of which returns two members. The northern division comprehends the wards of Chester and Easington, and the polling places are Durham, Sunderland, Lancheton, Wickham, Chester-le-Street, and South Shields. The southern division comprehends the wards of Darlington and Stockton, and the poling places are these two towns, and Bishop Auckland, Stanhope, Middleton-in-Teesdale, Barnard Castle, and Sedgefield. The following places within the county have by the same law obtained the privilege of electing two members each, viz. Gateshead, South Shields, Sunderland, and Tynemouth.

This is the only county palatine remaining in England, and it is called *palatine*, *a palatio*, because the owners thereof had, in this county, the authority to use the royal prerogative, as fully as the king had in his palace. The palatine privileges were granted to this county probably on account of its bordering upon the inimical kingdom of Scotland, in order that the inhabitants, having justice administered at home, might not be obliged to go out of their county, and leave it open to an enemy's incursions; and that the owners, being encouraged by so large an authority, might be the more watchful in its defence. There is a court of chancery in this county, and the bishop is at the head of the administration of justice.

The western angle of the county of Durham is hilly and mountainous, with black, naked, and barren regions, crossed by a ridge of high hills, from whose sides issue numerous streams flowing to the sea. There are some beautiful and fertile valleys in the eastern and central parts, pleasantly varied with hill and dale, and alternately appropriated to corn and pasture. The waste lands occupy nearly 120,000 acres of the western part of the county; but in the southern districts many hundred acres have been inclosed and cultivated within the last forty years. The common fields are now but few; for the land belonging to the townships has been inclosed for above a century. There is a great portion of wet ground still remaining, although draining is carried on to a great extent.

Near the river Tees, and in some spots bordering on the other rivers, the soil is loam or a rich clay. At a farther distance from these rivers the soil is of an inferior quality, and marshy, with patches of gravel interspersed. The hills between the sea and an imaginary line from Barnard Castle on the Tees to Alansford on the Derwent, are covered with a dry loam, the fertility of which varies with its depth. From this line westward the summits as well as the sides of the hills are moorish wastes.

The woodlands of Durham are not of very considerable extent, trees being chiefly confined to the parks and seats of the nobility and gentry, but many plantations have been made of late years. The banks of the rivers and brooks, however, particularly in the vicinity of Durham, are fringed with wood of long growth and much value. The public roads are in general good, but those belonging to private districts and townships want improving.

The port of Stockton-upon-Tees is well situated for commerce. Hartlepool, situated on a promontory, nearly encompassed by the German Ocean, which on the south side of the town forms a capacious bay, is advantageously placed for the reception of vessels, and landing of troops from the Continent; and South Shields sends out many ships.

The mineralogical substances found in Durham are numerous and valuable. The coal mines are some of the most extensive and productive in the kingdom, and the quantity of this important article is so great as to exceed all calculation. At Sunderland the coal trade furnishes employment for 520 vessels, independently of the *keels* which convey the coal from the staiths to the ships, which are 492 in number. This coal is chiefly conveyed to the metropolis, though great quantities are sent to the different ports of the Baltic, and in time of peace to France and Holland. The whole quantity annually exported from Sunderland alone amounts to about 315,000 Newcastle chaldrons, each chaldron being equal to 53 cwt. The number of persons dependent on this trade is very great, and some years ago, when the consumption was by no means so great as it is at present, amounted to upwards of 26,000 on the river Wear only. The seams or strata now worked are five in number, extending horizontally for many miles, and are from twenty to one hundred fathoms beneath the surface; while each stratum is from three to eight feet thick. Below these are several other seams of coal; and many parts of the county, besides those where the pits are now open, abound with this substance.

The principal lead mines of Durham are situated in Teesdale and Weardale; those of the former place have not been very productive, but the produce of the latter is of considerable value. The general method of working them is similar to that pursued in other mining counties. The ore of Weardale is melted by the blast-hearth, but in Teesdale air-furnaces have been introduced with much success.

Ironstone is found in the neighbourhood of Swalwell and Winlaton, where are the first iron-works in England.

Some excellent quarries of slate for buildings have been opened in different parts of the county. A beautiful black spotted limestone is dug up near Walsingham, and made into hearths, chimney-pieces, and other ornaments. This neighbourhood abounds also with fine millstones. The Newcastle grindstones are procured at Gateshead Fell; and firestone of high estimation, for building ovens, furnaces, and the like, is obtained in various parts of Durham, and exported in immense quantities.

Several extensive works for manufacturing salt from sea-water have long been established in the neighbourhood of South Shields; but owing to the discovery of a very singular salt spring at Birtley in this county, that process is not so much attended to now. This water rises at the depth of seventy fathoms, in an engine pit constructed for drawing water out of coal mines. It has for many years produced 20,000 gallons per day, four times more strongly impregnated with salt than any sea-water. In consequence of the discovery of this spring, about twenty-five years ago, a large and extensive manufactory of salt has been established near the spot, the quality of which is excellent. At Butterby, near Durham, is another salt spring, which issues from a rock in the river Wear, but is only visible when the water is low; it contains more of the sulphate of magnesia, or Epsom salt, than the spring at Birtley. Within a few yards of the Water-gate, on the south side of the town of Hartlepool, is a chalybeate spring, covered every tide by the sea. It is impregnated slightly with sulphur, which evaporates very quickly, leaving a sediment with salt of tartar; a gallon will yield 120 grains of sediment, two parts of which are nitrous, and the rest limestone.

Improvements in agriculture have been pursued with considerable spirit and success, in the environs of Darlington, chiefly through the patronage of a society of respectable gentlemen, who hold their meetings in the town, and bestow premiums upon merit. The usual rotation of crops in this county is, after summer fallow, wheat, oats, beans, or peas. On some spots of gravelly soil, turnips and barley are grown in almost perpetual succession, a crop of clover being sometimes interposed. The produce of wheat on good land is from twenty to thirty bushels per acre, the produce of barley is from thirty to forty, of oats from twenty to forty. The manures are chiefly lime and the produce of the fold-yard; and though abundance of sea-weed might be collected on the coast, the farmers make but little use of it. The farms are of a middling size, few of them exceeding 200 acres. The largest portion of each farm is appropriated to tillage, but towards the western extremity of the county the whole is applied to pasture. The leases seldom exceed six years, and are too frequently rendered of little value by injudicious restrictions. The leases held of the see of Durham are generally for life, or for twenty-one years, renewable every seven years on payment of a fine. The farm-houses are well situated and commodious, and improvements in farming and farming machinery become more and more common.

The cattle at Durham are, at present, in great repute; as, for form, weight, produce of milk, and quickness of fattening, there are none better. The sheep also, particularly the Tees Water breed, stand high in estimation. It is the largest breed in the island; the legs being longer, finer boned, and supporting a thicker and more firm and heavy carcass, than the Lincolnshire. They are also much wider on the backs and sides, and afford a fatter and finer grained mutton. The weight per quarter, in two-years' old wethers, is from twenty-five to thirty-five pounds, and in particular instances fifty-five pounds or more. The wool is shorter and lighter than some other English breeds. The Weardale sheep are small, but the meat is finely flavoured. When fat, the quarters seldom weigh more than fourteen or eighteen pounds each.

Durham, taking its dimensions into consideration, is inferior to no county in Great Britain for its numerous manufactures. It has cast-metal founderies, iron manufactories, potteries, glass-houses, copperas works, coal-tar and salt-works, quarries of marble, &c.; besides linen and woollen manufactories.

At the distance of about three miles from Darlington, at Oxenhall, are cavities in the earth, denominated Hell Kettles, to the origin of which are attached many fabulous conjectures. The diameter of the largest is not less than 114 feet, and that of the least seventy-five. About five miles from Hartlepool is one of the most singular and romantic clusters of rocks in the north of England, called Black Halls, formed by the force and constant action of the waves, which have separated enormous masses from the coast, washing some entirely away, but leaving others standing, like the vast towers of a cathedral; in some places the rock is perforated so as to resemble a fine pointed archway.

Near the north wall of the church-yard at Ryton is a large barrow, about twenty feet in perpendicular height, now planted with trees. It does not appear to have been opened; but a similar one, near Bradley Hall, in the same parish, inspected about thirty-five years ago, was found to contain a square cavity, formed by stones placed edgewise, in which a human body had been interred. Between one and two miles north of Brancepeth is Brandon Hill, a lofty eminence, on the summit of which is a remarkable tumulus, of an oblong form, 120 paces in circumference at the base, and about twenty-four feet in perpendicular height. It does not appear to have been opened. One mile north of Eggleston is an ancient structure, called the Standing Stones. This originally consisted of a cairn in the centre, surrounded by a trench, and that again encompassed by a circular arrangement of rough stones, many of which have been removed and broken, to repair the roads. Near a brook, at a small distance, is a large barrow, crossed from east to west by a row of stones.

On Fullwell Hill, a gigantic skeleton and two Roman coins were discovered about fifty-five years ago, together with a small urn of unbaked clay. Several copper coins have been found at the village of Whitburn. Some coins of the Emperor Hadrian were found while widening the road near Gateshead, which is supposed to have been a Roman station.

South Shields was the *ad finem* of Richard of Cirencester's itinerary, as appears from the Roman altars, coins, and other relics found there. Evchester, a small irregular village, is supposed to be the *Vindomara* of Antoninus; many Roman inscriptions, and an urn of uncommon form, nearly a yard high and seven inches wide, with a small cup in the centre, having been found there. Chester-le-Street has been supposed to be the *Condercum* of the

Romans, situated on the military way leading to Newcastle. Glanibanta, near the village of Lanchester, is another Roman station, which has survived the ravages of cultivation in an extraordinary degree, and is one of the most perfect in the kingdom. It occupies a fine eminence, and is of an oblong figure, being 174 paces from north to south, and 160 from east to west, within the vallum. In some parts the wall still remains perfect; the outside is perpendicular, twelve feet in height, and built of ashler work in regular courses, each stone being about nine inches thick and twelve long. The site of the Prætorium is clearly distinguishable. Binchester, the seat and manor of the Wren family, is the site of the Roman station called *Vinovium* by Antoninus. Its figure and extent seem nearly similar to those of the station just mentioned; but the walls have been destroyed, and the area inclosed and cultivated. A military way, it is supposed, issued from it, leading towards Chester-le-Street. Innumerable fragments have been discovered here.

The most ancient part of Durham Castle is the keep, now a mere shell; the magnificent hall is fast going to decay. Hilton Castle, an ancient baronial residence of the Hyltons, is situated in a pleasant vale on the north side of the Wear, about three miles from Wearmouth: its present form is that of an oblong square; the interior consists of five stories; the rooms are small, and exhibit every symptom of neglect and decay. Ravensworth Castle, the seat of Sir Thomas Henry, occupies part of the site of an ancient castle, which seems to have formed a quadrangle, having a square tower at each angle, connected by a curtain wall. Two of the towers are built up in the offices, the others are partly in ruins. Lumley Castle, about a mile to the east of Chester-le-Street, is one of the seats of the Earl of Scarborough. It forms a quadrangle, with an area in the centre; at each angle are projecting turrets of an octangular form; it is a grand model of the taste of its age. Brancepeth Castle, an irregular but stately pile, was erected about Stephen's reign, by the family of Bulmers. The original building has had many modern improvements added to it by the present proprietor. The castle of Bishop Auckland stands on the north angle of the town, and, together with its courts and offices, covers about five acres of ground. Raby Castle, the magnificent seat of the Earl of Darlington, owes its splendour to the Earl of Westmoreland, who enlarged a more ancient castle which stood here prior to the year 1379. The present mansion of Streatham Castle was erected on the foundation of the old castle at the beginning of the last century, and several of the apartments are retained in it. Barnard Castle is situated on the southern acclivity of an eminence, rising with a steep ascent from the river Tees; its ruins cover an extensive plot of ground.

Kepier Hospital, near Durham, was founded in 1112; but the only part of the monastic buildings now standing is the gateway, a strong and not unhandsome piece of masonry with pointed arches. The ruins of a monastery for gray friars may be seen at Hartlepool. Several remains of monastic buildings occur near the church at Monk Wearmouth. The monastery of Jarrow may still be traced in its ruins on the summit of an elevated ridge near the church. On the east side of the main street of Gateshead are the ruins of St Edmond's Monastery, which appears, from Bede, to have been established before the year 653. Finchall Priory was beautifully situated in a vale on the banks of the Wear; the ruins cover an extensive plot of ground, but are so much dilapidated that the original appropriation of their respective parts can be traced only with great difficulty. The remains of a chapel at Bear Park are most perfect, and display some neat ornamental architecture. There is at Walsingham the ruins of a considerable building, inclosed with a deep moat, supposed by some to have been a part of a monastery.

The ecclesiastical buildings now remaining, and most worthy of notice, are, the Cathedral of Durham, begun in 1093, in the Saxon and Norman style; Sedgefield Church, in the Saxon style; Bishop Wearmouth Church, supposed to have been founded very soon after the restitution made by Athelstan; and the parish church of Brancepeth, an ancient structure of the conventual form, but apparently of different ages.

The county of Durham contains a great number of noblemen and gentlemen's seats. The following are some of the principal: Streatham Castle, the seat of the Earl of Strathmore; Shincliff-Hall, that of R. Scott, Esq.; Croxdale-Hall, that of W. Salvin, Esq.; Raby Castle, that of the Duke of Cleveland; Lumley Castle, that of the Earl of Scarborough; Castle Eden, that of R. Burdon, Esq.; Harwicke, that of M. Russell, Esq.; Windleston, that of Sir John Eden, Bart.; Grange-Hall, that of G. Allan, Esq.; Winyard, that of the Marquis of Londonderry; Seaham, that of Sir R. Milbanke, Bart.; Ravensworth Castle, that of Sir S. H. Liddel, Bart.; Axwell Park, that of Sir T. Clavering, Bart.; Gibside, that of the Earl of Strathmore; Lambton Hall, that of Lord Durham; and Bradley Hall, that of the Bowes family.

The following titles are furnished from this county: Earl of Darlington to the Duke of Cleveland; Earl of Stanhope; Viscount Lumley to the Earl of Scarborough; Baron Auckland to the Eden family; and Baron Durham to the family of Lambton.

The inhabitants of this county, by accounts of doubtful accuracy, amounted in the year 1700 to 95,500, and in 1750 to 135,000. By the four decennial returns they are stated as follows: In 1801 they amounted to 160,561, in 1811 to 177,625, in 1821 to 207,673, and in 1831 to 253,700. The annual value of the real property appears by the assessment of 1815 to have been L.791,359.

DURHAM, a city, the capital of the county of that name, 260 miles from London. It is situated on the river Wear, which nearly surrounds it, and contributes to the fine situation; the castle and cathedral standing on an eminence, communicate no inconsiderable share of beauty. Besides the cathedral, there are six parish churches. The see is the most richly endowed of any in England, and the prebendaries are of great value. In the vicinity of the city are many interesting remains of antiquity. The corporation consists of a mayor, twelve aldermen, and twenty-four common council men, who nominate the freemen, by whom two members are returned to parliament. The market, held on Saturdays, is well attended. There is very little of trade, and there are no manufactures. The inhabitants amounted in 1801 to 7530, in 1811 to 6763, in 1821 to 9822, and in 1831 to 10,125.

DURKHEIM, a city, the chief place of a canton in the circle of the Rhine, in the kingdom of Bavaria. It stands on the river Isenach, and contains 500 houses, with 3081 inhabitants, who grow much wine.

DURLACH, a circle in the grand duchy of Baden, containing one city, two market-towns, and twelve villages, with 12,626 inhabitants. The capital is of the same name, situated on the river Pfing. It contains 471 houses, and 3873 inhabitants employed in making linen cloth, China ware, and other goods, and in growing fruit and wine.

DUROCHSKOI, a town of Asiatic Russia, in the government of Irkutsk, on the confines of China, near the Argun, 160 miles south-south-east of Nertchinsk.

DURON, an island in the Straits of Malacca, about twelve miles in length and three in breadth. Long. 103. 30. E. Lat. 0. 42. N.

DUROTRIGES, an ancient British nation, established in that part of the country which is now called Dorsetshire. Their name is derived from the two British words *dur*, water, and *trigo*, to dwell; and it seems pretty evident that they obtained their name from the situation of their country, which lies along the sea coast. It is not very certain whether the Durotriges formed an independent state under a prince of their own, or were united with their neighbours the Danmonii; for they were reduced by Vespasian under the dominion of the Romans, at the same time and with the same ease as the latter, and never afterwards revolted. The peaceable disposition of the inhabitants was probably the reason why the Romans had so few towns, forts, and garrisons in this pleasant country. Dorchester, its present capital, seems to have been a Roman city of some consideration, though our antiquaries are not agreed about its Roman name. It is most probable that it was the Durnovaria in the twelfth Iter of Antoninus. Many Roman coins have been found at Dorchester. The military way, called Jeening Street, passed through it; and some vestiges of the ancient stone-wall with which it was encompassed, and of the amphitheatre with which it was adorned, are still visible. The country of the Durotriges was included in the Roman province called *Flavia Cæsariensis*, and was governed by the president of that province as long as the Romans maintained any footing in these parts.

DUROUR'S ISLAND, in the East Indian Ocean, discovered by Captain Carteret in 1767. Long. 143. 21. E. Lat. 1. 15. S.

DURRAJAH, a town of Hindustan, belonging to the Mahrattas, in the province of Malwah, twenty-five miles north-west from Bopal. Long. 77. 9. E. Lat. 23. 28. N.

DURRAMPOOR, a town of Hindustan, in the province of Aurungabad, fifty miles south-south-east from Surat. Long. 73. 23. E. Lat. 20. 34. N.

DURRESTEIN, a town of Austria, in the province of the Lower Ens, and circle of Upper Manhartsberg. It is situated on the banks of the Danube, and belongs to Count Staremburg. Above it are the ruins of a castle in which Richard king of England was kept a prisoner. Near to it are extensive quarries of millstones and grindstones. The inhabitants are about 1000.

DURSLEY, a market-town of the hundred of Berkeley, in the county of Gloucester, 108 miles from London. It is a corporate town, but has long ceased to elect members of parliament. A considerable quantity of broad cloth is made, chiefly for the China trade. A market, held on Thursday, is well supplied. The inhabitants amounted in 1801 to 2379, in 1811 to 2580, in 1821 to 3186, and in 1831 to 3226.

DURY, JOHN, a Scotch divine, who travelled much, and laboured with great zeal to reunite the Lutherans with the Calvinists. His discouragements in this scheme started another still more impracticable, namely, to reunite all Christians by means of a new explication of the Apocalypse, which he published at Frankfort in 1677. He there enjoyed a comfortable retreat in the country of Hesse; but the time of his death is unknown. His letter to Peter du Moulin, concerning the state of the churches of England, Scotland, and Ireland, was printed at London in 1658, under the superintendence of Du Moulin, and is esteemed curious.

DUSKY BAY, on the west coast of Tarai Poenammoo, one of the islands of New Zealand. It is of considerable extent, and affords good anchorage in coves and harbours near the shore. In other parts of it the water is very deep. This bay was discovered by Captain Cook in 1769. Long. 166. 48. E. Lat. 45. 40. S.

DUSSARA, a fortified town of Hindustan, province of Gujerat, which contains about 1300 houses, which are chiefly possessed by Kurbatties; the remainder of the population being Coolees, Rajpoots, and other castes, besides a few Banyans. This place, with twelve surrounding villages, is the property of a Mahommedan zemindar, of Arabian descent, one of whose ancestors, about the year 1209, was put to death for killing a cow, and he has since been considered as a martyr, and his tomb is held in high esteem. The military force of the chief is estimated at 2000 horsemen and 100 infantry.

DUSSAULX, JOHN, a French writer, best known as the translator of *Juvenal*, was born at Chartres, on the 28th of December 1728. He studied first at La Fleche, and afterwards at Paris; and having obtained the situation of a commissary in the *gendarmerie*, he served under the Marshal de Richelieu, in Hanover, during the seven years' war. At the age of twenty-one he was admitted a member of the academy at Nanci; and in 1770 he published his translation of *Juvenal*. This work procured him admission into the Academy of Inscriptions; and he was also appointed ordinary secretary to the Duke of Orleans.

For some years he quietly prosecuted his literary occupations at Paris; but, upon the breaking out of the Revolution, his enthusiastic disposition led him to adopt its principles; and he took part in the debates of the legislative assembly. He spoke and voted, however, at all times for moderate measures; and, on several occasions, he was employed to calm the passions of the people during public tumults. At the memorable sitting of the convention of the 15th of January 1793, he voted that the king should be detained in custody during the war, and banished on the return of peace. It is rather remarkable, that when the committee of public safety wished to send him to the scaffold, his pardon was obtained by Marat, who represented him as an old dotard, incapable of becoming dangerous. He became president of the council of ancients in the month of July 1796, but left it in 1798. At the sitting of the 27th of April, he took leave of the assembly in a speech which was ordered to be printed. He died on the 16th of March 1799, after a long and painful illness.

Dussaulx was a man of considerable literary attainments, and amiable, upright, and disinterested in his conduct. His translation of *Juvenal* is esteemed the best version of that poet in the French language. His other works are, *Mémoires sur les Satiriques Latins; Lettres et Réflexions sur la fureur du Jeu, auxquelles on a joint une autre Lettre Morale*, Paris, 1775; *Discours sur la Passion du Jeu dans les différents Siècles; De la Passion du Jeu, depuis les temps anciens jusqu'à nos jours*, 1779, 8vo; *Vie de l'Abbé Blanchet*, prefixed to the *Apologues and Tales* of that author, Paris, 1784, 8vo; *De l'Insurrection Parisienne, et de la prise de la Bastille*, Paris, 1790; *Lettre au Citoyen Fréron*, 1796, 8vo; *Voyage à Barrège, et dans les Hautes-Pyrenées*, Paris, 1796, 2 vols. 8vo; *De mes Rapports avec Jean-Jacques Rousseau*, &c. Paris, 1798, 8vo, a curious work, which throws considerable light on the character of that celebrated man.

Marie-Jeanne Lieutau, the widow of Dussaulx, published memoirs of his life, which are exceedingly interesting. See also Palissot, *Mémoires sur la Litterature*; and *Biographie Universelle*.

DUSSELDORF, a circle of the Prussian province of Westphalia, on the right bank of the Rhine. Its extent is 144 square miles, and it comprehends three cities, two market-towns, and thirty-four villages, with a population of 28,500 inhabitants.

DUSSELDORF, a city, the capital of the circle of the same name, in the Prussian dominions. It stands where the river Dussel falls into the Rhine. It is one of the finest cities of Germany; and, though deprived of the splendour it exhibited under its ancient dukes, has become a flourishing place by the introduction of various manufactures. The former fortifications are converted into extensive and prolific gardens. It contains three Catholic, one Lutheran, one reformed church, and ten chapels, with a house of industry, penitentiary, and an hospital, with appropriate institutions for education. The houses are 1387, and the inhabitants, including the military, in 1817 were 18,084. Long. 6. 40. 35. E. Lat. 51. 14. 12. N.

DUST, or Dustee, a river of Persia, flowing from the interior through the province of Mekran, from the southern shore of which it is discharged into the Indian Ocean. Its course is supposed to extend, under different appellations, about 1000 miles.

DUTENS, Louis, a late French writer of some celebrity, was born at Tours, of Protestant parents, on the 15th of January 1730. In his youth he addicted himself to poetry; and in 1748 he repaired to Paris and composed a tragedy, entitled *The Return of Ulysses to Ithaca*, which he showed to the comedian Lanoue, requesting him to bring it on the stage. The latter, however, returned the piece, advising the author to retouch it. Irritated at this advice, Dutens went to Orleans, where he got his play represented with great applause; but he soon became sensible of the faults of his work, and abandoned a species of composition in which he found he was not destined to excel. He soon afterwards went to England. Before leaving France, he accidentally became acquainted with Miss Pitt, sister to the Earl of Chatham, who gave him a letter to her brother; but after a short stay in London he returned to France. Not long afterwards, he was recalled to London by one of his uncles, to accompany a young English nobleman on his travels. Soon after his arrival, the young nobleman changed his intention; but, at the same time, he procured for Dutens the situation of a tutor in a private family. The father of the pupil was a man of considerable literary and scientific attainments, who instructed Dutens in those branches of knowledge in which he was deficient. In this manner he learnt Greek and mathematics; and he at the same time applied himself to the oriental languages, and to Italian and Spanish. At the end of three years his pupil died; but one of his sisters being deaf and dumb, Dutens undertook to educate her. His young pupil, however, having become enamoured of her instructor, he deemed it a matter of delicacy and of duty to leave the house.

About this time he was appointed chaplain and secretary to the Honourable Mr Stuart Mackenzie, the English minister at the court of Turin, and left England in the month of October 1758. In 1760, when Mr Mackenzie returned to England, the secretary remained at Turin as chargé d'affaires. Dutens came to England in 1762, and attached himself to the family of Lord Bute, who, before he retired from office in 1763, procured him a pension. He again went to Turin as chargé d'affaires, and during this second mission he undertook the task of collecting and publishing a complete edition of the works of Leibnitz, and wrote his work on the *Discoveries of the Ancients*. He afterwards quitted Turin, returned to Britain, and attached himself to the Duke of Northumberland, who procured him a living in the north of England. He accompanied the duke's son, Lord Algernon Percy, in his travels through France, Italy, Germany, and Holland; and while at Paris, he was chosen a member of the Academy of Inscriptions. In 1776 he returned to England, and soon afterwards accompanied Mr Mackenzie and his lady on a tour to Naples. On his return he was invited by Lord Mountstuart, who had been appointed envoy extraordinary, to accompany him to Turin, and Dutens found himself for the third time chargé d'affaires at that court, during a short absence of the envoy. From Turin, which he left on account of some unpleasant circumstances, he went to Florence, and thence to Rome. He was in Paris in 1783, and returned to London the following year. The revenue he derived from his living of Elsdon, amounting to L.800 per annum, together with a considerable legacy left him by Mr Mackenzie, and estimated at L.15,000, enabled him to pass the remainder of his life in affluence, and in the best company. He died at his house, Mount Street, Grosvenor Square, on the 23d of May 1812.

Dutens was the editor of the works of Leibnitz, published at Geneva, 1769, in 6 vols. 4to; of the Greek pastoral romance of *Daphnis and Chloe*, by Longus, 1776, 12mo, and of Dacier's translation of the *Manual of Epictetus*, 1775, 18mo. He was also the author of the following works: *Le Caprice Poétique*, a collection of poems, 1750, 16mo. *Recherches sur l'origine des Découvertes attribuées aux Modernes*, 1766, 2 vols. 8vo, 4th edition, 1812. *Poesies*, 1767, 12mo, and 1777, 8vo. *Le Tocsin*, Rome, 1769, 12mo, reprinted under the title of *Appel au bon Sens*, London, 1777, 8vo. This work was directed against the French philosophers, and was published anonymously. *Explication de quelques médailles de Peuples, de Villes, et de Rois, Grecques et Pheniciennes*, 1773, 4to. *Explication de quelques médailles du cabinct de Duane*, 1774, 4to. *Troisième Dissertation sur quelques médailles Grecques et Pheniciennes, où se trouvent des observations pour servir à l'étude de la Paléographie Numismatique*, 1776, 4to. Dutens, at the same time, published a more complete edition of the two preceding works. *Logique, ou l'art de Raisonner*, 1773, 12mo, 1777, 8vo, and reprinted also in his miscellaneous works. *Du miroir ardent d'Archimède*, 1755, 1777, 8vo; *Des pierres précieuses et des pierres fines, avec les moyens de les connaître et de les évaluer*, 1776, 12mo, and reprinted at London and Paris. *Itinéraire des routes les plus frequentées, ou Journal d'un Voyage aux principales Villes d'Europe*, 1775, 8vo, and frequently republished with additions and improvements. *Lettre à M. D. B. (Debure) sur la réfutation du livre l'Esprit*, par J. J. Rousseau, 1779, 12mo, which contains some letters of Helvetius and Rousseau. *De l'Eglise, du Pape, de quelques points de controverse, et moyens de réunion de toutes les Eglises Chrêtiennes*, 1781, 8vo; several times reprinted, and finally under the title of *Considérations Théologiques sur les moyens de réunir toutes les Eglises Chrêtiennes*, 1798, 8vo. *Œuvres melées*, 1784, 8vo. Under the same title almost the whole works of Dutens were collected and published at London, 1797, 4 vols. 4to. *L'Ami des étrangers qui voyagent en Angleterre*, 1789, 8vo, frequently reprinted. *Histoire de ce qui s'est passé pour le rétablissement d'une régence en Angleterre*, 1789, 8vo. *Recherches sur le tems le plus reculé de l'usage des Voutes chez les anciens*, 1795. *Mémoires d'un Voyageur qui se répose*, Paris, 1806, 3 vols. 8vo. The two first volumes contain the life of the author, written in a romantic style; the third bears the title of *Dutensiana*, and is filled with remarks, anecdotes, bon mots, and so forth. Dutens is the author of the *Catalogue of Medals* in Swinburne's *Travels*, and of the French text to the second volume of the *Marlborough Gems*. There is a *Memoir* of his in the Collection of the Academy of Inscriptions, and he also published a small tract on the *Iron Mask*. He was a member of the Royal Society of London, and had the title of historiographer to the king. (See Memoirs of Dutens in the *Gentleman's Magazine for* 1812; Chalmers's *Biographical Dictionary;* and *Biographie Universelle.*)

DUTCHY. See Duchy.

DUTY, in general, denotes any thing that one is obliged to perform.

Duty, in commerce, signifies an impost laid on merchandise, at importation or exportation, commonly called the duties of customs; also the taxes of excise, stamp duties, &c. See Political Economy, and Taxation.

DUUMVIRI, in Roman antiquity, a general appellation given to magistrates, commissioners, and officers, where two were joined together in the same functions.

Duumviri Capitales were the judges in criminal causes. From their sentence it was lawful to appeal to the people, who alone had the power of condemning a citizen to death. These judges were taken from the body of the decuriones, and had great power and authority; they were members of the public council, and had two lictors to walk before them.

Duumviri Municipales were two magistrates in some cities of the empire, answering to the consuls at Rome. They were chosen out of the body of the decuriones, and their office commonly lasted five years, upon which account they were frequently termed *quinquinales magistratus.* Their jurisdiction was of great extent. They had officers who walked before them, carrying a small switch in their hands; and some of them assumed the privilege of having lictors carrying axes and the fasces or bundles of rods before them.

Duumviri Navales were the commissaries of the fleet, first created at the request of M. Decius, tribune of the people, in the time of the war with the Samnites. The duties of their office consisted in giving orders for the fitting out of ships, and issuing their commissions to the marine officers, &c.

Duumviri Sacrorum were magistrates created by Tarquinius Superbus for the performance of the sacrifices, and for keeping the sibyls' books. They were chosen from among the patricians, and held their office during life; they were exempted from serving in the wars, and from the offices imposed on the other citizens; and without them the oracles of the sibyls could not be consulted.

DWAL, in *Heraldry*, the herb nightshade, used by such as blazon with flowers and herbs, instead of metals and colours, for sable or black.

DWARACA, a town and celebrated temple of Hindustan, province of Gujerat, situated at the south-west extremity of the peninsula. There are twenty-one villages belonging to Dwaraca, containing 2500 houses, and, on the most accurate calculation, 100,000 inhabitants. The inhabitants were formerly much addicted to piracy, but of late years have been restrained by a treaty with the British. The temple is fabled to have been the residence of Krishna, at which 15,000 pilgrims annually pay their devotions, which is an abundant source of wealth to the Brahmins. Long. 69. 15. E. Lat. 22. 21. N.

DWARF, in general, an appellation given to things greatly inferior in size to that which is usual in their several kinds. Thus there are dwarfs of the human species, dwarf dogs, dwarf trees, and the like.

The Romans were passionately fond of dwarfs, whom they called *nani* or *nanæ*, insomuch that they often used artificial methods to prevent the growth of boys designed for dwarfs, by inclosing them in boxes, or by the use of tight bandages. Augustus's niece, Julia, was extremely fond of a dwarf called Sonopas, who was only two feet and a handbreadth in height. We have many other accounts of human dwarfs, but most of them deformed in some way or other, besides the smallness of their size. Many relations concerning dwarfs we must necessarily look upon as not less fabulous than those concerning giants. The following history, however, which there is reason to regard as authentic, is too remarkable not to be acceptable to the generality of our readers.

Jeffery Hudson, the famous English dwarf, was born at Oakham, in Rutlandshire, in 1619; and about the age of seven or eight, being then but eighteen inches high, he was retained in the service of the Duke of Buckingham, who resided at Burleigh-on-the-Hill. Soon after the marriage of Charles I. the king and queen being entertained at Burleigh, little Jeffery was served up at table in a cold pie, and presented by the duchess to the queen, who kept him as her dwarf. From seven years of age till thirty he never grew taller; but after thirty he shot up to three feet nine inches, and there remained fixed. Jeffery became a considerable part of the entertainment of the court. Sir William Davenant wrote a poem called *Jeffreidos*, on a battle between him and a turkey-cock; and in 1638 was published a very small book, called the *New Year's Gift*, presented at court by the Lady Parvula to the Lord Minimus, commonly called *Little Jeffery*, her majesty's servant, written by Microphilus, with a little print of Jeffery prefixed. Before this period Jeffery was employed on a negotiation of great importance; he was sent to France to fetch a midwife for the queen; and on his return with this gentlewoman and her majesty's dancing-master, and many rich presents to the queen from her mother Mary de' Medicis, he was taken by the Dunkirkers. Jeffery, being thus made of consequence, began to think himself really an important personage. He had borne with little temper the teasing of the courtiers and domestics, and had many squabbles with the king's gigantic porter. At last, being provoked by Mr Crofts, a young gentleman of family, a challenge ensued; and Mr Crofts coming to the rendezvous armed only with a squirt, the little creature was so enraged that a real duel ensued; and the appointment being on horseback with pistols, to put them more on a level, Jeffery, with the first fire, shot his antagonist dead. This happened in France, whither he had attended his mistress in the troubles. He was again taken prisoner by a Turkish rover, and sold into Barbary. But he probably did not remain long in slavery; for at the beginning of the civil war he was made a captain in the royal army, and in 1644 attended the queen to France, where he remained till the Restoration. At last, upon suspicion of his being concerned in the Popish plot, he was seized in 1682, and confined in the Gatehouse, Westminster, where he ended his life, in the sixty-third year of his age. This little hero cuts a considerable figure in Sir Walter Scott's novel of *Peveril of the Peak.*

In the *Memoirs of the Royal Academy of Sciences*, a relation is given by the Count de Tressau, of a dwarf called *Bebe*, kept by Stanislaus, king of Poland, and who died in 1764, at the age of twenty-three, when he measured only thirty-two inches. At the time of his birth he measured only between eight and nine inches. Diminutive as were his dimensions, his reasoning faculties were not less scanty, appearing indeed not to have been superior to those of a well-taught pointer. But that the size and strength of the intellectual powers are not affected by the diminutiveness or tenuity of the corporeal organs, is evident from a still more striking instance of littleness, given us by the same nobleman, in the person of M. Borulawski, a Polish gentleman, whom he saw at Luneville, and who at the age of twenty-two measured only twenty-eight inches. This miniature of a man, considering him only with reference to his bodily dimensions, appeared a giant with regard to his mental powers and attainments. He is described by the count as possessing all the graces of wit, united with a sound judgment and an excellent memory; so that we may with justice say of M. Borulawski, in the words of Seneca, and nearly in the order in which he has used them, *posse ingenium fortissimum ac beatissimum sub quolibet corpusculo latere.*

DYEING

Is the art of communicating a new and permanent colour to any substance whatever; but it is usually confined to the art of giving colours to wool, silk, feathers, cotton, or flax, or the thread or cloth formed of any of these substances. To this more limited signification we shall restrict ourselves in the following treatise. For dyeing or staining *paper*, *wood*, *bone*, *leather*, *marble*, &c. the reader is referred to these articles. We shall divide this article into six chapters. In the first we shall give a rapid sketch of the history of the art; in the second we shall treat of the nature and properties of wool, feathers, silk, cotton, and flax, of which the fabrics to be dyed are composed; in the third chapter we shall treat of *mordants*, or the substances by means of which the colours are fixed on the cloth or thread. The fourth chapter will be occupied with the mode of dyeing the simple colours, or *red*, *yellow*, *blue*, *black*, and *brown*. The object of the fifth chapter will be the compound colours, or the different shades of *green*, *purple*, *orange*, and *gray*. The sixth chapter will be occupied with a sketch of the processes of calico printing. Our object will be to give a general view of the processes, and to explain the theory of dyeing, so far as the present state of our knowledge enables us to go. We shall avoid minute details, except when they may be necessary for understanding the nature of the processes.

CHAPTER I.

HISTORY OF DYEING.

Nature has implanted in man a sense of pleasure which he derives from beholding lively colours properly displayed and contrasted. And this sense receives ample gratification from the gay plumage of the feathered tribes, and the endless variety displayed in the blossoms of the vegetable kingdom. The diversity in the colours of flowers must have early attracted the attention of man, and he could scarcely avoid feeling a desire to employ them to adorn his person; but their fading nature fitted them only for a temporary ornament. It would naturally occur to attempt to transfer some of the most lively colours of the vegetable kingdom either to the skin of the naked savage, or to the different articles of dress with which he covered himself up from the cold, or with which he decorated his person.

A few trials would speedily show that the gay colours of most flowers could not be transferred to any article of dress, at least without a great diminution of their splendour; but a considerable difference would be observed depending upon the colour of the flower. The *red* flowers would either lose their colour altogether, as they would communicate to cloth, not a *red*, but a *blue* colour. The yellow coloured berries, on the other hand, would be found in some instances to communicate a very lively and beautiful, though not a permanent colour.

By multiplying trials, various roots, barks, and fruits would be found capable of communicating certain colours to cloth. These facts would be treasured up, and thus a beginning would be made of the art of *dyeing*. Accordingly we find this art practised to a greater or smaller extent in the most remote ages, and among the most savage and barbarous nations. Even the lowest of the American tribes, in point of civilization, understood how to communicate several very fine colours, and considerable improvements in dyeing were borrowed from the Americans.

Produced early in Egypt.

It would be in vain, therefore, to attempt to discover to whom the art of dyeing is indebted for its origin, as the practice of it precedes the origin of history. From the writings of Moses, who led the Israelites out of Egypt about 1555 years before the commencement of the Christian era, it is obvious that the art of dyeing had in his time made great progress in Egypt. He mentions blue, and purple, and scarlet, and badgers' skins dyed red.[1] There are some reasons for believing that what is translated in the Old Testament *fine linen* was in reality a cloth made of cotton wool. Indeed it is certain that cloth made of cotton was used in India and Egypt in the most remote ages. Cotton wool would naturally attract the attention of mankind in those countries where the plant which yields it grows. Now we know that the cotton plant is a native of India. India and Egypt are countries in which the processes of dyeing are as likely to have originated as any other; for they constitute the cradle of the human race, and civilization appears to have made earlier progress in them than in any other.

Tyrian dye.

The art of dyeing was brought to a considerable degree of perfection at a very early period in Phœnicia. It appears that it was in Tyre where the method of dyeing woollen cloth *purple* was first discovered; and this discovery, there is reason to believe, is at least as old as the time of Moses. The purple was communicated by means of several species of univalve shell-fish, which no doubt abounded on the coast of Phœnicia. Pliny, in the thirty-sixth chapter of his sixth book, gives us an account of two species of shell-fish from which the purple was obtained. The first species was called *buccinum*, doubtless from some resemblance to a hunting horn; the second was called *purpura*. A single drop of the dyeing liquor was obtained from each fish by opening a vessel situated in the throat of the animal. The liquor, when extracted, was mixed with a considerable portion of salt, to prevent putrefaction. It was then diluted with five or six times as much water, and kept moderately hot in leaden or tin vessels, for the space of ten days, during which the liquor was frequently skimmed, to separate all impurities. After this, the wool, being first washed, was immersed and kept in the liquor for five hours. It was then taken out, carded, and again immersed and kept in the liquor till all the colouring matter was extracted. To produce particular shades of colour, carbonate of soda, urine, and a marine plant called *fucus*, were occasionally added. Several of these colours are particularly described by Pliny, though it is difficult to form an accurate conception of his meaning. The *purple* itself seems to have been similar to the colour of blood.

Pliny says the Tyrians first dyed their wool in the liquor of the *purpura*, and afterwards in that of the *buccinum*. We find allusions to this practice in several passages of the Old Testament. Doubtless Horace alludes to the same process when he says,

> .... te bis Afro
> Murice tinctæ
> Vestiunt lanæ.
> *Od.* ii. 16, line 35.

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[1] Exodus, xxv. 4 and 5.

History.

The shell-fish employed in this process were found abundantly both on the European and African shores of the Mediterranean. They still exist on these shores, and have been also met with abundantly on the coasts of England and France.

Purple.

The purple mentioned in Exodus was probably that dyed by the Tyrians. Ezekiel, who wrote about 593 years before the Christian era, in his prophecy against Tyre, says, "Fine linen with broidered work from Egypt, was that which thou spreadest forth to be thy sail; blue and purple from the isles of Elishah, was that which covered thee."[1] By Elishah it is generally supposed that Elis, on the west side of the Greek Peloponnesus, was meant. Hence it would appear that the Tyrians in Ezekiel's time drew their supply of shell-fish for dyeing purple from the coast of Greece.

From Herodotus it appears that purple was worn in Greece 559 years before the Christian era. It gradually made its way to Rome, and was purchased with avidity, notwithstanding its high price. After the establishment of the emperors upon the ruins of Roman liberty, the use of the purple was limited to the emperor, people of inferior rank being prohibited from wearing it, on pain of death. This of course sadly diminished the extent of the manufactory. It continued to languish for some centuries, and then became extinct; and the mode of dyeing the Tyrian purple was lost for many ages, but was again revived during the seventeenth century by Mr Cole of Bristol, and during the eighteenth century by M. Reaumur of France. But by this time finer colours had been discovered, and cheaper processes brought into use. It was not therefore thought advisable by the dyers to resume the methods followed by their Tyrian predecessors.

With the exception of the processes followed in the dyeing of purple, we are ignorant of the practices of the ancient dyers, or of the degree of progress which this *art* had made. Pliny, under whose province an account of dyeing naturally came, has passed it over in silence, and has assigned as a reason for his conduct that it was not reckoned among the liberal arts. *Nec tingendi rationem omisissemus, si unquam ea liberalium artium fuisset.*

Dyeing introduced into Greece.

The fine colours given in India to cotton cloths are universally known. The methods practised are no modern inventions, but were in common use when India was visited by Alexander the Great, and probably many ages before. These colours, which are both beautiful and permanent, prove that the methods of fixing gaudy colours on cotton were pretty far advanced. But these methods, as they have been described by Beaulieu and Bancroft, are so complicated, tedious, and imperfect, that they could be followed only where the wages of labour are exceedingly low, and never would answer in any part of Europe. There is reason to believe that the processes of dyeing cotton and linen were introduced into Greece only after the expedition of Alexander the Great into India.

The common people in Athens were very idle and very poor, spending their time in the public places, and receiving a daily pension of three oboli, or about fourpence halfpenny. But this sum would have purchased as much corn as three times the amount would do in this country; so that the income of a common Athenian citizen was equivalent to about thirteen pence halfpenny of our money. They went barefooted, and were dressed in garments which never had been dyed, but which were occasionally washed. The rich citizens wore garments which had been dyed; and the most common colour was *scarlet*, communicated to the cloth by *kermes*, a dyestuff still in use, and which we shall describe in a subsequent part of this treatise. This colour, as Pliny informs us, was scarcely less esteemed than the Tyrian purple. Cloths of the scarlet colour were worn by the emperors; and scarlet and purple seem to have been often confounded together.

The modes of dyeing black, blue, yellow, and green, were brought by Alexander the Great into Greece from India, as Pliny informs us.

Among the Romans, new-married women wore a *yellow* veil, and this colour was reserved for the women. In the circus the four different factions were distinguished by four different colours, one belonging to each faction. These were the green (*prasinus*), the orange (*rufatus*), the blue (*venetus*), and the white. These factions, with their colours, were transferred to Constantinople, and long distracted that city.[2] We are ignorant of the dyestuffs by means of which these colours were given to cloth.[3]

The want of soap, which was unknown to the Greeks, and only known to the Romans in Pliny's time as a pomatum for the hair, must have greatly cramped the processes of the ancient dyers; nor have we any evidence that *alum* was known to them, though they must have employed some substitute, otherwise the red colour of the kermes could not have been fixed upon the cloth. Alum appears to have been well known to Geber, who wrote in the eighth century. He mentions different manufactories of it, and talks of it as a substance familiarly known in his time. Is it not possible that the mode of making it had been known to the Tyrian dyers, but kept by them as a profound secret? The purple and scarlet dye was still in use during Geber's time, and even continued to be practised in the eleventh century. Alum, then, was certainly used by the Tyrian dyers before their manufactory was finally extinguished; but even if we admit that the ancients were unacquainted with *alum*, yet it is obvious, from Pliny's account of *alumen*, that it was a substance found native; that there were different species of it, for he enumerates four or five, and one of these may have been a native combination of sulphuric acid and alumina, which (if pure) would doubtless answer all the purposes of a mordant.

The ancient dyeing processes, such as they were, continued to be practised in Constantinople as long as the Greek empire lasted. It was during the crusades that the republics of Venice and Genoa reached the highest summit of their power. They were trading and manufacturing communities, and made a point of making themselves acquainted with the different arts at that time practised in Greece. Dyeing was not neglected by them; but the art and trade of the dyers of Constantinople were transferred by them to Italy.

Disco of arc

About the year 1300 a merchant of Florence accidentally discovered the method of making *archil*. He observed that a certain species of lichen (*lichen roccellus*), when macerated in urine, acquired a fine purple colour. This led him to try various experiments, which terminated in the discovery of archil, and in the application of it to the art of dyeing.

First tise on ing.

In the year 1429 the first collection of processes employed in dyeing was published in Venice, under the title *Mariegola dell' arte dei Tentori.* A second edition of this book, with many additions, was published in 1510. Giovan Ventura Rosetti formed the project of making this work more complete and more useful. He travelled into those parts of Italy and the neighbouring countries where attention was paid to the processes of dyeing, in order to acquire the requisite information. The result of his acquisitions was published under the name of *Plictho dell arte de' tentori, che insegna tenger panni, tele banbasi e sede, si per l'arte magiore, come per la commune.* It was published at Venice in the year 1548. A French translation of it appeared in Paris in the year 1716. This book constituted the first attempt at a methodical arrangement of the different processes. It even aimed at something like theory, though the state of knowledge at the time when it was written did not permit any successful explanation of the theory of dyeing.

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[1] Ezekiel, chap. xxvii. ver. 7.

[2] See Gibbon's Decline and Fall, vii. 78.

[3] Berthollet has given a catalogue of the dyestuffs of the ancients, after Bischoff, *Elements de l'Art de la Teincture*, i. 14. We do not consider it as worth transcribing, because it is altogether conjectural.

Int duc- tion f indi and coch eal.

In the Plictho no notice is taken either of cochineal or indigo. Hence we may conclude that, in 1548, neither of these important dyestuffs had made their way into Europe. Pliny mentions indigo under the name of *indicum;* but it appears to have been used by the Greeks and Romans only as a paint; yet there can be little doubt that in India it had been employed from time immemorial as a dyestuff. Cochineal could not be known till after the discovery of America. It was used by the Mexicans as a dyestuff. In 1523 Cortes received orders from the court of Spain to multiply this precious insect, to collect it, and send it to Spain.

Cochineal by itself gives only a *crimson* colour; it dyes *scarlet* when mixed with a solution of tin. This fact was discovered accidentally by Cornelius Drebbel about the year 1630. He communicated his observation to his son-in-law Kuffelar, who was a dyer at Leyden. He soon brought the process to perfection, kept it a secret, and brought the scarlet colour into fashion. Soon after, the same process was discovered by a German chemist called Keffler, who carried his secret to London in 1643. A Flemish dyer called John Kloeck got information of the process in 1647, and it gradually made its way through every country of Europe.

Indigo, though a much more important dyestuff than cochineal, did not make its way into general use without the greatest difficulty. The use of it was prohibited in England during the reign of Elizabeth; and the prohibition was not taken off till the time of Charles II. It was equally prohibited in Saxony, where it was styled in the prohibition a corrosive substance, and called food for the devil. Restrictions on the use of indigo in dyeing were imposed also in France, though it was not altogether prohibited, as it had been in England and Saxony.

The reason of these prohibitions and restrictions was, that *pastel* and *woad* were employed for dyeing blue; and fears were entertained that indigo would supersede these dyestuffs altogether. Now, as they were the product of the different kingdoms of Europe when they were employed, it was erroneously concluded that the introduction of a better and cheaper dye would injure the country by throwing these plants out of cultivation.

Im ve- men in Fra e.

The improvements in dyeing which took place in France may be dated from the administration of Colbert, who paid particular attention to the different branches of manufacture which were carried on by the French. In the year 1672 he caused a book of instructions for dyers to be published in Paris. This book was republished in 1708 under the following title: *Le teincturier parfait, ou instruction nouvelle et générale pour la teincture des laines et manufactures de laine de toutes couleurs, et pour la culture des drogues ou ingredients qu'on y emploie.*

But Colbert's encouragement of dyeing was clogged with restrictions and prohibitions, which would have been fatal to the art, had it not been for the facility with which they were evaded. The revocation of the edict of Nantes in the year 1685 was a fatal blow to the pre-eminence of France in manufactures. The most industrious and skilful workmen and artists were driven out of the country, and carried their knowledge and dexterity into Great Britain, Holland, and Prussia. Succeeding administrations endeavoured as far as possible to correct the fatal policy of Louis XIV. The art of dyeing in particular drew their attention, and the most eminent chemists which the country possessed were placed as a kind of superintendents of the art of dyeing. Their business was to endeavour to improve the processes, and to bring the art to a state of perfection. Dufay, Hellot, Macquer, and Berthollet, successively filled this important office; and each of these eminent men contributed somewhat to the improvement of the theory of dyeing. Dufay first formed tolerably accurate notions of the nature of colouring matters, and of the forces which made them attach themselves to cloth. Hellot published a well-arranged treatise on dyeing woollen cloth, such as it was practised in the best dyeing establishments in France; and Macquer gave an equally detailed account of the processes followed by the silk dyers. Macquer indeed meditated a general treatise on dyeing, and published a prospectus in the year 1791. But his great age, and the feeble state of his health for some years before his death, prevented him from completing the undertaking.

Berthollet, who was named his successor as superintendent of dyeing, published an excellent treatise under the title of *Elements de l'Art de la Teincture*, a second edition of which appeared in the year 1804. This work contains a very full and complete account of the processes of dyeing, such as they existed when Berthollet wrote; and is still well entitled to the attention of the practical dyer.

Scarcely any work upon dyeing deserving the name of a scientific treatise appeared in the English language till Bancroft published his *Experimental Researches concerning the Philosophy of Permanent Colours, and the best means of producing them by dyeing, calico printing,* &c. in the year 1794. Of this work a second volume afterwards appeared, not inferior in value to the first. But unfortunately the projected plan was never completed. Had this been the case, the work of Bancroft would have been by far the completest treatise on dyeing in any language.

Great improvements have been made of late years in calico printing, and several new dyeing materials have been introduced. Of these the most important is the bichromate of potash and the sulphate of manganese. The former communicates an indelible yellow, orange, and red; the latter various shades of brown equally indelible, and at present constituting a very fashionable mode of printing. The improvements in the dyeing of silk and woollen cloth are not so easily pointed out, though they are both numerous and important. One, however, may be mentioned; the substitution of the lac dye in most ordinary cases for cochineal. This last dyestuff is still used for giving a scarlet colour to superfine cloth; but for the coarser fabrics lac is almost universally substituted. The calico printers employ only cochineal, and, so far as we know, never use lac.

CHAPTER II.

OF THE NATURE AND PROPERTIES OF THE SUBSTANCES TO WHICH COLOURS ARE COMMUNICATED IN THE PROCESSES OF DYEING.

There has been much speculation among philosophical dyers respecting the nature of the colouring matters, and the way in which the different colours are induced by dye-

Substances to be coloured.

ing; but these speculations have not led to any information of much value. It has been demonstrated by Newton that *light* is divisible into seven rays, distinguished by the following colours; *red, orange, yellow, green, blue, indigo, violet.* The colour of an object is owing to its having the property of reflecting or transmitting certain rays, while it absorbs the rest. Thus a red body reflects or transmits the red ray and absorbs the rest, an orange body reflects or transmits red and yellow, a green body reflects or transmits the yellow and blue rays, and a white body all the rays. There is reason for believing that the colouring matters employed as dyestuffs are all transparent, and that the colour is produced by their action on the light transmitted through them from the white fibres of the cloth. Those colouring matters that transmit all the rays equally leave the cloth white; if the blue ray be transmitted and the rest absorbed, the colour of the cloth will be *blue*, and so on. This is all that we know about the mechanical nature of the dyestuffs. On what the circumstance depends that causes a transparent body to absorb one kind of ray, and transmit another through it, we do not know, nor is it likely that any knowledge will ever be acquired respecting it. The speculations of Delaval, accounting for the colours given by dyestuffs by the size of the colouring particles, appear to us altogether unfounded, and quite inapplicable to the subject under discussion.

Nature of colour and dye stuffs.

Silk and wool dye better than cotton and linen.

With respect to the aptitude of being dyed, and the brilliancy of the colours thus communicated, there is found to be very great difference in different tissues. Animal substances are much more easily dyed than vegetable substances. Of animal substances, *silk* receives colour, and the shades given are brighter and more beautiful than those which can be imbibed by any other tissue. Woollen cloth is also very fit for being dyed, and receives very brilliant colours with avidity, though in this respect it is inferior to silk. Cotton and linen are much more difficult to dye, and cannot be made to imbibe such brilliant colours as silk or woollen. Thus the rich scarlet given to cloth by the combined action of cochineal and the oxide of tin, has never been communicated to cotton cloth or linen. The Turkey-red dye, which is by far the finest and most permanent red that has ever been communicated to cotton cloth, is a crimson, or rather a crimson with a shade of brown. It has not the least approach to a scarlet.

Upon what this difference between animal and vegetable bodies in the capacity of receiving colours depends, we do not know. Both woollen and silk contain a notable quantity of azote among their constituents, while this principle is altogether wanting in cotton and linen. How far the property of easy dyeing depends upon the presence of azote it is impossible to say; but it is the only chemical difference in their constitution that can in the present state of our knowledge be pointed out. Both cotton and flax, so far as their chemical characters have been examined, are precisely similar in their properties to *lignin* or the woody fibres of trees, supposing them deprived of all their foreign ingredients. Now the constituents of lignin are as follows, according to the analysis of Prout.

Carbon	50·00
Hydrogen	5·55
Oxygen	44·45
	100·00

This is proportional to

3 atoms carbon	2·25
2 atoms hydrogen	0·25
2 atoms oxygen	2·00
	4·5

Hence these substances (cotton and flax) must either be composed of three atoms carbon, two atoms hydrogen, and two atoms oxygen, or of some multiple of these numbers. How many atoms go to the formation of an integrant particle of cotton or flax cannot be known till some substance be discovered with which they are capable of entering into definite combinations.

The only attempt to determine the atomic constituents of silk and wool is that of Dr Ure, according to whom their composition is as follows.

	Silk.	Wool.
Azote	11·33	12·3
Carbon	50·69	53·7
Hydrogen	3·94	2·8
Oxygen	34·04	31·2
	100·00	100·0

These are equivalent to the following atomic numbers.

	Silk.	Wool.
Azote	13 atoms	14 atoms.
Carbon	135	143 ......
Hydrogen	63	45 ......
Oxygen	68	62 ......

But a comparison between these two sets of bodies will be made with more advantage if we represent the number of atoms of the other constituents of each upon the supposition that the atoms of carbon in each is the same, or 66. On this supposition the composition will stand as follows.

	Lignin.	Silk.	Wool.
Azote	0 atoms	6·3 atoms	6·5 atoms.
Carbon	66	66·0	66·0 ......
Hydrogen	44	30·8	20·7 ......
Oxygen	44	33·2	28·5 ......

If the analyses of these bodies constituted a near approximation to the truth, it would follow from a comparison of them: 1. That in lignin the hydrogen and oxygen exist in the proportions which constitute water, while in silk there exists an excess of oxygen, and in wool this excess is still greater. 2. In lignin there is no azote, whereas in silk and wool the atoms of azote amount to about one tenth of the atoms of carbon. 3. The atoms of hydrogen in silk are to those in lignin as three to four, and in wool as two to four; so that lignin contains twice as much hydrogen as wool does. 4. In silk the atoms of oxygen are to those in lignin very nearly as three to four; but in wool the number of atoms of oxygen is to that in lignin rather in a less ratio than that of three to four.

These facts lead us but a very little way in discovering the difference between the nature of silk and wool, and that of cotton and flax; but they contain all the information which chemistry at present is able to furnish. We shall now state, in the following sections, the differences which have been observed in the mechanical structure of these different substances.

SECT. I.—*Of Wool.*

Wool, which is well known as the covering of sheep, derives its value from the length and fineness of its filaments. The filaments of wool are considerably elastic, for they may be drawn out beyond their usual length, and when the force is removed, they recover it again. The surface of the filaments of wool or hair is not perfectly smooth; for although no roughness or inequality can be discovered by the microscope, yet they seem to be formed of small laminæ placed over each other in a slanting direction, from the root of the filament towards its point, resembling the arrangement of the scales of a fish, which cover each other from the head of the animal to its tail; or perhaps they consist of zones placed over each other,

Substances to be coloured.

as is observed in the horns of animals. This peculiarity of structure of the filaments of hair and wool is proved by a simple experiment. If a hair be laid hold of by the root in one hand, and drawn between the fingers of the other hand, from the root towards the point, scarcely any friction or resistance is perceived, and no noise is heard; but if it be grasped by the point, and passed in the same manner between the fingers from the point towards the root, a resistance is felt, and a tremulous motion is perceptible to the touch, while the ear is sensible to a slight noise. Thus it appears, that the texture of the surface of hair or wool is not the same from the root towards the point, as it is from the point towards the root. This is further confirmed by another experiment. If a hair be held between the thumb and fore finger, and they are rubbed against each other in the longitudinal direction of the hair, it acquires a progressive motion towards the root. This effect depends not on the nature of the skin of the finger, or on its texture, for if the hair be turned, and the point placed where the root formerly was, the motion is reversed, that is, it will still be towards the root.

Felting.

On this peculiarity of structure, which was observed by M. Monge, depend the processes of felting and fulling, to which hair and wool are subjected for different purposes. In the process of felting, the flocculi of wool are struck with the string of the bow, by which the filaments are separately detached, and dispersed in the air. These filaments fall back on each other in all directions on the table, and when a layer of a certain thickness is formed, they are covered with a cloth, on which the workman presses with his hands in all parts. By this pressure the filaments of wool are brought nearer to each other; the points of contact are multiplied; the progressive motion towards the root is produced by the agitation; the filaments entangle each other; and the laminæ of each filament taking hold of those of the other filaments, which are in an opposite direction, the whole is retained in the state of close contexture.

Fulling.

Connected with this operation is that of fulling. The roughness on the surface of the filaments of wool, and their tendency to acquire a progressive motion towards the root, produce considerable inconvenience in the operations of spinning and weaving. These inconveniences are obviated by covering the filaments with a coat of oil, which fills up the cavities, and renders the asperities less sensible. When these operations are finished, the stuff must be freed from the oil, which would prevent it from taking the colour with which it is to be dyed. For this purpose it is taken to the fulling-mill, where it is beaten with large beetles, in a trough of water, through which clay has been diffused. The clay unites with the oil, which being thus rendered soluble in the water, is carried off by fresh portions of water, conveyed to it by proper apparatus. In this way the stuff is scoured; but this is not the sole object of the operation. By the alternate pressure of the beetles, an effect similar to that of the hands in the operation of felting is produced. The filaments composing a thread of warp or woof, acquire a progressive motion, are entangled with the filaments of the adjoining threads, those of the latter into the next, and so on, till the whole threads are felted together. The stuff is now contracted in all its dimensions, and, participating both of the nature of cloth and of felt, may be cut without being subjected to ravel; and, when employed to make a garment, requires no hemming. In a common woollen stocking web, after this operation, the stitches, when one happens to slip, are now no longer subject to run, and the threads of the warp and woof being less distinct from each other, the whole stuff is thickened, and forms a warmer clothing.

Substances to be coloured.

Importance of wool.

The various manufactures of which wool constitutes the basis are justly regarded as among the most important to man in civilized society. Accordingly, the production of fine wool, and the causes which retard or improve the breed of sheep from which it is obtained, have greatly occupied the attention of economists and philosophers in our own, as well as in other countries. The wool of different breeds of sheep, in different countries, it is well known, possesses very different qualities, both with regard to the fineness of the filament, and the colour. Some is of a white or yellow, and some of a reddish and black colour. Excepting the wool of the breed of sheep in Andalusia, the Spanish wool was formerly all of a brownish-black colour. This was preferred by the native Spaniards; and even at this day, the dress of some religious orders in Roman Catholic countries consists of cloth manufactured from this wool, and retaining its natural colour. But for the purposes of dyeing, white wool is now always preferred, because it is found susceptible of receiving better and more durable colours.

Scouring.

Wool is naturally covered with a kind of grease or oil, which is found to preserve it from insects or moths, and on this account this greasy matter is not removed, or the wool is not scoured, till it is to be dyed or spun.[1] The process for scouring wool is the following: It is put for about a quarter of an hour into a kettle, with a sufficient quantity of water, to which a fourth part of putrid urine has been added. It is then heated to such a degree as the hand can bear, occasionally stirred, and, after being taken out, is allowed to drain. It is then put into a basket, and exposed to a stream of running water, and moved about till the grease is so completely separated that it no longer renders the water turbid. After being drained, it is sometimes found to lose by this operation above one fifth of its weight. It is almost unnecessary to observe, that the more carefully and completely this process is performed, the better the wool is fitted to receive the colouring matter. Our chemical readers will readily perceive the nature of the changes which are effected in this process of scouring. The ammonia, or volatile alkali, which exists in the urine, combines with the oil of the wool, and forms a soap, which being soluble in water, is dissolved and carried off.

Dyeing.

Wool is either dyed in the fleece, or after it is spun into threads, or when it has been manufactured into cloth. For the purpose of forming cloths of mixed colours, it is dyed before it is spun; for the purposes of tapestry, it is dyed in the state of thread; but most commonly it is subjected to this process after it has been manufactured into cloth. In these different states the quantity of colouring matter which is taken up is very different. The proportion is largest when it is dyed in the fleece, because then the filaments being more separated, a greater surface is exposed to the action of the colouring particles. For a similar reason the quantity of colouring matter taken up is greater when in the state of thread or yarn, than when it is formed into cloth. But cloths themselves must vary greatly in this respect, according to their different qualities. Their different degrees of fineness, or closeness of texture, will produce considerable variations; and besides, the difference in the quantity and dimensions of the substances to be dyed, the different qualities of the ingredients employed in the process, and the different circumstances in which it is performed, should be a caution against trusting to precise quantities, regulated by weight or measure, which are recommended according to general rules. According to the fineness of the texture of the wool, and the nature of the colouring matter employed, it is found to be more or less penetrated with this matter. The coarse wool from the thighs and tails of some sheep receives colours with difficulty, and the finest cloth is never completely penetrated with the scarlet dye. The interior of the cloth appears always, when cut, of a lighter shade, and sometimes even white.

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[1] According to an observation of Reaumur, rubbing any stuff with greasy wool is sufficient to preserve it from moths.

Sect. II.—*Of Silk.*

Origin.

Silk, which forms the basis of one of the richest and most splendid parts of dress among the wealthy and luxurious in civilized society, is the production of different species of insects. The *phalæna bombyx*, or silk-worm, which is a native of China, attracted the attention of mankind in that country from the earliest ages. The honour of having first collected and prepared silk from the cocoons or balls in which it is wound up by the insect, during its metamorphosis, is ascribed by the Chinese historians to the wife of an emperor. The *phalæna atlas*, Lin. which is also a native of China, is said to form larger cocoons, and to yield a stronger silk. The silk-worm was first carried from China to Hindustan, and afterwards to Persia. Silk seems not to have been known to the Greeks or Romans till the time of Augustus. Its nature and origin were little understood; and for many ages it was so scarce that it could only be purchased at a price which was equal to its weight in gold. The emperor Aurelian, it is said, from a principle of economy, resisted the urgent solicitations of his empress, who wished to have a silken robe, alleging the extravagance of the expense. About the middle of the sixth century, two monks returned from India to Constantinople, and brought with them a considerable number of silk-worms, with instructions for managing and breeding them, as well as for collecting, preparing, and manufacturing the silk. Establishments were thus formed at Corinth, Athens, and other parts of Greece. The crusades, which greatly contributed to the diffusion of different kinds of knowledge, by the intercourse which took place between different countries, proved useful in disseminating the knowledge of rearing the silk-worm, and preparing and manufacturing its valuable productions. Roger, king of Sicily, about the year 1130, returning from one of these frantic expeditions, brought with him from Athens and Corinth several prisoners, who were acquainted with the management of silk-worms and the manufacturing of silk. Under their superintendence manufactories were established at Palermo and Cagliari in Sicily. This example was soon adopted and followed in different parts of Italy and Spain. In the time of James I. an attempt was made to establish the silk-worm in England. For this purpose the culture of the mulberry-tree, on which the insects feed, was strongly recommended by that prince to his subjects; but the attempts which were made have been hitherto unsuccessful.

Scouring.

The fibres of silk are covered with a coating or natural varnish of a gummy nature. To this are ascribed its stiffness and elasticity. Besides this varnish, the silk which is usually met with in Europe is impregnated with a substance of a yellow colour; and for most of the purposes to which silk is applied, it is necessary that it should be deprived both of the varnish and of the colouring matter. On this account it must be subjected to the operation of scouring; but for silks which are to be dyed this process should not be carried so far as for those which are merely to be whitened; and different colours, it is observed, require different degrees of this operation. The quantity of soap constitutes the chief difference. A hundred pounds of silk boiled in a solution of twenty pounds of soap for three or four hours, adding new portions of water during the evaporation, are sufficiently prepared for receiving common colours. For blue colours, the proportion of soap must be increased; and scarlet, cherry colour, &c. require a still greater proportion, for the ground must be whiter for these colours.

Silk which is to be employed white must undergo three operations. In the first the hanks are immersed in a hot but not boiling solution of thirty pounds of soap to a hundred of silk. When the immersed part is freed from its gum, which is known by its whiteness, the hanks are shaken over, as the workmen term it, so that the part which was not previously immersed may undergo the same operation. They are then wrung out as the process is completed. In the second operation the silk is put into bags of coarse cloth, each bag containing twenty or thirty pounds. These bags are boiled for an hour and a half in a solution of soap prepared as before, but with a smaller proportion of soap; and, that they may not receive too much heat by touching the bottom of the kettle, they must be constantly stirred during the operation. The object of the third operation is to communicate to the silk different shades, to render the white more agreeable. These are known by different names, as China-white, silver-white, azure-white, or thread-white. For this purpose a solution of soap is also prepared, of which the proper degree of strength is ascertained by its manner of frothing by agitation. For the China-white, which is required to have a slight tinge of red, a small quantity of anotta is added, and the silk is shaken over in it till it has acquired the shade which is wanted. In other whites a blue tinge is given by adding a little blue to the solution of soap. The azure-white is communicated by means of indigo. To prepare the azure, fine indigo is well washed two or three times in moderately warm water, ground fine in a mortar, and boiling water poured upon it. It is then left to settle, and the liquid part only, which contains the finer and more soluble parts, is employed.

Some use no soap in the third operation; but when the second is completed, they wash the silks, fumigate with sulphur, and azure them with river water, which should be very pure. But all these operations are not sufficient to give silk that degree of brightness which is necessary, when it is to be employed in the manufacture of white stuffs. For this purpose it must undergo the process of sulphuration, in which the silk is exposed to the vapour of sulphur; for an account of which see Bleaching. But before the silk which has been treated in this way is fit for receiving colours, and retaining them in their full lustre, the sulphur which adheres to it must be separated by immersion and agitation for some time in warm water, otherwise the colours are tarnished and greatly injured.

It has long been an object of considerable importance to deprive silk of its colouring matter, without destroying the gum, on which its stiffness and elasticity depend. A process for this purpose was discovered by Beaumé, but as it was not made public, others have been led to it by conjecture and experiment. The following account, given by Berthollet, is all that has transpired concerning this process. A mixture is made with a small quantity of muriatic acid and alcohol. The muriatic acid should be in a state of purity, and particularly should be entirely free from nitric acid, which would give the silk a yellow colour. In the mixture, thus prepared, the silk is to be immersed.

One of the most difficult parts of the process, espe-

Su ances be co ured.

cially when large quantities are operated upon, is to produce a uniform whiteness. In dyeing the whitened silk, there is also considerable difficulty to prevent its curling, so that it is recommended to keep it constantly stretched during the drying. The muriatic acid seems to be useful in this process, by softening the gum, and assisting the alcohol to dissolve the colouring particles which are combined with it. The alcohol which has been impregnated with the colouring matter may be again separated from it and purified, that it may serve for future operations, and thus render the process more economical. This may be done by means of distillation, with a moderate heat, in glass or stoneware vessels.

Al ing.

The preparation with alum is a very important preliminary operation in the dyeing of silk. Without this process few colours would have either beauty or durability. Forty or fifty pounds of alum, previously dissolved in warm water, are mixed in a vat with forty or fifty pailfuls of water; and to prevent the crystallization of the salt, the solution must be carefully stirred during the mixture. The silk being previously washed and beetled, to separate any remains of soap, is immersed in this alum liquor, and at the end of eight or nine hours is wrung out, and washed in a stream of water. A hundred and fifty pounds of silk may be prepared in the above quantity of liquor; but when it begins to grow weak, which may be known by the taste, twenty or twenty-five pounds of dissolved alum are to be added, and the addition repeated till the liquor acquires a disagreeable smell. It may then be employed in the preparation of silk intended for darker colours, till its whole strength is dissipated. This preparation of silk with alum must be made in the cold; for when the liquor is employed hot, the lustre is apt to be impaired.

Sect. III.—*Of Cotton.*

O in.

Cotton is the down or wool contained in the pods of a shrubby plant, which is a native of warm climates. Of this genus of plants (*Gossypium*, Lin.) there are four species, one of which only is perennial; the other three are annual plants; but of these there are many varieties, occasioned by the difference of soil or temperature in which they are produced. The principal differences among cottons consist in the length and firmness of the filaments, and in their strength and colour.

St cture.

The peculiar structure of the fibres of cotton is not well known. According to the microscopic observations of Leeuwenhoeck, they have two sharp sides, to which are ascribed the irritation and inflammation of wounds and ulcers when they are dressed with cotton instead of lint. This peculiarity of structure, it is also supposed, may occasion some difference in the conformation and number of the pores, on which alone the disposition of cotton to admit and retain colours better than linen seems to depend. In this respect, however, it is inferior to wool and silk, because, on account of its vegetable nature, its affinity for colouring matter is less powerful.

H a less af ity th wool fo olour- in atter.

It is well known that silk, cotton, and linen have a weaker affinity for colouring matter than wool. Le Pileur d'Apligny attempts to explain this by supposing that the pores of these substances are smaller than those of wool, and that the colouring particles enter them less easily and freely. But according to the observation of Dr Bancroft, the reverse of this seems to be the fact; for there is little difficulty in making silk, cotton, and linen imbibe colouring matter, even when it is applied cold, without any artificial dilatation of the pores, which is always necessary in the dyeing of wool. The only real difficulty is to make them retain the colours after the matter has been imbibed; because being admitted so readily into their undilated pores, the particles cannot be afterwards compressed and retained by the contraction of these pores, as is the case with wool. It requires double the quantity of cochineal which is necessary for wool to communicate a crimson colour to silk; a certain proof that it can take up a greater quantity, and consequently that the pores are sufficiently large and accessible. Unbleached cotton is always preferred for dyeing Turkey red, because in this state the colour is found to be most permanent; and this is ascribed to the pores or interstices being less open than after it has undergone the process of bleaching. The same thing is observed of raw or unscoured silk. It is found to combine more easily with the colouring matter, and to receive a more permanent colour in this state, than after it has been scoured and whitened. "The openness of cotton and linen," says Dr Bancroft, "and their consequent readiness to imbibe both colouring particles and the earthy or metallic bases employed to fix most of them, are circumstances upon which the art of dyeing and calico-printing is in a great degree founded."[1] But is not this too mechanical an explanation of the phenomenon? Might it not rather be alleged that it is owing to a difference of affinities which exists between the particles of colouring matter and the substance which is separated from the silk or cotton by the process of bleaching or scouring? This substance probably acts the part of a mordant; and having a stronger affinity for the stuff and for the colouring matter than the stuff has for the latter, the colour communicated is more durable when silk or cotton is dyed in the unbleached or unscoured state.

Substances to be coloured.

Preparations for dyeing.

To prepare cotton stuffs for receiving the dye, several operations are necessary. It must first undergo the process of scouring. By some it is boiled in sour water, or in alkaline ley. It should be kept boiling for two hours, then wrung out, and rinsed in a stream of water till the water comes off clear. The stuffs to be prepared should be soaked for some time in water, mixed with not more than $\frac{1}{50}$th part of sulphuric acid, and then carefully washed in a stream of water, and dried. In this operation the acid combines with a portion of calcareous earth and iron, which would have interrupted the full effect of the colouring matter in the process of dyeing.

Aluming.

Aluming is another preliminary process in the dyeing of cotton. The alum is to be dissolved in the manner already described in preparing silk. Each pound of cotton stuff requires four ounces of alum. By some a solution of soda, about $\frac{1}{16}$th part of the alum, and by others a small quantity of tartar and arsenic, are added. The thread is to be impregnated by working it in small quantities with this solution. The whole is then put into a vessel, and the remaining part of the liquor is poured upon it. In this state it is left for twenty-four hours, after which it is removed to a stream of water, and allowed to remain for an hour and a half, or two hours, to extract part of the alum. It is then to be washed. By this operation cotton is found to gain an addition of about $\frac{1}{40}$th part of its weight.

Galling.

The operation of galling is another preparatory process in the dyeing of cotton stuffs. The quantity of astringent matter employed must be proportioned to its quality, and the amount of the effect required. Powdered galls are boiled for two hours in a proportion of water, regulated by the quantity of thread to be galled. This solution being reduced to such a temperature as the hand can bear, is

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[1] *Philosophy of Permanent Colours*, p. 71.

Substances to be coloured.

divided into a number of equal parts, that the thread may be wrought pound by pound. The whole stuff is then put into a vessel, and the remaining liquor poured upon it, as in the former process. It is then left for twenty-four hours if it is to be dyed black, but for other colours twelve or fifteen hours are found sufficient. It is then wrung out and dried.

In the galling of cotton stuffs, which have already received a colour, the precaution should be observed of performing this operation in the cold, otherwise the colour is subject to injury.

Berthollet informs us, that cotton which had been alumed acquired more weight in the galling than that which had not previously undergone that process; for although alum adheres but in small quantities to cotton, it communicates to it a greater power of combining both with the astringent principle and with the colouring particles. This, we may add, may be considered as a good instance of the action of intermediate affinities, and of the advantage to be derived to the art of dyeing, from investigating and observing this action.

Sect. IV.—*Of Flax.*

Origin. Flax and hemp nearly resemble each other in their general properties; and, so far as relates to the process of dyeing, what is said of the one may be applied to the other. Flax or lint is obtained from the bark of *Linum usitatissimum*, and hemp from that of *Cannabis sativa*.

Watering. Before flax is properly prepared to receive the dye, it must be subjected to several processes. One of the most important is that of watering, by which the fibrous parts of the plant are separated, and brought to that state in which they can be spun into threads. As the quantity and quality of the product depend much on this preliminary operation, it becomes of the greatest consequence that it be properly conducted. During this process carbonic acid and hydrogen gas are given out. The extrication of these gases is owing to a glutinous juice, which holds the green colouring part of the plant in solution, and which is the medium of union between its cortical and ligneous parts, undergoing a certain degree of putrefaction. This substance seems to resemble the glutinous part, which is held dissolved in the juice obtained from plants by pressure; is separated from the colouring particles by means of heat; readily becomes putrid; and by distillation affords ammonia. But although it is held in solution with the expressed juice, it would appear that it cannot be separated from the cortical parts completely by means of water; and hence it happens that hemp or flax watered in too strong a current has not the requisite softness and flexibility. But, on the other hand, if the water employed in this operation be stagnant and in a putrid state, the hemp or flax becomes of a brown colour, and loses its firmness. In the one case the putrefactive process is interrupted; in the other it is continued too long and carried too far. This process, therefore, is performed with the greatest advantage in places near the banks of rivers, where the water may be changed so frequently as to prevent such a degree of putrefaction as would be injurious to the flax, as well as prejudicial to the workmen, from noxious exhalations; and at the same time not so frequently as to retard or interrupt those changes which are necessary for rendering the glutinous substance soluble in water.

By the process of watering flax, and by drying before and after that process, the green-coloured particles undergo a similar change to that which is observed in the green substance of the plants exposed to the action of air and light. The next part of the process, therefore, after watering, is to spread it out upon the grass, and thus expose it for some time to the air and sun. By this means the colour of the lint is improved, and the ligneous part becomes so brittle that it is easily separated from the fibrous part. This operation, as is well known, is usually performed by machinery.

The fibres of lint possess no perceptible degree of elasticity, and they appear to be perfectly smooth. No roughness or inequality can be detected by the feel, and no asperities can be perceived, even with the assistance of the microscope. Experience shows, that it produces no irritation on wounds or sores which are dressed with it, as is known to happen from a similar application of cotton stuffs.

Flax which is intended for dyeing must be subjected to a similar series of operations with cotton, in the different processes of scouring, aluming, and galling. A repetition of the mode of performing these operations is therefore unnecessary.

CHAPTER III.

OF MORDANTS.

The term mordant is applied by dyers to certain substances with which the cloth to be dyed must be impregnated, otherwise the colouring matters would not adhere to the cloth, but would be removed by washing. Thus the red colour given to cotton by madder would not be fixed, unless the cloth were previously steeped in a solution of a salt of alumina. It has been ascertained that the cloth has the property of decomposing the salt of alumina, and of combining with and retaining a portion of alumina. The red colouring principle of the madder has an affinity for this alumina, and combines with it. The consequence is, that the alumina being firmly retained by the cloth, and the colouring matter by the alumina, the dye becomes fast, or cannot be removed by washing the cloth with water, even by the assistance of soap, though simple water is sufficient to remove the red colouring matter from the cloth, unless the alum mordant has been previously applied.

The term *mordant* (from the Latin word *mordere*, to bite) was applied to these substances by the French writers on dyeing, from a notion entertained by them that the action of the mordants was mechanical; that they were of a corrosive or biting nature, and served merely to open pores in the fibres of the cloth, into which the colouring matter might insinuate itself. And after the inaccuracy of this notion was discovered, and the real use of mordants ascertained, the term was still continued, as sufficiently appropriate, or rather as a proper name, without any allusion to its original signification.

The term *mordant*, however, is not limited to those substances merely which serve, like alumina, to fix the colours. It is applied also to certain substances, which have the property of altering the shade of colour, or of brightening the colour, as it is called. Thus *cream of tartar* is usually called a mordant, because when chloride of tin is used, as is the case in the red dye upon silk or woollen, the addition of cream of tartar is necessary, not merely to brighten the colour, but to cause its equable application upon the cloth; for when the tartar is omitted, we observe that the shade is very unequal upon different parts of the surface, some spots being much darker and some much lighter than others. We believe that tartar acts chiefly, if not entirely, by forming a double salt with the chloride of tin, from which the tin is not liable to be partially precipitated. The consequence of this is, the equal distribution of the tin through the whole liquid, and the consequent equality of its application on the cloth. For the depth of the shade depends upon the proportion of tin fixed upon the cloth. Berthollet has proposed to distinguish those substances which are employed to alter the shade of colour from the mordants strictly so called, by giving them the name of *alterants*.

The mordants employed by dyers are but few in number. Alumina, the oxides of tin, the protoxide of lead, the black oxide of copper, and the infusion of nutgalls, constitute almost the whole of them. The peroxide of iron and the sesquioxide of manganese have also a strong affinity for cloth, especially for cotton cloth, and are frequently employed; but they serve at once the purpose of mordants and colouring matters. We believe also that in one important process for giving a fine red to cotton, what is usually called *the Turkey-red dye*, the *margarate of potash* constitutes an indispensable mordant.

Let us take a view of these different mordants in succession.

1. *Alumina.*—This is a soft, white, tasteless powder, insoluble in water, but soluble in acids, and constituting sweet-tasted and astringent salts, which have the property of reddening vegetable blues. These salts are soluble in water, but very few of them are capable of crystallizing. Of all the salts of alumina, the most important is *alum*, the nature and properties of which have been described in another part of this work. See ALUM

H used.

It is a double salt, composed of three integrant particles of sulphate of alumina united to one integrant particle of sulphate of potash or sulphate of ammonia and twenty-five integrant particles of water. The ammoniacal alum is less soluble in cold water than the potash alum; but both kinds are sufficiently soluble in hot water. Such is the affinity of alumina for woollen or silk stuffs, that when they are plunged into a solution of alum, the alumina leaves the sulphuric acid with which it was united, and combines with the fibres of the cloth. The affinity of alumina for cotton or linen, though considerable, is not so great as its affinity for wool or silk. On that account the cotton dyers and calico printers find it requisite to combine the alumina, before using it as a mordant, with a weaker acid than the sulphuric. The *acetic* is the one which has been made choice of, and the acetate of alumina is prepared by the following process: Three parts of alum and one part of acetate of lead are dissolved in eight parts of hot water. There is then added one eighth of a part of potash and as much chalk. The reason of the addition of the potash and the chalk is, that one part of acetate of lead is not sufficient to decompose three parts of alum. These substances prevent the residual alum from crystallizing, by decomposing it. The proper quantities of these salts which the dyers ought to employ are six parts of alum and seven parts of sugar of lead. These proportions would just convert the sulphate of alumina of the alum into acetate of alumina, without altering the sulphate of potash.

The wool or silk is put into a hot solution of alum, and the cotton into a hot solution of acetate of alumina, and passed through the liquid till a sufficient quantity of the alumina has combined with the fibres of the cloth. It is then wrung out, washed, and dried. The alumina remains firmly adhering to the cloth, and cannot be removed by washing, bleaching, or any of the processes to which such cloths are usually subjected.

Q ntity of umina w h adhe s to co n.

In order to form some notion of the quantity of alumina fixed upon cloth by the aluming process, the writer of this article made the following experiments: A quantity of cotton cloth was procured, such as is sometimes used for making light dresses of Turkey red. Of this, 1000 grains were burnt, and the ashes being reserved and analyzed, were found to contain 0·4 grain of alumina. 1000 grains of the same cloth which had been dyed Turkey red, and of course subjected to the aluming process, were burnt, and the ashes subjected to a chemical analysis. The alumina contained in them weighed eight grains. Hence 7·6 grains of this matter had combined with the cloth in the process of aluming.

The length of 1000 grains of the undyed cotton cloth was one yard five and two-third inches, and its breadth thirty-three inches. The length of 1000 grains of the Turkey red cloth was one yard and six inches, with a breadth of thirty-three inches. The two pieces of cloth, therefore, were very nearly of a size. We see that the dyed cloth had been stretched a very little during the processes to which it had been subjected. Thus it appears that a surface of cloth amounting to 1386 square inches, or rather 2772 square inches (as both sides of the cloth had been equally subjected to the aluming process), had combined with 7·6 grains of alumina, or every square inch of the cloth had combined with 0·0027 grains ($\frac{1}{370}$th grain nearly) of alumina. Small as this quantity may appear, it was sufficient to fix the red colouring principle of madder, and to constitute a very deep and beautiful dye.

A very pale shade of red is sometimes given to a portion of the cloth, which has a beautiful effect when contrasted with the deep Turkey-red dye. This is produced by limiting the quantity of alumina applied to the parts which are to be light red. In fact, no alum mordant whatever is applied to the parts which are to be light red; but they get a little during the steps taken to remove the excess of aluminous mordant, which has been applied to the parts that are to get the deep-red colour.

To ascertain the quantity of alumina which was sufficient to fix the light-red colour, the writer of this article got a portion of the same cotton cloth formerly operated on, dyed of the light-red colour. 1000 grains of this cloth being burnt, and the ashes analyzed, were found to contain 0·8 grain of alumina. Subtracting the 0·4 grain of alumina which 1000 grains of the undyed cloth contained, there remains 0·4 grain for the quantity communicated during the aluming process. These 1000 grains of cloth constituted a length of one yard and ten two-third inches. The breadth was thirty-two inches. Its surface (reckoning both sides) constituted $2986\frac{2}{3}$ square inches. So that every square inch of surface had combined with 0·00012 grains of alumina, or less than $\frac{1}{8000}$th of a grain. Yet this quantity of alumina, small as it is, was essential to the permanence of the dye; for when unalumed cloth was dyed with madder, the colour was speedily and easily washed out by water; but the light-red Turkey-red dye was perfectly fixed.

These facts are sufficient to show us the very small size of a particle of alumina. Were only 1000 particles of this substance fixed upon the square inch of surface of cloth, the weight of a particle of alumina would not exceed the millionth part of a grain. But that the number far exceeds 1000 is evident from this, that when we examine the surface of the cloth with a microscope, the red colour does not appear in spots, but is equally spread over the whole cloth. Many thousand particles of alumina upon the square inch would be requisite to produce this effect.

The aluming and the dyeing are sometimes given to the cloth together; but more frequently the aluming precedes, and the dyeing follows after the cloth has imbibed the mordant and been washed and dried.

2. *Tin.*—Of all the metallic oxides, those of tin are the most useful as mordants. They form, with acids, salts very easily decomposed; and the fibres of cloth have an affinity so strong for these oxides, that they readily withdraw them from their saline combinations, and unite with them. Tin forms two different oxides with oxygen. The protoxide is *black*, but the peroxide is yellow, and sometimes also white.

The tin mordants are formed by dissolving tin in muriatic acid. There are two chlorides of tin, as the combinations of that metal with chlorine are called. These are, the protochloride and the perchloride. The protochloride, when anhydrous, is a gray solid, with a pearly lustre; but when it is formed by dissolving tin in muriatic acid, it crystallizes in large oblique four-sided prisms, with one edge usually replaced by a tangent plane. The colour is white, with somewhat of the diamond lustre. The taste is acid, acrid, and disagreeable. When recently formed they dissolve in water; but when kept they dissolve imperfectly, leaving a white matter behind, which is an oxide of tin, and the quantity of this insoluble oxide increases with the age of the crystals.

How prepared as a mordant.

Calico-printers form their tin mordant by dissolving tin directly in muriatic acid; but the silk and woollen cloth dyers employ aqua regia for the purpose. Indeed tin for the dyers was originally dissolved in weak nitric acid; but when this method is followed, almost the whole tin precipitates in the state of an oxide in a few days. To prevent this precipitation, they added a little common salt or sal ammoniac to the nitric acid in which the tin was to be dissolved. Hellot informs us that Baron claimed the merit of having been the first person who employed aqua regia at Carcassone to dissolve tin. The object in view was to prevent the precipitation of the oxide, which always happens when nitric acid alone is used for that purpose.

The dyer's ordinary solution of tin is made with the kind of nitric acid called single *aqua fortis*. It is capable of dissolving about the eighth part of its weight of granulated tin. For each pound of aqua fortis it is usual to add about two ounces of common salt or sal ammoniac, and a little water to moderate the action of the acid. Those solutions which have been made most slowly, and with the least separation of fumes or vapours, have been found to succeed best; showing clearly that it is the protochloride of tin that constitutes the proper mordant. Two ounces of grain tin are usually allotted to every pound of aqua fortis. The metal should be added at different times, waiting till one part is nearly dissolved before another is added, otherwise too much heat may be evolved, which would cause the solution to go on too rapidly. The quantity of water added should be about one half of that of the aqua fortis used; so that the solution, when completed, should contain about one thirteenth of its weight of tin. About 20 lbs. of such a solution is required to die 100 lbs. of woollen cloth a full cochineal scarlet.

The process usually followed is this: Supposing 100 pounds weight of cloths intended to be died; ten pounds of cream of tartar are put into a suitable dyeing vessel of pure block tin,[1] with a sufficient quantity of clean soft water, and six or eight ounces of powdered cochineal. Immediately after this, ten or twelve pounds of the solution of tin are to be added, and when the mixture is nearly boiling hot, the cloth, previously completely wet, is put into the dyeing liquor, and turned through it by the winch, at first very rapidly, and afterwards slowly. This is to be continued for an hour and a half, after which the cloth is to be taken out and rinsed in clean water. By this first process the cloth has acquired a flesh colour. For the second or dyeing process the tin vessel is replenished with clean water. Five or six pounds of cochineal in powder are to be put into it, and well mixed by stirring it for a few minutes. After this the remaining part of the solution of tin is to be added; and the whole being well stirred, the cloth is to be put into the liquor, and turned very briskly through it, that both ends may receive an equal portion of the dye. After this it is turned more slowly for the space of half an hour, or until the dyeing liquor becomes exhausted, when the cloth is to be taken out, aired, and rinsed.

The process followed by the calico-printers for preparing the tin mordant is to dissolve tin in muriatic acid, by which a protochloride of tin is obtained. But Dr Bancroft found that, when a saturated solution of tin in muriatic acid was employed for dyeing woollen cloth scarlet, it had a corrosive effect on the cloth. He recommends a mixture of nitric and muriatic acid as a good solvent; and doubtless such a mixture would be cheaper and better than a solution of common salt or sal-ammoniac in nitric acid. Dr Bancroft found that a mixture of sulphuric and muriatic acid made a good solvent for the tin. Some farther experiments are still wanting to elucidate the best state of the tin mordant for the scarlet dye. We are of opinion that it is the protochloride of tin that constitutes the true mordant;[2] but some addition seems necessary to enable the fibres of the cloth to separate the oxide of the tin from the combination in which it exists, or rather to unite with the muriatic acid, when it is formed and disengaged by the decomposition of water, which obviously takes place, otherwise this acid, when evolved, will exert a corrosive action on the cloth.

The tartar is necessary to produce the scarlet colour. Without it the colour of the cochineal dye is crimson, or at most a rose colour. It doubtless acts principally by forming a double salt with the chloride of tin. But it must also convert a portion of the cochineal into a yellow dye; for scarlet is a compound colour, consisting of a great deal of red, mixed with a small quantity of yellow.

3. *Lead.*—We are not aware of the protoxide of lead being employed in any case as a mordant in dyeing silks or woollen cloth; but of late years it has been used as a mordant for cotton, to which the beautiful yellow given by means of chromic acid was to be communicated. For this purpose the lead is dissolved in nitric acid, or converted into nitrate of lead. This salt crystallizes in octahedrons, has a sweet and astringent taste, and dissolves readily in water. An aqueous solution of it thickened by gum is applied to those parts of the cloth which are to receive a yellow colour; or if the cloth has been already dyed red, a quantity of tartaric acid is mixed with the solution of nitrate of lead and gum, and after it has been applied and dried on the cloth, the piece is passed through water impregnated with a quantity of bleaching powder. The red colour is discharged; but the oxide of lead, which had united with the fibres of the cloth, still continues to adhere without alteration. The cloth is now passed through a solution of bichromate of potash. Those parts of it which contained the oxide of lead immediately decompose the bichromate; chromate of lead is formed and fixed upon the cloth, constituting a most beautiful and indelible yellow colour; or, by particular alterations in the process, this yellow colour may be changed to red, or to a very deep orange approaching red, and exceedingly beautiful.

4. *Copper.*—The black oxide of copper is employed as a mordant in giving a black colour to hats, or at least acetate of copper is employed in the process; and it is not easy to conceive any other purpose which such a salt can serve than contributing a portion of oxide of copper to act as a mordant.

5. *Galls.*—Nutgalls are excrescences which grow on

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[1] Copper vessels are found to injure the colour, and therefore are not used.

[2] We do not mean that the protoxide of tin remains fixed on the cloth: it doubtless becomes peroxide. But the superior solubility of protochloride of tin fits it better for the purpose.

Excr cence on oak.

the branches of some species of oak, in consequence of the puncture of an insect, the *cynips quercus folii.* The best kind come from the Levant. They are nearly spherical bodies, with protuberances on the surface. There is a cavity within where the insect lodged, and a round hole from that central cavity to the surface, by which the insect, after it was hatched from the deposited egg, eat its way out. These nutgalls have a very astringent and austere taste. When digested in water they give that liquid a brown colour, and the taste which they themselves have. When such an infusion is mixed with a solution of sulphate of iron, it strikes a deep blue or black colour. Nutgalls, besides a considerable portion of woody fibre, contain a notable quantity of two peculiar vegetable substances, to which they owe their value as dyestuffs or mordants. These are *tannin* and *gallic acid.* The latter of these substances is easily obtained in a state of purity; the former with difficulty.

Cont ns tann

The infusion of nutgalls contains scarcely any thing else than a solution of tannin and gallic acid. If we evaporate the solution in a gentle heat to dryness, and digest the residue in sulphuric ether or absolute alcohol, the gallic acid will be dissolved, and the tannin will remain in a state of tolerable purity, only coloured brown by the action of the air. Tannin, when pure, is white while moist. It becomes yellow when dried even *in vacuo,* and by subsequent exposure to the air it becomes darker coloured. Its taste is excessively astringent and harsh; and it is distinguished by the property of striking a deep blue or black with the salts of iron. Tannin is easily altered in its nature by heat. Its constitution, as determined by the experiments of Berzelius, is as follows:

Carbon	52·69	to 52·49
Hydrogen	3·86	to 3·79
Oxygen	43·45	to 43·72
	100·00	100·00

This corresponds best with

7 atoms carbon	5·25
3 atoms hydrogen	0·375
4⅓ atoms oxygen	4·333
	9·958

Hence it is either composed of these atoms or of some multiple of them, most probably of

21 atoms carbon	15·75
9 atoms hydrogen	1·125
13 atoms oxygen	13·00
	29·875

This would make its atomic weight 29·875.

Tannin exists not merely in nutgalls, but in oak bark, in the wood of the oak, in the leaves, and in fact in every part of that tree; but the quantity of it is much greater in nutgalls than in any other part.

Tannin possesses the characters of an acid. It reddens vegetable blues, effervesces with the carbonates, and unites in definite proportions with the bases.

and lic acid

Gallic acid exists also as a constituent of nutgalls, and may be extracted from them by means of ether or absolute alcohol. Its colour is white, though it is apt, like tannin, to become yellow when exposed to the atmosphere, and seems indeed capable of being converted into tannin by exposure to too high a temperature. It is not nearly so soluble in water as tannin, and is distinguished by an acid taste instead of an astringent one. Like tannin, it strikes a black with the salts of iron. But the gallate of iron is readily distinguished from the tannate. The former is an exceedingly fine black powder, which precipitates very slowly, while the latter is a deep blue, which precipitates rapidly, has a coarse appearance, and becomes black when dry. The constituents of gallic acid, according to the analysis of Berzelius, are as follows:

Carbon	56·64
Hydrogen	5·00
Oxygen	38·36
	100·00

This corresponds with

7½ atoms carbon	5·625
4 atoms hydrogen	0·5
4 atoms oxygen	4·0
	10·125

Or, if we double the quantities to get rid of the half atom,

15 atoms carbon	11·25
8 atoms hydrogen	1·00
8 atoms oxygen	8·00
	20·25

In gallic acid the hydrogen and oxygen exist in the proportions which constitute water; but in tannin there is a surplus of oxygen. In gallic acid there is rather more hydrogen than in tannin.

How used as a mordant.

The great use to which the infusion of nutgalls is put in dyeing is to give a black colour when mixed with solution of sulphate of iron. When used in this way it perhaps is improperly named a mordant; for the oxide of iron is known to have a strong affinity for the fibres of cloth, and the tannin and gallic acid have a strong affinity for the oxide. Hence probably the way in which the black dye is fixed on silk and woollen cloth. There can be no doubt that the tannin, which is by far the most abundant ingredient, is the principal agent in striking the black with the sulphate of iron. But the gallic acid probably adds to the lustre, and improves the beauty of the colour.

In the Turkey-red process for giving a fixed red colour to cotton cloth by means of madder, steeping the cloth in infusion of nutgalls is an important part of the process, as without this the colour would be apt to want equality of shade in different parts of the cloth. In this process there can be no doubt that tannin acts the part of a mordant. The galling, in preparing the cloth for the Turkey-red dye, always precedes the alumina process. Whether it has the property of making the alumina more fixed on the cloth than it otherwise would be, or what other purpose it may serve, is not very well understood; but it is certain that the boiling of the cloth in a pretty strong infusion of galls is important. The infusion of galls is made by boiling twenty-five pounds of nutgalls in forty gallons of water, till four or five gallons are boiled or evaporated. The specific gravity of the infusion is 1·020; or sometimes the process is twice repeated, employing each time only twelve and a half pounds of nutgalls in forty gallons of water. The specific gravity of each infusion in that case is only 1·010.

Such is an account of the mordants at present employed in dyeing, and the way of using them. It is not always necessary to employ mordants in dyeing; some colouring matters adhere to the cloth without the presence of any intermediate substance. This is the case with the oxides of iron and manganese. It is the case also with indigo, and it was the case also with the colouring matter from the buccinum and purpura employed by the ancient Phœnician dyers in dyeing the celebrated purple, of which an account has been given in the first chapter of this treatise. To those colouring matters which adhere to the cloth of themselves Bancroft has given the name of *substantive* colours, while he distinguishes those that require a mordant by the name of adjective colours.

Mordants.

Effects of mordants on the colour.

Mordants have a very considerable effect on the colour; and by varying the mordant, very different colours, and a great variety of shades, may be obtained from the same colouring matter. Some mordants themselves may be considered as communicating a colour, without the addition of any colouring substance; and although, when the latter is added, a new set of affinities is brought into action, yet there is little doubt that the mordant also has a considerable share in fixing the shades of colour. Let us take an example in dyeing with cochineal. When the aluminous mordant is employed, the colour produced is crimson; but when the oxide of iron is substituted for the alumina, the colour obtained is black. The effect is obviously produced by a change in the action of the affinities between the colouring matter and the mordant, and the colouring matter and light. In the use of mordants, therefore, it is necessary to attend to their combined effects with the colouring matter employed, and, to be able to communicate particular colours to stuffs with any degree of certainty, to know the amount of that effect.

Even in the mode of applying mordants, the variety of shades may be greatly multiplied. Different effects, for instance, are produced by previously impregnating the stuff with the mordant, or by mixing it with the bath. Different effects also arise from using heat, or as the stuff is more or less rapidly dried; and this must appear to be the case, if we consider the different affinities which are in action, and the change on the action of these affinities in these different circumstances, as well as in others which can scarcely be appreciated. The combination of these substances which have an affinity for the stuff, and the decompositions which are the result of that combination, are greatly facilitated by the evaporation of the water or other liquid which held these substances in solution; because by its affinity, which is opposed to the action of the affinity between these substances and the stuff, the affinity of the latter produces a more limited effect. But in dyeing, the process should proceed slowly, that the substances may not be separated before their mutual affinities have begun to operate.

Considerable differences must be observed in the mode of employing the mordant, as the force of affinity between the stuff and the colouring matter is greater or less. When this affinity is strong, the mordant and the colouring substance may be mixed together; the compound thus formed immediately enters into combination with the stuff. But if the affinity between the stuff and the colouring particles be weak, the compound formed of the latter and the mordant may separate, and a precipitation take place, before it can be attached to the stuff; and hence it is in these cases that the mordant, which is to serve as the medium of union between the stuff and the colouring matter, must be combined with the former, before the application of the latter. It is from these differences that different processes must be followed in fixing colouring matters on animal and vegetable productions; as, for instance, in dyeing wool or silk black, or with cochineal.

In estimating the effects of mordants, and in judging of the most advantageous manner of applying them, it is necessary to attend to the combinations which may be formed, either by the action of the ingredients of which they are composed, or by that of the colouring matter and the stuff. It is necessary also to take into consideration the circumstances which may tend to bring about these combinations with more or less rapidity, or that may render them more or less perfect. The action which the liquor in which the stuff is immersed may have, either on its colour or texture, must also be considered; and, to be able accurately to judge of the extent of this action, we must know the proportions of the principles of which the mordant is composed; which of these principles remains in an uncombined state in the liquor; and the proportion or quantity which is thus separated.

S ple C ars.

CHAPTER IV.

OF THE MODE OF DYEING SIMPLE COLOURS.

Dyers have divided colours into two classes, namely, *simple* and *compound* colours. The *simple* are produced by a single dyeing process, and cannot be obtained by mixing together different colours. The compound colours are obtained by mixing together any two of the dyestuffs which produce the simple colours. By this means two colours are given to the cloth at once; and the shade depends upon the proportions of each dyestuff employed.

The simple colours are five in number; namely, *red, yellow, blue, black,* and *brown.* The last of these may be considered also as a compound colour, as it may be formed by mixing the dyestuffs for two simple colours together. The compound colours are *orange, green, purple,* and *gray.* We shall in this chapter confine ourselves to the mode of dyeing the simple colours, dividing it into five sections, in each of which we shall treat of a simple colour.

Sect. I.—*Of Red.*

In treating of the red dye, the simplest method seems to be to give an account, in the first place, of the dyestuffs employed for dyeing red; and in the second place, to describe the methods followed by the dyer to give a red colour to silk, wool, cotton, and flax.

I.—*Description of the Dyestuffs.*

The principal colouring matters used in dyeing red are *madder, cochineal, kermes, lac, archil, carthamus, Brazil wood,* and *logwood.*

Cont s two c ur- ing m ters.

1. *Madder* is the root of a plant, the *rubia tinctorum,* which is cultivated in the south of Europe. There are two varieties, the *rubia cordifolia* and the *rubia peregrina.* It is this last which is cultivated in the south of Europe, and comes to us from the Levant. The roots are wiery, and very much branched. They have a red colour externally, but are yellow within. This plant was cultivated by the Greeks and Romans, and was employed in medicine, and also in dyeing, as Dioscorides and Pliny inform us. It was called *erythrodamus* and *vœrantia* by the Greeks, and *rubia* by the Romans. From the last Greek name is derived the French word *garance,* by which madder is distinguished in that language.

It is the woody portion of madder that is useful in dyeing: the bark and pith are comparatively of little value. Madder has been examined by many chemists; but Robiquet and Colin alone have succeeded in separating the red colouring matter, and in determining its properties. They have distinguished it by the name of *alizarin,* an appellation derived from *alizari,* by which madder is distinguished in the Levant.

Madder contains two colouring matters; one, which is yellow, is soluble in cold water; the other, the alizarin, is soluble only in boiling water. To the yellow colouring matter Kuhlmann has given the name of *xanthin.* This matter considerably injures the colour of the alizarin; hence the reason why cloth dyed with madder has at first a dull brownish-red colour, which it loses in proportion as the xanthin is removed.

Ali n how- tain

To obtain *alizarin,* Robiquet and Colin recommend the following process. Mix pounded madder with two thirds or with its own weight of concentrated sulphuric acid, and set the mixture aside for two or three days, taking care that heat is not evolved. All the other constituents of the madder, except the alizarin, are converted into charcoal; and should heat have been evolved, even the alizarin itself will be charred. Wash the black matter thus formed, to extract from it all the acid. What remains is a mixture of charcoal and alizarin Let it be dried and digested with a portion of cold alcohol, which will dissolve a fatty matter which it contains. Let it now be digested in boiling alcohol till all the alizarin is dissolved. Mix the alcoholic solutions with water, distil off the alcohol, and filter the residual liquor. The alizarin remains upon the filter in a state of purity. Various other processes for extracting alizarin have been given by Robiquet and Colin, and by Kuhlmann and Zenneck.[1] But for these we refer to the respective publications of these chemists. The process which we have given we consider as of easiest execution.

Its per-ties.

Alizarin is insipid, and destitute of smell. According to Zenneck, it possesses weakly acid properties; but Colin and Robiquet consider it as perfectly neutral. It sublimes easily in long flexible capillary needles, having an orange colour; but unless the subliming vessels be very low and flat, much of the alizarin is decomposed during the process. Two watch-glasses applied to each other, for example, answer very well as a subliming vessel. During the process the alizarin gives out an aromatic odour like that of benzoin. It is almost insoluble in cold water; but it is moderately soluble in boiling water, to which it communicates a rose-red colour. At the temperature of 54°, 212 parts of alcohol, of the specific gravity 0·83, dissolve one part of alizarin. At the same temperature sulphuric ether, of specific gravity 0·73, dissolves $\frac{1}{160}$th part of its weight of it. The alcoholic solution is red, that of ether yellow or orange. It is slightly soluble in bisulphide of carbon, oil of turpentine, naphtha, and the fat oils, communicating to these bodies a reddish-yellow colour. Chlorine has little action on it, yet it injures the colour a little, and makes it incline to yellow. Sulphuric acid dissolves it, and acquires at the same time a blood-red colour. Nitric and muriatic acid dissolve it, and slightly alter the shade of its colour. These acids, when dilute, do not dissolve it. With alkalies it forms soluble combinations, having a violet-red colour, which do not afford crystals. The alkaline carbonates dissolve it, assuming a violet colour. With the alkaline earths it forms precipitates, having a violet or lilac colour; with alumina a precipitate which is red or reddish-brown. With the metallic oxides it forms insoluble combinations, having a violet or reddish-brown colour.

It has a marked affinity for various animal matters. It dissolves in the white of an egg diluted with water; and if we coagulate the albumen by heat, the alizarin combines with it, leaving the liquid portion tinged yellow. Albumen, containing a portion of alizarin in solution, is precipitated by a solution of chloride of calcium; yet this salt does not precipitate uncombined albumen diluted with the same quantity of water. Phosphate of lime appears also to have a marked affinity for the colouring matter of madder. Indeed this is obvious, from the well-known fact, that the bones of animals which have taken for some time a quantity of madder mixed with their food, are tinged red.

Urine, when left in contact with madder, extracts from it the alizarin, and acquires a red colour, even when quite recent and acid. Milk is coloured yellow by madder, and red coagulated curd is deposited upon the madder. The solution of animal gelatin does not precipitate the red colouring matter of madder.

We are not aware that madder is employed in dyeing silk or wool, but it constitutes one of the most beautiful and fixed red dyes for cotton and linen, and for dyeing these substances it has been in use probably at least two thousand years. As the yellow colouring matter or *xanthin* is not used in dyeing, it seems unnecessary to give any account of it in this place.[2] It gives a very beautiful yellow colour, and might be employed in calico-printing, were it not that the extraction of it would cost too much money.

Nature of cochineal.

2. *Cochineal* is the name given to a small insect that inhabits the *cactus coccinilifera*, and three or four other species of cactus, upon which it remains immoveable, drawing its nourishment from the juices of the plant. The insect is called by entomologists *coccus cacti*. It is the female insect (which is without wings) that constitutes the dyestuff. The insect is small, having a kind of hemispherical back, crossed by numerous wrinkles, and of a dark reddish-brown colour.

This insect is a native of Mexico, and had been employed by the natives as a red tinging matter. When the Spaniards entered that country in 1518 it drew their attention; and in 1523 Cortes received orders from the court of Spain to procure it in as great quantity as possible. He left the cultivation of the insect to the natives, who prosecuted it so successfully that great quantities of it were imported into Europe. The earlier Spanish writers described it as an insect, but at a later period it came to be considered as the seed of a plant; and this opinion continued the prevalent one, till the contrary was proved by Melchior de Ruuscher, about the beginning of the eighteenth century. This man, who was a native of Holland, affirmed in a society, from oral information which he had obtained in Spain, that cochineal was a small animal. Another person, whose name has not been made known, maintained the contrary with so much heat and violence, that the dispute at length ended in a bet. Ruuscher charged a Spaniard, one of his friends, who was going to Mexico, to procure for him in that country authentic proofs of what he had asserted. These proofs, legally confirmed in October 1725, by the court of justice in the city of Antiguera, in the valley of Oaxaca, arrived at Amsterdam in the autumn of the year 1726. Ruuscher caused this evidence to be published under the following title: *The History of Cochineal proved by authentic documents*.[3]

The fact that cochineal is an insect had been suspected before. In a very crude and unsatisfactory paper on cochineal, published in the *Philosophical Transactions for* 1668,[4] this is distinctly stated as an undoubted fact. In 1672 Dr Lister, in a paper inserted also in the *Transactions*, throws out a conjecture that the cochineal insect may be a sort of kermes; which conjecture is now known to be well founded. Leeuwenhoeck is said to have examined cochineal microscopically in 1703, and to have ascertained it to be an insect. About the beginning of the year 1757 Mr Ellis obtained some of the joints of the plant on which the insects breed, from South Carolina, and presented them the same year to the Royal Society. These specimens, Mr Ellis observes, were full of the nests of this insect, in which it appeared in its various states, in the most minute, when it walks about, to the state when it becomes fixed, and wrapt up in a fine web which it spins about itself. With the assistance of the microscope, Mr Ellis discovered the true male insect in the parcels which had been sent to him from America; and in August 1756, in consequence of Mr Ellis's discovery, Dr Garden caught a male cochineal fly, which, he observes, is rarely to be met with. He supposes that there may be 150 or 200 females for one male. These discoveries proved indisputably that the cochineal is an animal production.

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[1] See Kuhlmann, *Ann. de Chim. et de Phys.* xxiv. 225; Zenneck Poggendorf's *Annalen.* xiii. 261; Robiquet et Colin. *Jour. de Pharmacie*, xii. 407; and *Ann. de Chim. et de Phys.* xxxiv. 225.

[2] For an account of it we refer the reader to the *Jour. de Pharmacie*, xiv. 354.

[3] *Natuerlyke Historie van de Couchenille, beweezen mit authentique documenten.* Amsterdam, 1729, 8vo, 175 pages.

[4] No. xl. p. 796.

Contains cochinealin.

Cochineal has been subjected to a chemical examination by various individuals; but the most successful analysis of it is by Pelletier and Caventou in 1818, which was published in the eighth volume of the *Annales de Chimie et de Physique*, p. 250. They found it to contain about half its weight of the peculiar colouring matter to which they applied the name *carmine;* but we prefer the name cochinealin, already given to this substance by John, who was the person that first obtained it and described its properties. Cochinealin may be obtained by the following process:—

Digest cochineal in alcohol, as long as it communicates a red colour to that liquid. The alcoholic solution being left to spontaneous evaporation, lets fall a crystalline matter of a fine red colour. Dissolve these crystals in strong alcohol, and mix the solution with its own bulk of sulphuric ether. The liquid becomes muddy, and gradually deposites the cochinealin, which constitutes a purple crust on the bottom of the vessel.

Properties of cochinealin.

Cochinealin has a fine purple-red colour, is granular, and consists of small crystals. When left exposed to the air, it undergoes no sensible alteration. At 122 degrees it melts; and if the heat be increased, it swells up and is decomposed, yielding carburetted hydrogen gas, a great deal of oil, and a little water having a slightly acid taste. It furnishes no traces of ammonia.

It is very soluble in water. The aqueous solution has a fine carmine colour, and, how much soever concentrated, does not deposite crystals. It dissolves also in alcohol; but the solubility diminishes in proportion to the strength of the alcohol. In sulphuric ether it does not dissolve. The weak acids dissolve it, probably in consequence of the water which they contain. When the cochinealin is pure, no acid throws it down from its aqueous solution; but they precipitate it when in combination with the peculiar animal matter of cochineal. They produce a sensible change upon its colour, causing it gradually to assume a tint of yellow. This is the reason why cochineal will not dye scarlet, unless when mixed with bitartrate of potash. The concentrated acids decompose it altogether.

Alkalies also alter the colour of solutions of cochinealin. It first becomes violet, and at last yellow; and the original colour cannot be again restored. Lime-water occasions a precipitate when poured into an aqueous solution of this substance; but barytes and strontian water occasion no precipitate, though they change the colour to yellow. Alumina has a strong affinity for cochinealin. When newly precipitated alumina is agitated in an aqueous solution of it, the liquid is rendered colourless, and the alumina converted into a beautiful *lake.* The pigment called *carmine*, accidentally discovered by a Franciscan monk about the middle of the sixteenth century, and the process for obtaining which was published by Homberg in 1656, consists essentially of a combination of cochinealin and alumina.

Most of the saline solutions alter the colour of the aqueous solution of this substance; but few of them are capable of producing a precipitate in it. Acetate of lead, however, throws down a copious violet sediment from the decoction or infusion of cochineal; and by decomposing this sediment by means of sulphuretted hydrogen, the cochinealin may be obtained in a state of purity. The chloride of tin throws down a violet precipitate, and the perchloride strikes a fine scarlet colour, but precipitates nothing. When gelatinous alumina is added to this mixture, we obtain a fine red precipitate, which is not altered by boiling.

Cochineal was at one time used in great quantity in Europe, chiefly for dyeing fine scarlet cloth. When Bancroft published his work on colours in 1794, he informs us that the annual European consumption was about 3000 bags, or 600,000 lbs., of which about 240,000 lbs. were consumed in Great Britain. The demand has since that time very much diminished; and the price has in consequence sunk from about thirty shillings to about nine shillings and sixpence per pound. This diminution is chiefly owing to the substitution of the lac dye for cochineal. Cochineal, however, is still used for the dyeing of fine scarlet cloth.

3. *Kermes.*—This is also the female of an insect which inhabits a species of oak. The tree, which is a native of the countries bordering on the Mediterranean and Asia, is called by Linnæus *quercus ilicis*, and the insect *coccus ilicis.* This substance was known to the ancients, though they were ignorant of its nature. Dioscorides calls it κοκκος, and Pliny *coccum* and *granum.* It was used in medicine; and there can be no doubt that it was employed in Asia at a very early period as a dyestuff. There is reason to suspect that the *scarlet* cloth mentioned by Moses to adorn the tabernacle was dyed by means of kermes. If this conjecture has any foundation, the kermes dye must have been known in Egypt before the time of Moses.

The word *kermes* or *alkermes* is at present in the East the common name for the animal which produces the dye, as well as for the dye itself. Probably it comes from the Arabic. If the kermes dye was known in Egypt and Phœnicia in the time of Moses, there is some difficulty in explaining how it was altogether unknown to the Greeks and Romans till the time of the Emperor Aurelian, who began his short reign in the year 270 of the Christian era. Vopiscus informs us that the king of Persia sent to that emperor, besides other articles of great value, some woollen cloth, which was of a much costlier and brighter purple than any that had been ever seen in the Roman empire, and in comparison of which all the other purple worn by the emperor and the ladies of the court appeared dull and faded. Vopiscus goes on to say that this cloth had been dyed in India, and that the assertion of the king of Persia, *sume purpuram qualis apud nos est*, was false; for Aurelian, Probus, and Diocletian, had sent dyers into the East on purpose to get information respecting this precious dye; but that their attempts utterly failed of success.[1]

From this passage it would appear that the use of kermes in dyeing had been known at a very early period in India, from which it gradually made its way into Persia, and afterwards into Europe. And as the colour which it yielded was more beautiful than the celebrated Phœnician dye, it may have contributed to put an end to the monopoly of the Phœnician dyers. The term *scarlet*, the origin of which is unknown, but which was certainly employed early in the twelfth century, was applied to the colour given to cloth by the kermes dye.

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[1] Vopiscus in *Vita Aureliani*, cap. 29.

Kermes is gathered chiefly in Languedoc, Spain, and Portugal. The insects are collected in the months of May and June, when the female, which alone is useful, is distended with eggs. To destroy the young insects, the kermes is exposed to the steam of vinegar for about half an hour, and afterwards dried. It is in the form of small grains of a reddish-brown colour. Kermes, as appears from the experiments of Lassaigne,[1] contains the very same colouring matter as cochineal; but its quantity is not so great, and of course it is mixed with a greater proportion of animal matter. The introduction of cochineal greatly diminished the consumption of kermes. It is seldom used in this country, yet it gives a very fixed and beautiful colour to woollen cloth.

4. *Lac.*—This is an animal production which has been long known in India, and used for dyeing silk and other purposes. It is the *nidus* of the *coccus lacca*, Linnæus, and is generally produced on the small branches of the *croton lacciferum*. Three kinds of lac are well known in commerce:—1. Stick lac is the substance or comb, in its natural state, forming a crust on the small branches or twigs. 2. Seed lac is said to be only the above separated from the twigs and reduced into small fragments. Mr Hatchett, who has examined this substance with his usual skill and precision, found the best specimens considerably deprived of their colouring matter.[2] According to the information which he received from Mr Wilkins, the silk dyers in Bengal produce the seed lac by pounding crude lac into small fragments, and extracting part of the colouring matter by boiling. 3. Shell lac is prepared from the cells, liquefied, strained, and formed into thin transparent laminæ. There is also a fourth kind, called *lump lac*, which is obtained from the seed lac by liquefaction, and afterwards formed into cakes. The best lac is of a deep red colour: when it is pale and pierced at the top, the value is greatly diminished; for then the insects have left their cells, and it can no longer be of use as a dyestuff.

Als imi- lar co- chin l.

Unverdorben has likewise examined lac, but his experiments throw no light upon the nature of the colouring matter. Being derived from a coccus, as well as the colouring matter of cochineal and kermes, the probability is that it is of the same nature. In the state in which it comes to this country (that of a purple powder), it dissolves readily in boiling hot water. In this way it is employed by the dyers. Being much cheaper than either cochineal or kermes, it has in some measure superseded these dyestuffs, except when a very fine scarlet is wanted, in which case cochineal is still employed.

5. *Archil.*—This substance, called *orseille* by the French, is a violet-red paste, of which there are two varieties, one, which is the best, made in the Canary Islands, the other manufactured in the south of France. It is made from two species of lichens, the roccella and the parellus. Berthollet, who has copied Hellot, who again copied Micheli, has given the following description of the mode of preparing it. The plant is reduced to a fine powder, which is afterwards passed through a sieve, and slightly moistened with stale urine. The mixture is daily stirred, each time adding a certain proportion of soda in powder, till it acquire a clove colour. It is then put into a wooden cask, and urine, lime-water, or a solution of sulphate of lime (*gypsum*), is added in sufficient quantity to cover the mixture. In this state it is kept; but to preserve it any length of time, it is necessary to moisten it occasionally with urine. We suspect that soda is not employed in the preparation of this dyestuff; at least it is not employed in the manufacture of cudbear, the preparation of which, being a manufacture of this country, we have often witnessed.

H pre- pa .

If we adopt the opinion of Tournefort, the preparation of archil was known to the ancient Greeks. He thinks that the purple of Amorgos, one of the Cyclades, the colour given to the famous tunics of that country, was formed by a dyestuff made from the lichen roccella.[3]

Cudbear how prepared.

What is called in this country *cudbear*, and in Germany *persio*, is prepared from the lichen *tartareus*, and *omphalodes*, by a process quite similar to that employed for making archil. The lichen is steeped and left for some time in flat vessels moistened with ammonia distilled from putrid urine. When the purple colour is sufficiently developed, the whole is dried in the open air, and reduced to a fine powder. The manufacture of this dyestuff was begun about the year 1777, at Leith, by Mr Mackintosh and Dr Cuthbert Gordon, from which last the British name of *cudbear* (originally *Cuthbert*) is derived. Leith was found an improper place for the manufacture; but Mr Mackintosh transferred it to Glasgow, and manufactured cudbear during the rest of his life with success. He left it to his son Charles Mackintosh, Esq. who still carries it on. The lichens used were at first collected in the Highlands of Scotland; but the rocks of that country being stript of their covering, the manufacturers had recourse to Sweden and Norway, and likewise to Sardinia, from which countries prodigious quantities of the lichens were brought. There is said also to be a manufactory of cudbear in Liverpool.

Neither archil nor cudbear are capable of giving fast colours to cloth; but they are considered as indispensable by the dyers, because they greatly improve the brilliancy of some of the colours.

Contains erythrin.

The nature of the substance in the lichen roccella, which furnishes the colouring matter of archil, has been investigated by Heeren, who has distinguished it by the name of *erythrin*. It may be obtained from the lichen by the following process: Digest the lichen for some time in alcohol, taking care not to raise the heat to the boiling point, because at that temperature a portion of the erythrin is decomposed. The alcoholic solution has a green colour. Filter it while hot, and mix it with twice its bulk of water, which will render it muddy. Raise the liquid to the boiling temperature, and introduce into it chalk in powder, until the precipitate, which was at first dispersed through the liquor, collects in flocks. This precipitate consists chiefly of *roccellate of lime*.[4] The liquid must be filtered while boiling hot. During the cooling it deposites erythrin in the state of a fine powder, of a brown colour. Dissolve it in hot alcohol, digest the solution with ivory black, filter, and mix it with one and a half times its bulk of boiling water. The liquor remains at first clear, but during the cooling the erythrin precipitates nearly white.

The following process for extracting erythrin from the lichen roccella is easier than the preceding. Pour on the lichen a small quantity of concentrated ammonia, and digest for some time, stirring well, but without the application of heat. Dilute the muddy and reddish solution thus obtained with water; and then add to it some dilute solution of chloride of calcium. Roccellate of lime precipitates, and the filtered liquid has a reddish colour. Add to it a slight excess of muriatic acid. The erythrin precipitates instantly, and gives the liquid the aspect of a yellowish jelly. When we heat to the boiling temperature, the erythrin is again dissolved, and it is precipitated in powder during the cooling of the liquid. It may be deprived of its brown colour by ivory black.

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[1] *Ann. de Chim. et de Phys.* xii. 102.

[2] *Phil. Trans.* 1804.

[3] Tournefort's *Voyage*, i. 248, English translation.

[4] Roccellic acid is an acid discovered by Heeren in the lichen roccella.

Its properties.

Erythrin is a soft powder, having usually a slight shade of red, and a slightly crystalline aspect, when obtained from a weakly acid liquid. When pure it is perfectly white. It has neither taste nor smell. At a temperature a little above 212°, it melts into a transparent liquid, which becomes hard and brittle during the cooling. If the heat be raised still higher, it froths, is partly volatilized, and partly charred; but not the least trace of ammonia can be observed to be formed. Hence we may conclude that erythrin contains no azote. When held to the flame of a candle it burns like a resin. It is scarcely soluble in cold water, and requires 170 times its weight of boiling water to dissolve it. At the temperature of 53° it dissolves in twenty-two and a half times its weight of alcohol, of specific gravity 0·825. It is soluble in 2·29 times its weight of the same alcohol at the point of ebullition. When this last solution cools, the whole is converted into a mass of the consistence of mortar. It is insoluble in ether, and little soluble in oil of turpentine. Muriatic acid has no action on it, but acetic acid dissolves it with facility when boiling hot, but lets it fall again on cooling. Both nitric acid and concentrated sulphuric acid dissolve it, but they alter its nature. The aqueous solutions of the alkalies, or their carbonates, dissolve it with facility, and the solutions are colourless. By the continued action of the alkalies, the erythrin is decomposed. When this action takes place in close vessels, an extractive substance is formed, which is soluble in water, having a bitter taste, and which Heeren on that account has called *bitter of erythrin.* When the action is continued in vessels to which the air has access, the red or rather violet substance is formed which constitutes the colouring matter of archil.

During the conversion of erythrin into the red matter three different substances are obtained, namely, the *red colouring* matter, a *yellow* substance, and a *wine-red* substance. They are first mixed or combined; but the red colouring matter may be separated by dissolving the compound substance in alcohol, evaporating the solution to dryness, and digesting the residue in ammonia. The red colouring matter remains when this solution is evaporated.

It is little soluble in water. Alcohol dissolves it, and the solution has a crimson-red colour. It is quite insoluble in ether. The alkalies and their carbonates dissolve it, and the solution has a fine deep colour. The acids throw it down from these solutions under the form of carmine red powder, but they do not precipitate it from its solution in alcohol. Heeren has shown that alcohol has the property of altering erythrin, and of converting it into a snow-white substance, to which he has given the name of *pseudo-erythrin,* because it does not yield the red colouring matter, but only the wine red. It has been analyzed by Liebig, who found its constituents,

Carbon	60·810
Hydrogen	6·334
Oxygen	32·856

These correspond with

8 atoms carbon	6
5 atoms hydrogen	0·675
3¼ atoms oxygen	3·25
	9·925

Hence these atoms, or some multiple of them, must represent the composition of pseudo-erythrin.

Colouring matter of cudbear.

The colouring matter of cudbear is obviously very nearly the same as that of archil. It has been slightly examined also by Heeren, who has pointed out some distinctive characters which it possesses.

In France, besides the lichen parellus, the lichen dealbatus is employed, and the archil is obtained by treating the lichens with putrid urine and lime. Robiquet has subjected the lichen dealbatus to a chemical analysis, and has extracted from it the matter which yields the red dye, and which he has distinguished by the name of *orcin.* It constitutes white crystals, having a sweetish and nauseous taste, melts when heated, and may be distilled over without decomposition. It dissolves both in water and alcohol. It is obvious that its properties are quite different from those of erythrin; yet the process for converting it into the red dyestuff is nearly the same as for archil and cudbear.

6. *Carthamus,* or *Safflower.*—This is the petals of the blossoms of the carthamus tinctorius, a plant formerly cultivated in Germany and France; but now the dyestuff comes usually from Egypt and the countries round the eastern part of the Mediterranean, and from India.

The method of preparing the flowers of carthamus in Egypt, as it is described by Hasselquist, is the following. After being pressed between two stones, to squeeze out the juice, they are washed several times with salt water, pressed between the hands, and spread out on mats in the open air to dry. In the day time they are covered, that they may not dry too fast with the heat of the sun, but they are left exposed to the dew of the night. When they are sufficiently dry, they are put up, and kept for sale under the name of *saffranon.* Care should be taken afterwards not to keep it in too dry a place; for unless it is a little moist, its properties are considerably impaired.

Carthamus contains two colouring substances, a yellow substance, which is soluble in water; and as it is of no use, it is extracted by the process mentioned above, by squeezing the flowers between stones till no more colour can be pressed out. The flowers become reddish in this operation, and lose nearly one half of their weight. The other colouring matter, which is red, is soluble in alkaline carbonates, and it is precipitated by means of an acid. A vegetable acid, as lemon juice, has been found to produce the finest colour. Next to this, sulphuric acid produces the best effect, provided too great a quantity, which would alter and destroy the colour, be not employed. The juice of the berries of the mountain-ash, or *rowan-tree* (*sorbus aucuparia,* Lin.), is recommended by Scheffer as a substitute for lemon juice, and it is thus prepared. The berries are bruised in a mortar with a wooden pestle, and the expressed juice, after it has been allowed to ferment, is bottled up. The clear part, which is most acid, becomes fitter for use the longer it is kept; but this operation requires a period of some months, and can only be conducted in summer.

From the colouring matter extracted by means of an alkali, and precipitated with an acid, is procured the substance called *rouge,* which is employed as a paint for the skin. The solution of carthamus is prepared with crystals of soda, and precipitated with lemon juice which has stood some days to settle. After being dried on delft plates with a gentle heat, the precipitate is separated, and ground accurately with talc which has been previously reduced to a very subtile powder; and on the fineness of the talc depends the difference between the cheaper and dearer kinds of *rouge.*

Carthamus furnishes about five per cent. of this matter (abstracting the talc), which is the true red colouring matter. It reddens vegetable blues while moist, whether from the acid employed in throwing it down, or from its own acid properties, has not been determined. It is insoluble in water and dilute acids, but slightly soluble in

Si ple Co rs.

alcohol. The solution has a rose-red colour, but when boiled becomes yellow. Ether is still a worse solvent of *rouge* than alcohol. It is insoluble in oils, both volatile and fixed; but it dissolves readily, and with a yellow colour, in alkaline leys, or alkaline carbonates. According to Dobereiner (who considers it as an acid, which he calls *carthamic*), soda saturated with it crystallizes in fine colourless needles, having a silky lustre, which become instantly red when an acid is added to them.

As a dyestuff, safflower affords only a fugitive colour, destroyed by exposure to the sun, and removed by washing. It is used, however, occasionally to give a red colour to silk.

7. *Brazil Wood.*—This wood comes from Brazil, and from Pernambuco; and in the former case is said to be the wood of the *cæsalpina sapan*, *cæsalpina crista*, and *cæsalpina vesica*; in the latter, of the *cæsalpina echinata*. These trees are large, and rich in colouring matter. The wood is very hard, and is said to sink in water. When fresh cut it is pale, but becomes reddish by exposure to the air. Its taste is sweetish. The red colouring matter of Brazil wood is very easily acted on by chemical agents, acids rendering it *yellow*, and alkalies *violet*. Chevreul has given us the following process for extracting this colouring matter in a state of purity. Digest the raspings of the wood in water till that liquid has dissolved all the colouring matter, and evaporate the infusion to dryness, to get rid of a little acetic acid which it contains. Dissolve the residue in water, and agitate the solution with litharge, to get rid of a little fixed acid which it contains. Evaporate again to dryness. Digest the residue in alcohol: filter and evaporate to drive off the alcohol. Dilute the residuum with water, and add to the liquid solution of gelatine, till all the tannin which it contains is precipitated. Filter again, evaporate to dryness, and digest the dry mass in alcohol, which will leave undissolved the excess of gelatine that may have been added. This last alcoholic solution being evaporated, the pure colouring matter of Brazil wood remains behind.

Co ring ma r how b- tai l.

It s oper- ti

It is soluble in water and in alcohol, but its fine red colour does not appear till all the acid which it naturally contains is saturated. Acids give it a yellow colour. The sulphuric, nitric, and muriatic acids, give it a pale dirty yellow. Fluoric acid gives it at first a yellow colour, which is gradually altered to grayish green; while the phosphoric and citric give it a fine permanent yellow colour, which might be employed for dyeing silk and wool. For these facts we are indebted to Bonsdorf. A very minute quantity of alkali gives the infusion of Brazil wood a violet colour; it is therefore a delicate re-agent for alkalies. When neutral salts, with an alkaline base, are dissolved in the infusion of Brazil wood, it assumes a rose-red colour. Acetates act most decidedly in producing this effect. When newly precipitated alumina is agitated in this infusion, it assumes a carmine-red colour.

When Brazil wood is boiled in water, we obtain a rose-coloured solution, and the undissolved wood becomes black, but still yields to alcohol a dark-red colour. When an acid is poured into the decoction, a red precipitate falls, and the filtered liquid is yellow. Ammonia gives the decoction a purple colour, and throws down a purple precipitate. The carbonates of potash and soda render it carmine red, and throw down a precipitate of the same colour. Alum throws down an abundant carmine precipitate, but the liquid retains the same colour. The protochloride of tin gives a rose-red precipitate, and renders the decoction colourless.

F s red in

Brazil wood is the substance from which red ink is prepared. The colour which it communicates to cloth has very little permanence; yet it is occasionally employed in dyeing cotton what are technically called *chemical colours*, by which is understood colours that will not resist washing. The decoction of Brazil wood, which is called juice of Brazil, is found to answer better for the process of dyeing when it has been kept some time, and has even undergone some degree of fermentation, than when it has been fresh prepared. The colour by keeping becomes of a yellowish red.

Simple Colours.

Within the last five or six years, Brazil wood has been nearly superseded by a wood imported from Africa, to which our dyers give the name of *camwood*. It is richer, and gives a finer colour, than any of the varieties of Brazil wood. It is not so much affected by alkalies, nor so liable to assume a violet shade; and the yellow colouring matter with which it is mixed gives the red a more lively appearance. We have not learned the botanical name of the tree which yields this wood.

8. *Logwood.*—This wood is usually, on the Continent, called *Campeachy wood.* It is the wood of the *hematoxylon Campeachianum*, a tree which grows to a considerable size in Jamaica, and on the eastern shore of the Bay of Campeachy. Its specific gravity is greater than that of water; it has a fine grain, and is susceptible of a fine polish. Besides the colouring matter to which it owes its value, logwood contains resin and oil, which are soluble in water; acetic acid and salts, consisting of potash and lime, combined with a vegetable acid, which are soluble in water saturated with chloride of potassium. It contains also sulphate of lime, oxalate of lime, a little alumina, and some peroxide of iron and oxide of manganese. Chevreul, to whom we are indebted for a chemical examination of logwood, has given the following process for extracting its colouring matter, which he has distinguished by the name of *hematin*.

Yields hematin.

How obtained.

The raspings of the wood are digested in water of a temperature from 122° to 131°, till every thing soluble is taken up. Evaporate the aqueous solution to dryness by a gentle heat, and treat the residue with alcohol of the specific gravity 0·843, which dissolves the colouring matter, leaving a brown residue still containing colouring matter in chemical combination. Filter the alcoholic solution, and distil it till what remains becomes of the consistence of a syrup. This syrup being mixed with some water, crystals begin immediately to be deposited. Leave it for twenty-four hours to evaporate spontaneously, then decant the liquid portion from off the crystals, and wash them with a little alcohol. The decanted liquid being left to spontaneous evaporation, will yield more crystals, and finally remains a thick uncrystallizable liquid. If it be evaporated to dryness, macerate the dry mass in cold water, and evaporate afresh: more crystals are obtained, which may be purified, like the other, by washing them in alcohol. These crystals thus obtained constitute *hematin*, or the pure colouring matter of logwood.

Its properties.

They have considerable lustre, and a scarlet colour. Under the microscope they appear to constitute needles arranged in sphericles. When rubbed on a glass it appears *orange* by transmitted light, and white by reflected light. But if we let fall on it a drop of alcohol, it appears *carmine red* by transmitted, and *yellow* by reflected light. When put into the mouth it is at first tasteless; but after some time a sensation of astringency, acridity, and bitterness, is perceived. When heated in a retort to decomposition, it gives out among other products ammonia, from which we may conclude that it contains azote. After every thing volatile is driven off, there remains fifty-four per cent. of charry matter half fused; which, when burned in the open air, leaves a quantity of lime and peroxide of iron, amounting to rather less than one per cent. of the hematin employed.

Hematin requires for solution 1000 times its weight of water. By evaporation it does not yield crystals, but when very much concentrated it is converted into a confused crystalline mass. It dissolves in alcohol and ether, and the solutions have a reddish-yellow colour. It combines with the acids, which render it yellow when added in small quantity; but when in a larger proportion they give it a red colour. Sulphurous acid and carbonic acid give the solution of hematin a pale-yellow colour. Boracic acid gives it a pale-red, and phosphoric and phosphorous acid a pale-orange colour. Arsenious acid has no sensible action on it. Sulphuretted hydrogen gas renders it yellow; and if we keep a solution of hematin charged with this gas for some time in a corked phial, it loses its colour altogether; but the colour appears if we remove the gas by means of a little oxide of lead. The salifiable bases give solution of hematin a violet, purple, or blue colour. With the fixed alkalies it forms compounds perfectly saturated and soluble. The alkaline earths fall down in combination, and have a purple colour when they fall from neutral salts, and a blue colour when from subsalts. An excess of alkali destroys the colour altogether. With the hydrated oxides of antimony, zinc, bismuth, nickel, iron, and copper, it forms blue or purple coloured compounds. The compound which hematin forms with alumina and oxide of copper at once may be fixed upon linen or cotton, and gives a blue colour like that of indigo, only it is rendered yellow by the concentrated acids, while indigo remains unchanged, unless the acid be the nitric. The protoxide of tin, when united with hematin, forms a blue-coloured compound, while its combination with the peroxide of tin is red. We see from this that the protoxide of tin possesses the characters of an alkali, while the peroxide is an acid. A solution of gelatine throws down a concentrated solution of hematin purple.

Hematin is easily altered. When a mixture of alkali and hematin is kept *in vacuo*, or in a well-corked phial, quite full, no action takes place; but when air has access, oxygen is absorbed, and the hematin quite destroyed in a few hours. During this action, the blue colour of the liquid changes first into red, and then into brown. The alkali becomes saturated with carbonic acid.

II.—*Method of dyeing Wool Red.*

All the colouring matters employed for dyeing wool red by modern dyers require a mordant to fix them. The shade of colour depends partly upon the kind of colouring matter used, partly on the mordant, and partly on the quantity of colour which the cloth is made to imbibe by the length of time that it remains exposed to the action of the dyeing liquor. The purple of the ancients, the colouring matter of which was obtained from different species of shell-fish, required no mordant; but it has already been observed that this mode of dyeing has been for ages out of use.

Madder red.

Madder Red.—Madder is only employed for dyeing coarse woollen stuffs; and the following is the process. The stuffs are first boiled for two or three hours with alum and tartar; they are then left to drain, slightly wrung out, put into a linen bag, and carried into a cool place, where they are to remain for some days. The quantities and proportions of the alum and tartar are varied according to the views of the dyer, and the shade of colour which is wanted. Some recommend five ounces of alum and one ounce of tartar to each pound of wool. By increasing the proportion of tartar to a certain degree, a deep and permanent cinnamon colour, instead of a red, is produced. This arises from the yellow tinge which is induced by means of the acid on the colouring particles of the madder. Others propose to diminish the proportion of tartar, and to employ only a seventh part. In conducting the process of dyeing with madder, the bath should not be brought to the boiling point; because at that temperature the fawn-coloured particles would be dissolved, and a different shade obtained from that which is desired. When the water is at that degree of temperature which the hand can bear, Hellot recommends the addition of half a pound of grape madder for every pound of wool to be dyed. It is then to be well stirred before the wool is introduced, which must remain for an hour without boiling, excepting for a few minutes towards the end of the process, that the combination of the colouring particles with the stuff may be more certain.

Proce

Rosir

Madder reds are sometimes rosed, as it is called, with archil and Brazil wood. In this way they become more beautiful and velvety; but this brightness is not permanent. But madder reds, even when they are most perfect, are far inferior to those obtained from lac and cochineal, and even to that produced by kermes; but as the expense of the materials is comparatively small, they are employed, as we have already observed, for coarse stuffs.

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Different authors recommend different proportions of madder. Poerner proposes to employ one third of the weight of the wool, while Scheffer limits the quantity to one fourth. In one process, Poerner added to the alum and tartar a quantity of solution of tin equal in weight to the tartar, and after two hours boiling allowed the cloth to remain in the bath, which had been left to cool for three or four days. He then dyed it in the usual way, and thus obtained a fine red. According to another process, he prepared the cloth by the common boiling, and dyed it in a bath slightly heated, with a larger proportion of madder, tartar, and solution of tin. The cloth remained twenty-four hours in the bath; and when it had become cold he put it into another bath, made with madder only, where it remained for twenty-four hours. By this process he got a fine red, somewhat brighter than the common, but inclining a little to yellow. Scheffer informs us that he obtained an orange-red by boiling wool with a solution of tin and one fourth of alum, and then by dyeing with one fourth of madder. A cherry colour is obtained, according to Bergman, by dyeing with one part of a solution of tin and two of madder, without previously boiling the wool. By exposure to the air this colour becomes deeper. By boiling the wool for two hours with one fourth of sulphate of iron, then washing it, and afterwards immersing it in cold water with one fourth of madder, and then boiling for an hour, the result is a coffee colour. But if the wool has not been soaked, and if it be dyed with one part of sulphate of iron and two of madder, the colour is a brown approaching to red.

Diffe t mord s.

When sulphate of copper is employed as the mordant, the madder dye yields a clear brown, inclining somewhat to yellow; and a similar colour may be produced by dyeing the wool, simply soaked in hot water, with one part of sulphate of copper and two of madder. But when this mordant and dyestuff are used in equal proportions, the yellow is somewhat more obscure, approaching to green; and in both these instances exposure to the air does not produce a darker colour. Berthollet informs us that he employed a solution of tin in various ways, both in the preparation and the application of the madder; and by the use of different solutions of tin, he found, that although the tint was somewhat brighter than what is obtained by the common process, it was always more inclined to yellow or fawn colour.

Scarl

Scarlet.—The finest and most splendid of all colours is scarlet. This, like other colours, is of various shades, according to the quality and proportion of the colouring matter employed. The scarlet dye is communicated to woollen stuffs by means of cochineal, the history and properties of which we have already detailed. The Mexicans, as appears from their history, employed alumina as the basis or mordant to fix the colour of cochineal; and previous to the discovery of the solution of tin, the use of the same substance seems to have prevailed in Europe. The fine colour obtained from the latter received, as we have already mentioned, different names in different places; as that of *bow dye* in England, *scarlet of the Gobelins* in France, and in Holland *Dutch scarlet.*

Process.

Boiling.

In the process for dyeing scarlet two operations are necessary. The first is denominated the boiling, and the second is distinguished by the name of finishing or reddening. The operation of boiling, which is the first part of the process, is conducted in the following manner:—For one hundred pounds of cloth, six pounds of pure tartar are added to the water, which is made pretty warm. The bath is then to be briskly stirred; and when the heat has increased a little more, half a pound of powdered cochineal is to be added, and the whole is then to be well mixed. The next moment five pounds of a very clear solution of tin are to be poured in and carefully mixed. When the bath begins to boil, the cloth is introduced, and briskly moved for two or three turns: after which it is moved more slowly. The boiling having continued for two hours, the cloth is taken out, exposed to the air, and carried to the river to be well washed.

Reddening.

In the preparation of the second bath, which is for the reddening, the boiler is to be emptied, and when the bath has just reached the boiling point, five pounds and three quarters of cochineal, previously powdered and sifted, are to be added. These are to be carefully mixed; and after having ceased stirring, when a crust has formed on the surface, and opened of itself in several places, thirteen or fourteen pounds of solution of tin are poured in. Should the bath during the boiling rise above the edge of the boiler, it may be cooled with a little cold water. This solution being well mixed, the cloth is put in, and two or three times quickly turned. It is then boiled in the bath for an hour, taking care to keep it under the surface. It is afterwards taken out, exposed to the air, and, when it has cooled, washed in the river and dried.

Proportion of ingredients.

There are no determinate proportions of cochineal and solution of tin in either of these operations. Hellot informs us that some dyers employ two thirds of solution of tin and one fourth of cochineal in the boiling or first operation, and the other one third of the solution of tin with the remaining three fourths of the cochineal in the second operation, or the reddening. He adds farther, that the use of tartar gives a greater degree of permanency to the colour, provided the proportion do not exceed one half the weight of the cochineal employed. According to Berthollet, several dyers at present adopt this practice. Tartar, he observes, promotes the solution of the colouring matter; and this effect is greater when it is ground with the cochineal, after which it is found that the residuum is more completely exhausted. But this consideration is of inferior consequence when the operations are successively performed, because any colouring matter that may remain in the residuum is employed in the next operation. It ought not, however, to be overlooked, that the tartar communicates to the colour a rosy hue.

Shorter process.

It is the practice of some dyers not to remove the cloth out of the boiling. They merely refresh it, and perform the operation of reddening in the same bath. When this is done, the infusion of cochineal, made in a separate vessel, and mixed with the proper proportion of solution of tin, is added. By conducting the process in this way the scarlet is supposed to be equally fine, and there is a considerable saving of time and fuel.

Brighter red.

To give scarlet the bright lively red, which, as it approaches to the colour of fire, has been distinguished by the name of *fiery scarlet*, a yellow tinge is communicated by boiling fustic in the first bath, or by adding a little turmeric to the cochineal. A larger proportion of the solution of tin also produces this yellow shade, but it renders the cloth harsh, and limits the action of the colouring matter. The use of fustic or turmeric, therefore, although the colour obtained from them is not permanent, is preferable to an excess of the solution of tin. When these substances are used, the inside of the cloth, when it is cut, appears yellow; but in the ordinary processes, the cochineal, it is found, does not penetrate the cloth, for when no other substance is employed the cloth is internally white.

Tin and copper boilers.

The use of tin boilers is recommended in dyeing scarlet. When copper boilers are employed, the acid acts on the metal, and thus forming a solution, injures the beauty of the colour. Tin boilers, however, are attended with several inconveniences. It is difficult to procure them of sufficient size, and they are apt to be melted by the incautious continuance of the fire after they have been emptied. In the use of copper boilers there are several necessary precautions. They must be kept very clean, the acid liquor should not be allowed to remain in them for any length of time, and some contrivance should be adopted to prevent the cloth from touching the metal, either by using a net or a wicker basket.

Different proportions of ingredients.

Different proportions of materials, we have observed, are recommended by different authors. For the boiling, Scheffer directs an ounce and a half of solution of tin, with an equal quantity of starch, and as much tartar, to every pound of cloth. The effect of the starch is to give more uniformity to the colour. When the water boils, a dram of cochineal is to be added; it is then to be well stirred, and after the wool is introduced, to be boiled for an hour, taken out, and washed. The proportions for the reddening bath, in which the wool is to be boiled half an hour, are half an ounce of starch, three fourths of an ounce of solution of tin, half an ounce of tartar, and seven drachms of cochineal. In Scheffer's process, it may be observed, the proportion of solution of tin is smaller than in that of Hellot, but the quantity of tin in the solution of the former is greater than in that of the latter.

Poerner's process.

Poerner has described three principal processes, according to the variety of the shade of the scarlet. He uses no cochineal in the boiling; the materials of which are one ounce and six drachms of tartar, and an equal weight of solution of tin, the latter being added after the tartar is dissolved, for every pound of cloth. As soon as the boiling has commenced, the cloth is introduced, and it is boiled for two hours. For the reddening of the first process he employs two drachms of tartar and one ounce of cochineal, adding gradually afterwards two ounces of solution of tin. For the reddening of the second process the same quantity of cochineal and solution of tin, without any tartar, is employed. In the reddening of the third process, two drachms of tartar with one ounce of solution of tin, one ounce of cochineal, and two ounces of common salt, are directed to be used. The colour produced in the first process has the deepest shade, that of the second is more lively, while that of the third is paler and brighter.

Different shades.

By the use of tartar in the reddening in different proportions, various shades of scarlet may be obtained. When it is employed, the shade is deeper and fuller; but when it is entirely omitted, the scarlet approaches to an orange colour. The shade of colour also is subject to considerable variety, from the different degrees of strength of the solution of tin. To ascertain this effect, Berthollet made a number of experiments. He found that a solution of tin, composed of sixteen parts of nitric acid, two of muriate of ammonia, and three of tin, produced a deeper shade than when the proportions of the acid and muriate of ammonia were equal, with only two parts of tin. The last proportions, he observes, succeeded best. Four parts of water were mixed with the solution. When the proportion of muriate of ammonia amounted only to half a part, the colour was brighter, and inclining to orange.

Use of common salt.

Common salt has the effect of increasing the brightness of scarlet, while it is also attended with the advantage of causing the colour to penetrate deeper into the cloth. It seems difficult to explain why common salt, which gives a deeper shade to the colour of the infusion of cochineal, and indeed produces a similar effect on colours in general, should diminish the intensity of the colour of scarlet. The proportion of common salt mentioned above is, according to Poerner, the greatest that can be employed. When less is used, the shade, though lighter, is more agreeable. By adding five ounces of white sugar to the ingredients of the second process, a fine colour, which is always lighter than that of the first process, will be obtained. The colour, it is said, is more permanent, and the shade more agreeable, when the cloth is left twenty-four hours in the boiler after it has cooled.

Method of using the lac dye.

For dyeing fine woollen cloth the lac dye is commonly used. It comes to the dyer in the state of a fine powder, having a brownish-red colour, inclining to violet. It contains much less colouring matter than cochineal, but is incomparably cheaper. To dye forty-three pounds of fine woollen cloth, six pounds of lac, three pounds of cream of tartar, and five pounds of tin mordant are put into a dyeing vessel, either of tin, or at least lined with tin, with a sufficient quantity of water. The whole is brought to the boiling temperature, and after it has boiled briskly a sufficient time to dissolve the colouring matter, the cloth is passed through it for about an hour, or till it has acquired the requisite depth of colour.

Tin mordant, how made.

The tin mordant used is made by dissolving two ounces of tin in thirty pounds of aquafortis mixed with one pound of muriatic acid. The solution is transparent, and it is kept in well-corked bottles for use. The tin is doubtless in the state of protochloride, though it sometimes also gets into the state of perchloride. Either state will answer, but in the second case the dyeing process is much slower, the cloth not seeming to imbibe the perchloride of tin so rapidly as the protochloride. From the above proportions, it is obvious that to dye forty-three pounds of woollen cloth scarlet, one third of an ounce of tin converted into protochloride is sufficient. This is rather less than 146 grains of tin; so that each pound of the woollen cloth combines with not more than 3·4 grains of tin. It is obvious from this that the particles of tin must be exceedingly minute indeed, otherwise 3·4 grains of tin could not be so minutely divided as to cover the surface of a pound weight of woollen cloth.

When the dyer wishes the scarlet to assume a brighter shade, he sometimes adds a little quercitron bark, which, by the yellow colour which it induces, adds materially to the brightness of the colour. This plan was first suggested by Dr Bancroft, and it has been since pretty generally acted on.

Dr Bancroft recommended the tin mordant to be prepared by dissolving tin in muriatic acid mixed with one fourth of its weight of sulphuric acid. This solution, he says, answers very well, and is much cheaper. We cannot find, however, that any of the dyers in this country follow that process. We can hardly think that the present method of using so much nitric and so little muriatic acid is a good one. The object being to obtain a protochloride of tin, one would think that muriatic acid would be a better vehicle. Tin dissolves in this acid very well, and the protochloride of tin formed in this way is easily obtained in crystals. But the tin mordant, as prepared by the dyers, contains a great excess of nitric acid; and we cannot avoid suspecting that this excess is connected with the shade of scarlet produced. The nitric acid doubtless renders a part of the colouring matter of the lac yellow, and thus changes the dark crimson colour natural to this dyestuff into scarlet.

Cochineal is still employed to a considerable extent in dyeing the finest kinds of woollen cloth scarlet. The process is precisely the same as when lac is employed, remembering only that cochineal is much richer in colouring matter than lac, and that therefore a smaller quantity will serve. Dr Bancroft introduced the method of putting the cochineal, the tin mordant, and the tartar into the dyeing vessel at once, and dissolving them all together in water before the cloth is passed through the liquid; and this method is pretty generally though not universally followed.

Dr Bancroft's method of using quercitron bark to supply the place of a portion of the cochineal, is likewise pretty generally followed. The price of cochineal, in consequence of the introduction of the lac dye, has sunk from thirty shillings the pound to about nine shillings and sixpence. This makes the saving not so considerable in point of expense as it was when Bancroft wrote, though even at present it is an important saving.

Diffe
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To produce different shades of scarlet, and the other colours which are derived from it, all that is necessary is to vary the proportions of cochineal, tartar, and solution of tin; and for the shades which incline most to yellow, the addition of quercitron bark or fustic is requisite. The use of the tartar is to deepen the colour, and the solution of tin produces a shade of orange. When the shade of colour required to be communicated to the stuff is light, the time of continuing the process must be shortened.[1]

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Crimson.—The processes which are employed to dye wool a crimson colour are two. The stuff is either dyed crimson at once, or the crimson shade is communicated to it after being previously dyed of a scarlet colour. To dye crimson by a single process, a solution of two ounces and a half of alum and an ounce and a half of tartar for every pound of stuff, is employed for the boiling, and the stuff is afterwards to be dyed with an ounce of cochineal. It is usual also to employ solution of tin, but in smaller proportion than for dyeing scarlet. The processes employed, it is scarcely necessary to observe, must vary according as the shade wanted is deeper or lighter, or more or less distant from scarlet. Common salt is also employed by some in the boiling. To render the crimson deeper, and to give it more bloom, archil and potash are frequently used; but this bloom, it ought to be observed, is extremely fugacious. By adding tartar and alum, the boiling for crimson is sometimes prepared after a scarlet reddening; and it is said that the colour possesses more bloom when both the boiling and reddening are made after scarlet, than when the crimson is dyed in a fresh bath prepared on purpose. In dyeing these colours the wild cochineal may be employed; but as it contains a smaller proportion of colouring matter, the quantity must be greater.

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Different substances, as the alkalies, alum, and earthy salts in general, convert the colour of scarlet to crimson, which is the natural colour of cochineal. To effect this, the stuff previously dyed scarlet is boiled for an hour in a

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[1] Berthollet, ii. 194.

Siple Cours.

solution of alum, the strength of which is to be regulated by the depth of shade required. In conducting this process, it is necessary to observe, that water impregnated with earthy salts has a considerable effect in varying the shade, so that the quantity of alum employed must be proportioned to the purity of the water. Hellot tried soap, soda, potash, and some other substances, and although they produced the crimson, yet it was of a deeper shade, and had less lustre, than what was produced by means of alum. Ammonia produced a good effect, but, from its great volatility, a considerable proportion must be put into the bath, moderately heated, with a little sal ammoniac, and an equal quantity of potash. By this process the stuff became of a bright rosy colour, and thus rendered a smaller quantity of cochineal necessary. Poerner directs the stuff, previously dyed scarlet, to remain twenty-four hours in a cold solution of sal ammoniac and potash.

Hagrain crimon, &c.

To produce crimsons, as well as scarlets, in half grain, madder is to be substituted for half the quantity of the cochineal; or in other proportions, according to the shade desired. The same boiling is given as for scarlet in grain, and the other parts of the process are to be conducted as for reddening the scarlet or crimson. Even the common madder red assumes a greater degree of lustre when the boiling is made after the reddening for scarlet.

At present we are not aware that kermes is ever employed by the dyers in this country. The use of this dye-stuff seems to have been completely superseded by cochineal and lac dyes. Certainly the colour given by kermes is not so fine as that given by these substances, but it has the advantage of being exceedingly durable.

III.—*Method of dyeing Silk Red.*

Dient prosses wit mad- der

Madder Red.—The colour which is obtained from madder does not possess sufficient brightness for dyeing silk. We shall here, however, describe some of the processes which are employed for this purpose. That of De la Folie is the following: Half a pound of alum is to be dissolved in each quart of hot water, and two ounces of potash are afterwards to be added. When the effervescence has ceased, and the liquor has become clear, the silk must be kept in it for two hours, after which it is to be washed and put into the madder-bath. The silk which is dyed in this way becomes more beautiful by means of the soap proof. The process of Scheffer is somewhat different. For each pound of scoured silk he directs a solution of four ounces of alum and six drachms of chalk to be prepared. When the sediment has formed, the solution is to be decanted, and having become quite cold, the silk is immersed in it, and left for eighteen hours. It is then taken out and dried, and afterwards dyed with an equal weight of madder. The colour thus obtained is of a dark shade. Mr Guhliche describes another process. For every pound of silk he proposes a bath of four ounces of alum and one ounce of solution of tin. When the liquor has become clear it is decanted, and the silk carefully soaked in it for twelve hours, after which it is to be immersed in a bath with half a pound of madder softened by boiling with an infusion of galls in white wine. The bath is to be kept moderately hot for an hour, and then made to boil for two minutes. The silk, being taken from the bath, is to be washed in a stream of water, and dried in the sun. The colour thus obtained is very permanent. By leaving out the galls it is clearer. The brightness of the first colour may be considerably increased by passing the stuff through a bath of Brazil wood, to which one ounce of solution of tin is added. In this way the colour becomes extremely beautiful and durable.

Pros with ra- zil od.

Silk is sometimes dyed with Brazil wood, and the colour thus obtained has been distinguished by the name of *false crimson*, to distinguish it from the more durable colour which is produced by cochineal. The silk, after being boiled with soap, is to be alumed. It is then to be refreshed at the river, and dipped in a bath more or less charged with Brazil juice, according to the depth of shade required. If pure water be employed, the colour will be too red for crimson; but to remedy this, the stuff may be passed through a weak alkaline solution, or a little alkali may be added to the bath, or the stuff may be washed in hard water till it has acquired the proper shade. To deepen the shade of false crimsons or dark reds, the solution of logwood is added to the Brazil bath, the silk being previously impregnated with the latter; or a little alkali may be added, according to the shade required.

Simple Colours.

With cochineal.

The crimson produced by cochineal is called *grain crimson*, to distinguish it from false crimson. The silk, being well cleansed from the soap at the river, is to be immersed in alum liquor of the full strength, and to remain for a night. It is then to be washed and twice beetled at the river. The bath is prepared by filling a long boiler two thirds with water, to which are added, when it boils, from half an ounce to two ounces of powdered white galls for every pound of silk. When it has boiled for a few moments, from two to three ounces of cochineal, also powdered and sifted, for every pound of silk, are put in, and afterwards one ounce of tartar to every pound of cochineal. When the tartar is dissolved, one ounce of solution of tin is added for every ounce of tartar. In the preparation of this solution of tin, the following proportions are recommended by Macquer. For every pound of nitric acid two ounces of sal ammoniac, six ounces of fine grain tin, and twelve ounces of water, are employed. When these ingredients are mixed together, the boiler is to be filled up with cold water; and the proportion of the bath for every pound of silk is about eight or ten quarts of water. In this the silk is immediately immersed and turned on the winch till it appear to be of a uniform colour. The fire is then increased, and the bath is kept boiling for two hours, taking care to turn the silk occasionally. The fire is afterwards put out, and the silk put into the bath, where it is allowed to remain for a few hours longer. It is then taken out, washed at the river, twice beetled, wrung, and dried. Two processes are recommended by Scheffer and Macquer. In that of the former, a greater proportion of cochineal is employed in the dye-bath; but in that of the latter, a yellow ground is previously communicated to the silk. The colour which is thus obtained resists the action of soap, and is more durable than that which is produced by means of carthamus.

Poppy red.

To obtain other shades of red, the above processes must be varied. If, after the silk has been wrung out of the solution of tin, it is steeped for a night in a cold solution of alum, in the proportion of one ounce to a quart of water, wrung, and dried, then washed and boiled with cochineal, it will only appear of a pale poppy colour; but a fine poppy red may be produced by steeping it twelve hours in the solution of tin, diluted with eight parts of water, then left all night in the solution of alum, washed, dried, and passed through the two baths of cochineal, taking care to add to the second bath a small quantity of sulphuric acid. The same colour may be produced by dyeing the silk previously with anotta, and then passing it successively through a number of baths prepared with an alkaline solution of carthamus, to which lemon juice has been added, till it acquire a fine cherry-colour. To brighten the colour, the silk, after being dyed, may be immersed in hot water acidulated with lemon juice.

Cherry red, &c.

Other shades of red, as a cherry red, and flesh red, are also produced by carthamus. For a cherry red it is not necessary that the stuff be previously dyed with anotta, and the proportion of colouring matter is smaller. A flesh-red colour is obtained by adding a little soap to the bath, which has the effect of softening the colour, and of retarding the action of the colouring matter on the stuff. To produce dark shades, it is sometimes usual to mix archil, and by this means the expense is diminished.

Scarlet.

Those who have produced a colour on silk which comes nearest to scarlet, Berthollet observes, begin with dyeing the silk crimson. It is then dyed with carthamus, and lastly it is dyed yellow without heat. By this process a fine colour is obtained; but the dye of the carthamus is not permanent, as it is destroyed by the action of the air, and the colour becomes deeper. The following is Dr Bancroft's process. In a solution of murio-sulphate of tin, diluted with five times its weight of water, the silk is to be soaked for two hours; and after being taken out, it is to be wrung and partially dried. It is then to be dyed in a bath prepared with four parts of cochineal and three of quercitron bark. In this way a colour approaching to scarlet is obtained. To give the colour more body, the immersion may be repeated both in the solution of tin and in the dyeing bath; and the brightness of the scarlet is increased by means of the addition of carthamus. A lively rose colour is produced by omitting the quercitron bark, and dyeing the silk with cochineal only; and by adding a large proportion of water to the cochineal, a yellow shade is obtained, which changes the cochineal to the compound scarlet colour.[1]

Rose colour.

IV.—*Method of dyeing Cotton and Linen Red.*

The dyestuff usually employed to give a red colour to cotton and linen is madder. It is easier to dye cotton than linen; but as the processes are the same for each, one general description will apply to both. There are two kinds of madder red; the one is called *simple* madder red, and the other, which was originally invented in the Levant, is distinguished in this country by the name of *Turkey red.* This last constitutes by far the brightest and most beautiful and permanent red which is communicated to cotton; we shall therefore proceed to give a somewhat particular account of the process.

The method was first put in practice in Glasgow about forty years ago, by M. Papillon, a French gentleman, who established a Turkey-red dye-work along with Mr Mackintosh. He made an agreement with the commissioners and trustees for manufactures in Scotland, that the process was to be by them published for the benefit of the public at the end of a certain term of years. The period agreed upon having expired in 1803, the trustees laid a minute account of the different processes before the public. Since that period Turkey-red dyeing has been conducted in Glasgow upon a very extensive scale. Different individuals, possessed of both chemical skill and considerable sagacity, have studied the different parts of this very complicated method of dyeing. The effects of each individual operation have been carefully investigated, and the whole has been somewhat shortened and simplified, though it still constitutes the most complicated process in the whole art of dyeing. The Turkey-red dye is practised by a considerable number of persons in Glasgow; but the oldest, and perhaps the most extensive establishment, is that of Henry Monteath and Company at Rutherglen Bridge. The character of that house has been long established, and the beauty of their Turkey-red dye is known and appreciated in every part of the globe where British manufactures are known. From Glasgow the Turkey-red dye has gradually made its way into Lancashire.

Cotton cloth which is to receive the Turkey-red dye is never bleached beforehand; because it has been found that the first parts of the processes succeed better with unbleached than with bleached cloth.

The steep

1. The first step of the dyer is to remove the weaver's dressing. This is done by steeping the cloth in a weak alkaline ley. To this the technical name of the *rot steep* is given. From four to five pounds of caustic potash are generally employed for every 100 lbs. of cotton cloth. The temperature of the solution is from 100° to 120°, and the cloth is kept in the steep for twenty-four hours, and then well washed.[2]

2. From seven to ten pounds of carbonate of soda are dissolved in a sufficient quantity of water to keep the cloth (supposed always to weigh 100 lbs.) wet. In this ley the cloth, previously deprived of the weaver's dressing, is boiled for some time.

The steep

3. The process which we are now going to describe is the one upon which the goodness of the Turkey-red dye depends more than upon any of the others. Without it the dye cannot be produced upon new cloth; but when cloth which has been frequently washed with soap is to be dyed (an old cotton shirt, for example), this process may be omitted altogether. It is evident from this that soap communicates to cotton cloth the same properties as the process which we are now going to describe.

A liquor is composed of the following ingredients:

1 gallon of gallipoli oil,
1½ gallon of soft sheep dung,
4 gallons of solution of carbonate of soda, of the specific gravity 1·06,
1 gallon of solution of pearl ash, of the specific gravity 1·04,

mixed with a sufficient quantity of cold water to make up twenty-two gallons. The specific gravity of this liquor should be from 1·020 to 1·025.

This liquor has a milk-white appearance, and is in fact a kind of incipient soap. It is put into a large wooden open cylindrical vessel, called the *liquor tub* (see Plate CCVI. fig. 1 and 2), and is kept continually in a state of agitation by a kind of wooden levers, driven round in it by machinery put in motion by the steam-engine. This liquor is conveyed by a tin pipe to the *padding machine*, which is situated in an apartment below. Several sections of this machine are given in the same plate, fig. 3, 4, and 5. A kind of trough in this machine is kept always full of the milky liquor, and the pieces of cloth to be dyed are made to pass through this liquid, and are thoroughly soaked with it.

By this process the cloth is impregnated with the soapy matter, and the longer this matter is left undisturbed on the cloth, the better does it take the dye. Fourteen days is the least period that this impregnation is allowed to remain.

The sheep dung gives the cloth a dark-green colour, and is found materially to assist the bleaching which the cloth afterwards undergoes. This bleaching goes on much more rapidly with than without the sheep dung, especially when the cloth is exposed on the grass between the different operations. In what way the sheep dung contributes to this acceleration has not been determined, but the fact is certain.[3]

4. When the weather is favourable, the cloth, after be-

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[1] *Philosophy of Permanent Colours*, 312.

[2] In general the alkaline ley of No. 9 is worked up in this process, and when this is done less potash is required.

[3] No advantage has been found to result from using the alkalies caustic in this process; and a mixture of potash and soda answers much better than soda alone.

ing impregnated with the oleaginous liquor, is spread upon the grass to dry. But should the weather be rainy, as it would not do to allow the oleaginous liquid to be washed out by the rain, the goods are dried in the stove.

5. After the cloth has been dried in the stove, it is a second time impregnated with the oleaginous liquid described in No. 3, by means of the padding machine. It is then spread on the grass for some hours if the weather be favourable, and ultimately dried in the stove.

The impregnation with the oleaginous liquor, the exposure on the grass, and the stove drying, are repeated a third time. When the weather is rainy, which prevents exposure on the grass, and obliges the workmen to dry the cloth at once in the stove, the impregnation with the oleaginous liquor is sometimes repeated a fourth time.

Upon the sides of the tubs in which the oleaginous liquor is kept, a white solid crust gradually accumulates. This matter being examined, was found to consist almost entirely of phosphate of lime. It was doubtless derived from the sheep dung with which the saponaceous liquid was mixed.

6. The next process is to steep the cloth in a weak solution of pearl ash, of the specific gravity 1·0075 to 1·01, heated to the temperature of 120°. From this liquor it is wrung out and again dried.

7. A mixture is now made of the following substances:

1 gallon gallipoli oil,
3 gallons soda ley of specific gravity 1·06,
1 gallon caustic potash ley of specific gravity 1·04,

diluted with as much water as will make up the whole to twenty-two gallons. In this liquid, which is milky, like the preceding, and which contains an imperfect soap, the cloth used formerly to be tramped with the hand, and then wrung out. It is now soaked with the liquid by means of the padding machine, in the manner described under No. 3.

If the weather be fine, the cloth thus impregnated with the soap is exposed on the grass. It is then dried in the stove.

8. The above process (No. 7) is repeated thrice; and after each soaking in the saponaceous liquor, the cloth is exposed on the grass for some hours, and then dried in the stove.

9. The cloth, thus so many times soaked in the saponaceous liquor, is now steeped in a mixed ley of pearl ash and soda of the specific gravity from 1·01 to 1·0125, heated to the temperature of 120°. After being taken out of the steep, and allowed to drain for a few hours (taking care to preserve the liquor), the cloth is well washed. The object of this process is to remove any superfluous oil with which the cloth may be impregnated, the object being that all the oil adhering to the cloth should be in combination with an alkali. About half the alkali used in this process disappears during the steeping. The remaining liquor, which is about half as strong as at first, is reserved for future use. The cloth thus washed clean is dried in the stove.

T gall- in

10. The preceding washing is necessary for the success of the next operation, called the *galling;* for the nutgall liquor will not be imbibed by the cloth unless it be thoroughly freed from all uncombined oil, which would give it a greasy feel. If the first steeping in alkali and washing has not fully accomplished this necessary object, they ought to be repeated.

For the galling, eighteen pounds of Aleppo galls are to be boiled for four or five hours in twenty-five gallons of water till it is reduced to about twenty gallons; and the liquid being now passed through a sieve, is sufficient for impregnating 100 lbs. of cloth with the requisite quantity of nutgalls. Of late years, sumach from Sicily has been substituted for nutgalls, thirty-three lbs. of sumach being considered as equivalent to eighteen lbs. of nutgalls. Sometimes a mixture of nine lbs. nutgalls and sixteen and a half lbs. of sumach is employed.

Through this decoction the cloth is either tramped by the hand, or it is passed and soaked in it by means of the padding machine. The temperature of the decoction should be from 80° to 100°. It is unnecessary to steep the cloth in the gall liquor; a complete soaking is all that is necessary. The cloth, thus soaked in a decoction of fustic, comes out dyed yellow, a colour which serves to improve the madder red by rendering it more lively.

The aluming.

11. The next process is to fix the alumina mordant upon the cloth. This step is essential, because without it the madder dye would not remain fixed in the cloth, but would be easily washed out. Accordingly the depth of the shade of red depends entirely upon the quantity of alumina fixed on the cotton. In a preceding part of this article we have stated the quantity of alumina fixed by this process upon the surface of a square yard of cloth.

In this country common alum is usually employed; but in many parts of the Continent they use acetate of alumina. The high price of that article prevents its employment in Britain. Acetate of alumina, however, is made in this country by the chemical manufacturers, and largely used by the calico-printers. It is made by mixing acetate of lime (obtained by saturating the acetic acid formed when wood is distilled with lime) with a solution of alum, and afterwards drawing off the clear liquor; or by mixing acetate of lead with solution of alum, though that process is more expensive.

Alum (as has been explained under the article ALUM) is a double salt, composed of

3 atoms sulphate of alumina,
1 atom sulphate of potash,
25 atoms water.

To form the alum liquor used by the Turkey-red dyers: To a solution of alum in water of the specific gravity 1·04 as much pearl ash, soda, or chalk is added as is sufficient to precipitate the alumina contained in the alum. Through this muddy liquor, which should have a temperature of from 100° to 120°, the cloth is passed and steeped for twelve hours. The alumina, in the state of extreme division which it has when thus newly precipitated, is readily imbibed by the cloth, and unites with the fibres of the cotton.

12. The cloth thus united to alumina is stove dried, and then washed out of the alum liquor.

13. These essential preliminary steps having been taken, the cloth is ready for being dyed.

The dyeing.

From one to three lbs. of madder reduced to the state of powder for every pound of cloth is employed, the quantity depending upon the shade of colour wanted. The cloth is entered into the boiler when the water is cold. It is brought to boil in one hour, and the boiling is continued for two hours. During the whole of this time the cloth is passed through the dyeing liquor by means of the winch.

For every twenty-five lbs. of cloth dyed, one gallon of bullock's blood is added. This is the quantity of cloth dyed at once in a boiler. This addition of blood is indispensable for obtaining a fine red colour. Various attempts have been made to dispense with the use of blood in Turkey-red dyeing, but hitherto they have been unsuccessful. No satisfactory explanation of the way in which the blood acts has been given. For our own parts, we are disposed to consider the colouring matter of the blood as the useful ingredient. It is probably fixed upon the cloth to a certain extent, and by its fine scarlet tint it is obvious that it must improve the colour of madder red.

14. After the cloth has been thus dyed, it was formerly customary to steep it in a solution the same as that described in No. 7. This was called the *cuing* process. It is now generally dispensed with, and is unnecessary if the cloth has been well cleaned before the galling process. The object of it is merely to dissolve any greasy matter which may continue attached to the cloth, and to form a soap with it, which assists in the subsequent process.

The clearing.

15. Madder contains two colouring matters, a brown and a red. Both are fixed upon the cloth by the dyeing process. The consequence is, that the cloth has a dirty brownish-red colour, which is any thing but agreeable. Fortunately the brown colouring matter is not nearly so *fixed* upon the cloth as the red colouring matter. The next process, called the *clearing process*, is to get rid of the brown colouring matter. For this purpose the cloth is boiled from twelve to fourteen hours, in a mixture of five pounds of soda, eight pounds of soap, and sixteen to eighteen gallons of the residual liquor of No. 9, with a sufficient quantity of water. These quantities are supposed to be employed to clear a hundred pounds of cloth. By this process the brown colouring matter is almost wholly removed, and the cloth begins to assume the fine tint which distinguishes Turkey-red dyed cloth.

16. The next process serves not merely to remove the brown colouring matter more completely, but also to improve the shade of red. Five or six pounds of soap, and from sixteen to eighteen ounces of protochloride of tin, in crystals, are dissolved in water, in a globular boiler, into which the cloth is put. The boiler is then covered with a lid which fits close; and the boiling is conducted under the pressure of two atmospheres, or at the temperature of 250½°. The boiler is furnished with a safety valve and a small conical pipe, the extremity of which has an aperture about $\frac{5}{16}$ths of an inch in diameter, from which there issues a constant stream of steam during the operation. We have given a section and elevation of this boiler in Plate CCVII. fig. 8 and 9, and in fig. 10 a plan of its top, and in fig. 11 of its lid. The use of the salt of tin is to give a shade of scarlet to the cloth. The oxide of tin seems to combine with the oleaginous acid of the soap, and this insoluble soap unites with the red colouring matter of the madder fixed upon the cloth, and improves the shade of colour.

17. After these processes, the cloth is spread out on the grass and exposed to the sun for a few days, which finishes the clearing. It is seldom that recourse is had to a bleaching liquor, consisting of a solution of chloride of lime in water, especially when a salt of lime is used in the cleaning process. When this method is employed, however, one gallon of the solution of chloride of lime, of the specific gravity 1·015, is mixed with twenty gallons of pure water. The cloth is immersed in this dilute solution from five to ten minutes, which is sufficient for completing the clearing.

Remarks on the processes.

Such are the different steps in fixing this beautiful and permanent colour, as practised in the principal works in Glasgow. Many attempts have been made to shorten these tedious processes, but hitherto these attempts have been unsuccessful. The impregnation with oil, or rather with soap, is essential, as is evident from this, that if one, two, or three of these operations be omitted, the red is inferior in proportion to the number of omissions.

Cloth bleached by chloride of lime does not produce a good red. Probably the fibres of the cotton wool are combined with lime, or rather sulphate of lime, which, by decomposing the oleaginous soap, prevents it from being deposited upon and combining with the cloth. But cloth bleached by the old process, namely, boiling in ley or soap, and exposing to the action of the sun, answers perfectly, and will produce as good a red as when unbleached cloth is used; but there would result no saving from bleaching the cloth in this way before commencing the impregnation with the oleaginous soap, because the bleaching is effected betwixt the oil operations by exposing the cloth on the grass.

The colour would be as good without the galls or sumach as with them. But there would be considerable difficulty in sufficiently impregnating the cloth with the solution of alum without its being previously passed through the gall decoction, and more particularly if the cloth be in the least degree greasy. The use of the galls, then, is to facilitate the fixation of the alumina upon the cloth.

Alumina is essential to the fixation of the colour; for without it the madder dye would be fugitive, and would disappear whenever the cloth was washed. The subsequent *clearing* operations would completely remove both the colouring matters of the madder, unless it were cleared along with a quantity of cloth that had received alumina, and been dyed a deep red. In that case the unalumed cloth will receive a little alumina from the alumed portion. This will serve to fix the colour; but as the quantity of alumina which in such a case is imbibed is very small, the red colour will be very pale. It is in this way that the two shades of red, the deep and the pale, which are often seen upon garments and furniture dyed Turkey red, are given. These two shades, by their contrast, frequently add considerably to the beauty of the pattern. The fustic, as well as the tin, probably serves to render the red colour more lively by the shade of yellow which they superinduce.

The three essential processes in the Turkey-red dyeing are, the impregnation with oleaginous soap, the impregnation with alumina, and the dyeing with madder. The last communicates the colour, the second fixes the colour, and the first gives beauty to the colour.

For the better understanding of the Turkey-red processes, we have got drawings made of the principal machinery used.

Fig. 1 and 2, Plate CCVI., exhibit a section and plan of the *liquor tub*, in which the mixture of oil and alkali is put, with its agitators to prevent the oil from separating and swimming on the surface. From the liquor tub (which is placed in an upper room) the liquor passes by a tin pipe to the padding machine, represented in various ways in figs. 3, 4, and 5.

It consists essentially of a box for holding the liquor, through which the cloth passes; and afterwards it goes between two rollers, the distance between which regulates the quantity of liquor which the cloth retains.

a, is the lapper for folding the cloth.

b, a compound lever for regulating the pressure.

c, the box for containing the liquor.

d, a frame or *scrae* for laying the cloth on before it passes through the liquor.

e, pulleys for moving the lapper; and

f, the cylinders between which the cloth passes. They regulate, by their distance from each other, the quantity of liquor allowed to remain in the cloth.

Figs. 6 and 7 represent the elevation and plan of a *dyeing box* on the latest and most improved construction.

a, the winch for moving the cloth through the liquor while dyeing.

b, steam pipe for supplying the vessel with steam.

c, *c*, *c*, the dotted part, represents the valves through which the steam enters into the vessel.

d, *d*, *d*, *d*, divisions of the vessel for different pieces of cloth.

e, catch for stopping or setting on the winch at pleasure.

f, valve for regulating the quantity of steam admitted.

Figs. 8 and 9 represent a section and elevation of the clearing boiler. Fig. 10 represents exactly the mouth of this boiler, and fig. 11 the lid or cover. On the upper edge of this cover there is fixed all round a layer of hemp (a piece of flat rope). The lid is slipt into the inside of the boiler, and by the piece of rope it attaches itself exactly to the inside. The elasticity of the steam within presses it firmly against the inside rim of the mouth, and renders it quite steam-tight.

Scar t with ochi- neal

The scarlet colour communicated to cotton by means of cochineal is far from being permanent; but if this colour is wished to be communicated to cotton, Dr Bancroft recommends to steep the cotton, previously moistened, for half an hour, in a diluted solution of murio-sulphate of tin, and then having wrung the cotton, to plunge it into water in which as much potash has been dissolved as will neutralize the acid adhering to the cotton, so that the oxide of tin may be more copiously fixed on the fibres of the cotton. The stuff being afterwards rinsed in water, may be dyed with cochineal and quercitron bark, in the proportion of four pounds of the former to two and a half or three pounds of the latter. A full bright colour is thus given to the cotton, which will bear slight washings with soap, and exposure to the air. Indeed the yellow part of the colour derived from quercitron bark will bear long boiling with soap, and will resist the action of acids.

Cri on.

With the aluminous mordant, as it is usually applied by calico-printers for madder reds, cotton dyed with cochineal receives a beautiful crimson colour, which will bear several washings, and resist the weather for some time. It is not, however, to be considered as a fixed colour. Dr Bancroft is of opinion that the addition of a small portion of cochineal in dyeing madder reds upon the finer cottons, would be highly advantageous to the calico-printers. By this addition the madder reds are rendered more beautiful, and the fawn colour, or brownish-yellow hue, which injures these colours, would be thus overcome.[1]

SECT. II.—*Of Yellow.*

All the yellow dyes, as well as the red, require a mordant to fix them on the cloth; and the usual mordant employed is alumina. As in the last section, we shall in the first place give an account of the dyestuffs usually employed for giving a yellow colour to cloth, and then give a sketch of the methods employed for giving a yellow colour to wool, silk, cotton, and linen.

I.—*Description of the Dyestuffs.*

The principal colouring matters used in dyeing yellow are *weld*, *fustic*, *catechu*, *anotta*, and *quercitron*. We shall give a short account of these dyestuffs in succession.

Sub nces emp ed in d ng yell Wel

1. *Weld*, in French *gaud* or *vaud*, is the dried leaves and stems of the *reseda luteola*, a plant which grows wild in Britain, and in different European countries. Its leaves are long, narrow, and of a bright green, but the whole plant is made use of in the dyeing of yellow. There are two kinds of weld, cultivated and wild, the former of which is deemed more valuable than the latter, as it yields a much greater proportion of colouring matter. When this plant is fully ripe, it is pulled, dried, and bound up in bundles for the use of the dyer. The wild species grows higher and has a stronger stalk than that which is cultivated, by which the one may be readily distinguished from the other.

A decoction of this plant, if strong, has a brownish-yellow colour, and when diluted with water, it acquires a shade of green. The acids render this colour more pale, while alkalies, common salt, and sal ammoniac, render it deeper; and when sufficient quantities of these substances are dissolved in the decoction, a deep-yellow precipitate falls. A solution of alum or of protochloride of tin throws down a fine yellow lake; sulphate of iron occasions a black precipitate, and sulphate of copper a brownish-green precipitate.

Luteolin.

Chevreul has discovered in weld a yellow colouring matter, to which he has given the name of *luteolin*. It may be sublimed, and in that case it crystallizes in needles, which are transparent, and have a pale-yellow colour. Luteolin dissolves in water, but the solution has little colour; yet silk or woollen previously impregnated with alumina, if passed through it, acquires a fine yellow colour. It is soluble in alcohol and ether. It combines with acids, but still more readily with bases. The compound which it forms with potash has a golden-yellow colour; but when exposed to the air it assumes first a shade of green, and then passes into brown. The compounds of luteolin with the other bases are easily obtained by double decomposition.

The yellow colour communicated by weld is more permanent than that communicated by quercitron or by old fustic.

Fustic.

2. *Fustic*[2] is the name given by the dyers in Great Britain to the wood of the *morus tinctoria*, a tree which grows in the West Indies, and probably also in South America. In France it is distinguished by the name of *bois jaune*. The wood is yellow, as its name imports, with orange veins. Ever since the discovery of America it has been used in dyeing, as appears from a paper in the Transactions of the Royal Society, of which Sir William Petty was the author. Its price is moderate, the colour it imparts is permanent, and it readily combines with indigo, which properties give it a claim to attention as a valuable ingredient in dyeing. Before it can be employed as a dyestuff, it must be cut into chips and put into a bag, that it may not fix in, and tear the stuff, to which it is to impart its colouring matter.

Properties.

When a decoction of yellow wood or fustic is made very strong, the colour is of a reddish yellow, and when diluted it is of an orange yellow, which it readily yields to water. It becomes turbid by means of acids, its colour is of a pale yellow, and the greenish precipitate may be re-dissolved by alkalies. The sulphates of zinc, iron, and copper, as well as alum, throw down precipitates composed of the colouring matter and the different bases of the salts employed.

Morin.

Chevreul discovered in fustic a yellow uncrystallizable colouring matter, to which he has given the name of *morin*. It restores the colour of turmeric paper reddened by lime. It is but little soluble in water, even when boiling hot. Alcohol is a better solvent of it than water, and ether still better than alcohol. When the alcoholic or ether solutions are evaporated, they deposite yellow crystals. The aqueous solution is rendered muddy by gelatine. The solutions of the fixed alkalies and alkaline earths give the aqueous solution a fine yellow colour, without occasioning any precipitate. Alum causes it to assume a greenish-yellow colour. The sulphated peroxide of iron renders it green, and then throws down a precipitate. Concentrated sulphuric acid increases the intensity of the yellow colour, while nitric acid gives it a reddish shade, and renders it muddy. Boiling nitric acid converts it into oxalic acid. By combining with oxygen it seems to assume a red colour. Morin, when distilled, yields a liquid, which crystallizes as it cools, and furnishes a number of yellowish-brown needles. According to the experiments of George, boiling water extracts from fustic 0·15, and alcohol 0·09 of matter; and the wood is composed of

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[1] *Philosophy of Permanent Colours*, 317.

[2] The origin of the word *fustic* is not very well understood. The French applied the term *Fustet* to the *rhus cotinus* or *Venice sumach*, which yields fugitive and bad yellow. Bancroft supposes that *fustic* is merely a corruption of the word *fustet*. When the morus tinctoria was introduced, about a couple of centuries ago, being the wood of a large tree, it was called *old fustic*, while the rhus cotinus, being only a shrub, was called *young fustic*. Rhus cotinus being now hardly used by dyers, the term fustic has been assigned to the wood of the morus tinctoria.

Lignin	74
Morin	9·1
Tannin	4
Gum	2
Resin	9
	98·1

3. *Catechu*, or *terra japonica*, comes from the East Indies, and is the inspissated decoction of certain plants containing tannin, but principally of the *areka nut*, the wood of *mimosa catechu*, the leaves of the *nauclea catechu*. Areka nuts, cut into small pieces, are sprinkled in an earthen vessel with water holding saltpetre in solution. A portion of the bark of kantai-babela (a species of mimosa) is added. The vessel is closed by a lid luted down with clay, that the temperature may be the higher. After an ebullition of two hours, the fire is gradually diminished during five or six hours. When the vessel is cold the areka nuts are taken out, and the decoction is evaporated down to the consistency of a syrup. It is then kneaded into small balls, and left to dry in the shade.

Constituents.

The principal constituents of catechu are tannin and extractive. The former may be thrown down by gelatine, the latter remains in solution. It has a reddish-brown colour and a sweetish taste. In India catechu is employed in dyeing and calico-printing. The colours which it gives are very various, depending upon the nature of the mordants employed along with it; but they are all very fixed. With verdigris and sal ammoniac the colour is brown; with protochloride of tin yellow; with perchloride of tin a brown, or, if nitrate of copper be added, a deep bronze; with nitrate of alumina a copper red; with nitrate of iron a deep brownish gray.

We are not aware that catechu is employed in this country, either by the dyers or calico-printers; but it is entitled to their attention, both on account of its cheapness, and the permanency and variety of the colours which it gives.

4. *Anotta*, in French *rocou*, is a species of paste of a red colour, obtained from the berries of the *bixa orellana*, Lin. which is a native of America. The anotta of commerce is imported from America to Europe in cakes of two or three pounds weight, where it is prepared from the seeds of the tree mentioned above; but the Americans are said to be in possession of a species of anotta superior to that which they export, both for the brilliancy and permanency of the colour it imparts. They bruise the seeds with their hands moistened with oil, separating with a knife the paste as it is formed, and drying it in the sun; but the seeds are pounded with water when designed for sale, and allowed to undergo the process of fermentation.

According to John, the cakes of anotta are composed of twenty-eight parts of resin mixed with colouring matter, twenty parts of coloured extractive, twenty-six of gum, and twenty of lignin, mixed with an acid and an aromatic substance.

The colouring matter of anotta is but little soluble in water, though it communicates a yellow colour to that liquid. It is more soluble in alcohol, and tinges it orange. Ether dissolves it still better, and assumes also an orange colour. We obtain the colouring matter in a sufficiently pure state by evaporating the alcoholic solution to dryness, treating the residue with ether, and finally distilling off the ether. It is a reddish-brown substance, heavier than water, soft and adhesive. Even when exposed to a very low temperature, it does not become brittle. When heated it melts, and when sufficiently heated in an open vessel it takes fire and burns like a resin.

Its c ur. ing m ter.

We may likewise obtain the colouring matter of anotta by digesting it in a caustic alkaline solution, and then saturating the alkali by an acid. The colouring matter precipitates in orange flocks. Concentrated sulphuric acid gives anotta an indigo-blue colour; but in contact with air this colour soon passes into green, and then into violet brown. Cold nitric acid does not alter the colour of anotta but if the quantity of acid be small, the mixture assumes the consistence of a syrup, and detonates when slightly heated, leaving charcoal. Anotta gives an orange-red colour to oils, both fixed and volatile.

According to Chevreul, anotta contains two different colouring matters, the one yellow and the other red. The yellow colouring matter is soluble in water and alcohol, and slightly in ether; the red colouring matter is scarcely soluble in water, but it dissolves in alcohol and ether, communicating to these liquids an orange-red colour.

Anotta yields an orange precipitate with a solution of alum, and the sulphates of copper and iron produce effects of nearly a similar nature. With a solution of tin the precipitate is of a lemon colour, and slowly deposited.

It is employed both for dyeing silk and cotton, but the colours which it yields have little permanency.

Quei ron bark.

5. *Quercitron bark.*—Quercitron, as it is denominated by Dr Bancroft, is the *quercus nigra* of Linnæus, and is a large tree which grows spontaneously in North America. The bark of it yields a considerable quantity of colouring matter, which was first discovered by Dr Bancroft in the year 1784, in whom the use and application of it in dyeing were exclusively vested for a certain term of years by virtue of an act of parliament. To prepare it for use, the epidermis is taken off and pounded in a mill, the result of which process is a number of filaments and a fine light powder; but as these do not contain equal quantities of colouring matter, it will be proper to employ them in their natural proportions.

Quercitron bark contains a good deal of tannin, and a yellow colouring matter capable of being extracted by water. The aqueous solution, when evaporated to dryness, leaves a quantity of extract, amounting to eight per cent. of the weight of the bark employed. The tannin is that variety which forms a green precipitate with oxide of iron. Its presence is injurious to the beauty of the yellow colour, because it is precipitated by the same re-agents as the colouring matter itself, and of course communicates to it a shade of brown. To free the colouring matter from tannin, ox bladder steeped in water, and deprived of every thing soluble in cold water, is introduced into the quercitron infusion. With this substance the tannin gradually unites, and thus is removed from the solution. It may be thrown down also by a solution of gelatine.

When the infusion of quercitron is gently concentrated, the colouring matter is deposited in crystals, which have a pearly lustre as long as they continue suspended in the liquid. To this colouring matter Chevreul has given the name of *quercitrin*. It restores the yellow colour of turmeric paper reddened by an alkali. It is but little soluble in ether, more soluble in alcohol, and still more soluble in water. The aqueous solution is tinged orange by alkalies. The acetates of lead and copper, and the protochloride of tin, throw it down in yellow flocks. The sulphated peroxide of iron gives it an olive-green colour, and then precipitates it. Sulphuric acid dissolves quercitrin, the solution is orange with a shade of green, and is rendered muddy when mixed with water. When quercitrin is subjected to distillation, it yields, among other products, a liquid which speedily deposites yellow crystals possessing the characters of quercitrin.

Other substances.

Besides the substances already mentioned as employed in the dyeing of yellow, we may add saw-wort to the number (*serratula tinctoria*, Lin.), a plant which yields a colouring matter nearly similar to that of weld, and may of consequence be used as a proper substitute. Dyers' broom (*genista tinctoria*) produces a yellow of very indifferent nature, and is therefore only employed in dyeing stuffs of the coarsest kind. Tumeric (*curcuma longa*) is a native production both of the East and West Indies, and yields a more copious quantity of colouring matter than any other yellow dyestuff; but it will probably never be of any essential service in dyeing yellow, as no mordant has yet been discovered capable of giving permanency to its colour.

Chamomile (*anthemis tinctoria*) yields a faint yellow colour, the hue of which is not unpleasant, but is far from being durable, and even mordants are not capable of fixing it. Sulphate of lime, tartar, and alum, bid fairest for success.

Fenugreck (*trigonella fœnugræcum*) yields seeds which, when ground, communicate to stuffs a pale yellow of tolerable durability; and the best mordants are found to be alum and muriate of soda, or common salt. American hiccory (*juglans alba*) is a tree, the bark of which yields a colouring matter in every respect resembling that of the *quercus nigra*, but in quantity greatly inferior. French berries (*rhamnus infectorius*) produce a tolerable yellow colour, but it is by no means permanent. When used in the process of dyeing, they are to be employed in the same manner as weld. According to Scheffer, a fine yellow colour may be imparted to silk, thread, and wool, by means of the leaves of the willow; but Bergman informs us that only the leaves of the sweet willow (*salix pentandra*) are proper for producing a permanent colour, as a few weeks' exposure to the sun extracts that which is produced by the colouring matter from the leaves of the common willow.

In Switzerland and in England the seeds of purple trefoil are sometimes employed in the art of dyeing, on which Vogler made a number of experiments, in order to ascertain what colours they would produce; and he found that a fine deep yellow was afforded by a bath made of a solution of these seeds with potash; that sulphuric acid yielded a light yellow, and sulphate of copper or blue vitriol a yellow inclining to green. M. Dizé informs us that the seeds of trefoil impart to wool a beautiful orange, and to silk a greenish yellow; and that while aluming is necessary in the process of dyeing with the seeds of trefoil, a solution of tin cannot be employed.

Many other vegetable substances are occasionally employed in dyeing yellow, but it seems useless to enumerate them. Saffron and turmeric yield exceedingly beautiful but fugitive yellows. The colouring matter of saffron (*crocus sativus*) is extremely rich; it has been subjected to a chemical examination, and distinguished by the name of *polychroite* by Bouillon La Grange and Vogler, to whom we are indebted for the first examination of it.

The finest and most fixed of all the yellows on cotton is chromate of lead. It is employed abundantly by the calico-printers, but scarcely by the dyers in general. On that account we think it better to reserve it till we come to that part of this article in which we propose to describe the processes followed by the calico-printers.

II.—*Of the Processes for dyeing Wool Yellow.*

With weld.

In dyeing woollen stuffs with weld, the mordants employed are alum and tartar, and by their means a pure, permanent yellow is obtained. The boiling is to be conducted in the usual way; and, according to Hellot, four ounces of alum to one ounce of tartar are to be employed. Other dyers, however, employ half as much tartar as alum. The colour is rendered paler, but more lively, by means of the tartar.

Preparation of the bath.

The bath is prepared by boiling the plant inclosed in a thin linen bag, and keeping it from rising by means of a wooden cross. Some boil it till it sinks to the bottom of the vessel; while others, after it is boiled, take it out and throw it away. From three to four pounds of weld, and sometimes less, are allowed for every pound of stuff; but the quantity must be regulated by the intensity of the shade desired. Some dyers add a small quantity of quicklime and ashes, which are found to promote the extraction of the colouring matter. These substances at the same time heighten the colour, but render it less susceptible of resisting the action of acids.

For different shades.

With other additions, and different management, different shades may be obtained. Thus lighter shades are produced by dyeing after deeper ones, adding water at each dipping, and keeping the bath at the boiling temperature. These shades, however, are less lively than when fresh baths are employed, with a suitable proportion of weld. The addition of common salt or sulphate of lime to the weld bath communicates a richer and deeper colour. With alum it is paler and more lively, with tartar still paler, and with sulphate of iron the shade inclines to brown. According to Scheffer, by boiling the stuff two hours, with one fourth of its weight of a solution of tin, and the same proportion of tartar, and then washing and boiling it with an equal weight of weld, a fine yellow is produced; but if the stuff be in the state of cloth, its internal texture is not penetrated. Poerner recommends a similar preparation as for dyeing scarlet, and by these means the colour is brighter, more permanent, and lighter.

With quercitron bark.

Dr Bancroft recommends the quercitron bark as one of the cheapest and best substances for dyeing wool yellow. The following is the simple process which he has proposed for its application. The bark is to be boiled up with about its weight, or one third more, of alum, in a suitable proportion of water, for about ten minutes. The stuff previously scoured is then to be immersed in the bath, taking care to give the higher colours first, and afterwards the paler straw colours. By this cheap and expeditious process, colours which are not wanted to be of a full or bright yellow may be obtained. The colour may be considerably heightened by passing the unrinsed stuff a few times through hot water, to which a little clean powdered chalk, in the proportion of about a pound and a half for each 100 lbs. of stuff, has been previously added. The bark, when used in dyeing, being first reduced to powder, should be tied up in a thin linen bag, and suspended in the liquor, so that it may be occasionally moved through it, to diffuse the colouring matter more equally.

Process for permanent colours.

But although the above method possesses the advantages of cheapness and expedition, and is fully sufficient for communicating pale yellows; to obtain fuller and more permanent colours, the common mode of preparation, by previously applying the aluminous mordant, ought to be preferred. The stuff, therefore, should be boiled for about one hour or one hour and a quarter, with one sixth or one eighth of its weight of alum dissolved in a proper proportion of water. The stuff is then to be immersed, without being rinsed, into the dyeing bath, with clean hot water, and about the same quantity of powdered bark tied up in a bag as that of the alum employed in the preparation. The stuff is then to be turned as usual through the boiling liquor, until the colour appears to have acquired sufficient intensity. One pound of clean powdered chalk for every 100 lbs. of stuff is then to be mixed with the dyeing bath, and the operation continued for eight or ten minutes longer. This addition of the chalk raises and brightens the colour.

For different shades.

Orange Yellow.—To communicate a beautiful orange yellow to woollen stuffs, ten lbs. of quercitron bark, tied up in a bag, for every 100 lbs. of stuff, are to be put into the bath with hot water. At the end of six or eight minutes, an equal weight of murio-sulphate of tin is to be added, and the mixture well stirred for two or three minutes. The cloth, previously scoured, and completely wetted, is then immersed in the dyeing liquor, and briskly turned for a few minutes. By this process the colouring matter fixes on the cloth so quickly and equally, that after the liquor begins to boil, the highest yellow may be produced in less than fifteen minutes.

High shades of yellow, somewhat similar to those obtained from quercitron bark by the above process, are frequently given with young fustic (*rhus cotinus*, Lin.), and dyers' spirit, or nitro-muriate of tin; but this colour is much less beautiful and permanent, while it is more expensive, than what is obtained from the bark.

Bright Golden Yellow.—This colour is produced by employing ten pounds of bark for every 100 pounds of cloth, the bark being first boiled a few minutes, and then adding seven or eight pounds of murio-sulphate of tin, with about five pounds of alum. The cloth is to be dyed in the same manner as in the process for the orange yellow.

Bright yellows of less body are produced by employing a smaller proportion of bark, as well as by diminishing the quantity of murio-sulphate of tin and alum. And indeed every variety of shade of pure bright yellow may be given by varying the proportions of the ingredients.

For greenish yellow.

To produce the lively delicate green shade, which, for certain purposes, is greatly admired, the addition of tartar, with the other ingredients, only is necessary, and the tartar must be added in different proportions, according to the shade which is wanted. For a full bright yellow, delicately inclining to the greenish tinge, it will be proper to employ eight pounds of bark, six of murio-sulphate of tin, with six of alum, and four of tartar. An additional proportion of alum and tartar renders the yellow more delicate, and inclines it more to the green shade; but when this lively green shade is wanted in the greatest perfection, the ingredients must be used in equal proportions. The delicate green lemon yellows are seldom required to have much fulness or body. Ten pounds of bark, therefore, with an equal quantity of the other ingredients, are sufficient to dye three or four hundred pounds of stuffs.[1]

For pale green yellow.

To produce the exquisitely delicate and beautiful pale green shades, the surest method, Dr Bancroft observes, is to boil the bark with a small proportion of water, in a separate tin vessel, for six or eight minutes, and then to add the murio-sulphate of tin, alum, and tartar, and to boil them together for about fifteen minutes. A small quantity of this yellow liquor is then to be put into a dyeing vessel which has been previously supplied with water sufficiently heated. The mixture being properly stirred, the dyeing process is to be conducted in the usual way, and the yellow liquor, as it is wanted, gradually added from the first vessel. In this way the most delicate shades of lively green lemon yellows are dyed with ease and certainty. Weld is the only dyestuff from which similar shades of colour can be obtained; but it is four times more expensive. The yellows dyed from quercitron bark, Dr Bancroft adds, with murio-sulphate of tin and alum as mordants, do not exceed the expense of one penny for each pound of stuff, besides a considerable saving of time, labour, and fuel.[2]

Verd used tarta

A greenish shade may also be produced without tartar, by substituting verdigris dissolved in vinegar, along with the bark; but it is neither so permanent, nor so bright and delicate, as that produced by means of tartar. Sulphate of indigo also, in very small proportion, communicates a similar shade when it is employed with the bark, murio-sulphate of tin, and alum; but it is apt to take unequally on the stuff, and besides, in the language of the dyers, the colour has a tendency to *cast* or *fly* in the finishing.

Cochi andm empl

Small proportions of cochineal, employed along with the bark and other ingredients, raise the colour to a beautiful orange, and even to an aurora. Madder may be also employed with the same view, for it heightens the yellow obtained from quercitron bark, although the colour thus obtained is inferior in beauty to that from cochineal. The madder may also be employed with weld for the same purpose.[3]

Colou from citron very ble.

The colours obtained from quercitron bark, by the processes which we have now described, are very durable. They resist the action of the air, of soap, and of acids. It is by the effects of alum, but especially of tartar, that these colours become so fixed as to remain permanent by exposure to the air. It is observed of the highest yellows, even when they approach to the orange, and which are best dyed either with muriate or murio-sulphate of tin and bark, that although they resist the action of soap and acids, they are apt to lose their lustre and become brown by the effect of the sun and air; but this also happens to yellows dyed with nitro-muriate of tin, both with the bark and with weld, but in a still greater degree with other yellow vegetable colouring matters. In some of these this defect is less easily obviated by alum and tartar, than it is in the yellow obtained from weld and quercitron bark.[4]

III.—*Of the Processes for dyeing Silk Yellow.*

With

To dye silk a plain yellow colour, the only ingredient which was formerly employed was weld. The following is the process. The silk being previously scoured in the proportion of twenty pounds of soap to the hundred of stuff, and then alumed, and washed after the aluming, or, as it is called, *refreshed*, the bath is prepared with two pounds of weld for every pound of silk; and having boiled for fifteen minutes, it is to be passed into a vat through a sieve or cloth. When the temperature is such as the hand can bear, the silk is introduced and turned until it has acquired a uniform colour. While this operation is going on, the weld is to be boiled a second time in fresh water; one half of the first bath is taken out, and its place supplied with a fresh decoction. The temperature of the fresh bath may be a little higher than the former; but it is necessary to guard against too great a degree of heat, that the colouring matter already fixed may not be dissolved. The stuff is to be turned as before, and afterwards taken out of the bath. A quantity of soda is to be dissolved in a part of the second decoction, and a larger or smaller proportion of this solution is to be added to the bath, according to the intensity of the shade required. When the silk has been turned a few times, a skain is wrung out, that it may be examined whether the colour be sufficiently full, and have the proper golden shade. To render the colour deeper, and to give it the gold cast, an addition of the alkaline solution is to be made to the bath, and to be repeated till the shade has acquired sufficient intensity. The alkaline solution may also be added along with the second decoction of the weld, observing the precaution that the temperature of the bath be never too great.

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[1] Bancroft, 330.

[2] *Ibid.* 333.

[3] *Ibid.* 355.

[4] *Ibid.* 334.

For deeper colour.

For other shades.

To produce other shades of yellow, having more of a gold or jonquille colour, a quantity of anotta, proportioned to the shade required, is to be added to the bath along with the alkali. Lighter shades of yellow, such as pale lemon or Canary bird colour, are obtained by previously whitening the silk, and regulating the proportion of ingredients in the bath by the shade required. To communicate a yellow having a tinge of green, a little indigo is added to the bath, if the silk has not been previously azured. To prevent the intensity of the shade from being too great, the silk may be more slightly alumed than usual.

A cheaper process.

But, according to Dr Bancroft, the different shades of yellow obtained from weld may be given to silk with equal facility and beauty, and at a cheaper rate, by employing quercitron bark as a substitute. A quantity of bark powdered and enclosed in a bag, in proportion to the shade of colour wanted, as from one to two pounds for every twelve pounds of silk, is put into the dyeing vat while the water is cold. Heat is then applied; and when it has become rather more than blood warm, or of the temperature of 100°, the silk, having previously undergone the aluming process, is to be immersed and dyed in the usual way. If a deep shade is wanted, a small quantity of chalk or pearl-ashes may be added towards the end of the operation. To produce a more lively yellow, a small proportion of murio-sulphate of tin may be employed; but it should be cautiously used, as it is apt to diminish the lustre of the silk. To produce such a shade, the proportions of the ingredients may be four pounds of bark, three of alum, and two of murio-sulphate of tin. These are to be boiled with a proper quantity of water for ten or fifteen minutes; and the temperature of the liquid being so much reduced as the hand can bear it, the silk is immersed and dyed as usual, till it has acquired the proper colour. Care should be taken to keep the liquor constantly agitated, that the colouring matter may be equally diffused.[1]

For an orange colour.

To dye silk of an aurora or orange colour, after being properly scoured, it may be immersed in an alkaline solution of anotta, the strength of which is to be regulated by the shade required; and the temperature of the bath should be between tepid and boiling water. When the desired shade has been obtained, the silks are to be washed and twice beetled, to free them from the superfluous colouring matter, which would injure the beauty of the colour. When raw silk is to be dyed, that which is naturally white should be selected, and the bath should be nearly cold; for otherwise the alkali, by dissolving the gum of the silk, destroys its elasticity. Silk is dyed of an orange shade with anotta; but the stuffs must be reddened with vinegar, alum, or lemon juice. The acid, by saturating the alkali employed to dissolve the anotta, destroys the yellow shade produced by the alkali, and restores its natural colour, which inclines to a red. But although beautiful colours are obtained by this process, they do not possess any great degree of permanency.

Yellow dye from mushrooms.

Several kinds of mushrooms afford lively and durable yellow dyes. A bright shining dye of this description has been extracted from the *boletus hirsutus*, which commonly grows on walnut and apple trees. The colouring matter is contained both in the tubular part, and also in the parenchyma of the body of the mushroom. To extract the colouring matter, it is pounded in a mortar, and the liquor which is thus obtained is boiled for a quarter of an hour in water. An ounce of liquor is sufficient to communicate colouring matter to six pounds of water. After the liquor has been strained, the stuff to be dyed is immersed in it, and boiled for fifteen minutes. When silk is subjected to this process, after being dyed, it is made to pass through a bath of soft soap, by which it acquires a shining golden yellow colour, which has a near resemblance to the yellow of the silk employed to imitate embroidery in gold. This has been hitherto brought from China, and bears a very high price, the method of dyeing it being unknown in Europe. All kinds of stuff receive this colour; but it is less bright on linen and cotton, and seems to have the strongest affinity for silk. The use of mordants, it is supposed, would modify and improve it greatly.[2]

IV.—*Of the Processes for dyeing Cotton and Linen Yellow.*

Processes with weld.

The process which has been usually followed in dyeing cotton and linen yellow, is by scouring it in a bath prepared in a ley with the ashes of green wood. It is afterwards washed, dried, and alumed, with one fourth of its weight of alum. After twenty-four hours it is taken out of the aluming and dried, but without being washed. The cotton is then dyed in a weld bath, in the proportion of one pound and a quarter of weld for each pound of cotton, and turned in the bath till it has acquired the proper colour. After being taken out of the bath, it is soaked for an hour and a half in a solution of blue vitriol (sulphate of copper), in the proportion of one fourth of the weight of the cotton, and then immersed, without washing, for nearly an hour in a boiling solution of white soap, after which it is well washed and dried.

For a deeper yellow,

A deeper yellow is communicated to cotton by omitting the process of aluming, and employing two pounds and a half of weld for each pound of cotton. To this is added a dram of verdigris, mixed with part of the bath. The cotton is then to be dipped and worked till the colour become uniform It is then taken out of the bath, that a little solution of soda may be added, after which it is returned and kept for fifteen minutes. It is then wrung out and dried.

and other shades.

Other shades of yellow may be obtained by varying the proportion of ingredients. Thus a lemon colour is dyed by using only one pound of weld for every pound of cotton, and by diminishing the proportion of verdigris, or using alum as a substitute.[3]

Cheaper and more permanent colours.

But a better method, as it affords more permanent and more beautiful colours, and at a smaller expense, is recommended by Dr Bancroft. This is by the use of quercitron bark, and the calico-printers' aluminous mordant, or the sugar of lead. The following is the process which he proposes to employ for producing bright and durable yellow colours. One pound of sugar of lead and three pounds of alum are to be dissolved in a sufficient quantity of warm water. The cotton or linen, after being properly rinsed, is to be soaked in this mixture, heated to the temperature of 100°, for two hours. It is then taken out, moderately pressed over a vessel, to prevent the waste of the aluminous liquor. It is then dried in a stove heat, and after being again soaked in the aluminous solution, it is wrung out and dried a second time. Without being rinsed, it is to be barely wetted with lime water, and afterwards dried; and if a full, bright, and durable yellow is wanted, it may be necessary to soak the stuff in the diluted aluminous mordant, and, after drying, to wet it a second time with lime water. After it has been soaked for the last time, it should be well rinsed in clean water, to separate the loose particles of the mordant, which might injure the application of the colouring matter. By the use of the lime-water, a greater proportion of alumina combines with the stuff, besides the addition of a certain proportion of lime.

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[1] Bancroft, 345.

[2] *Philosophical Magazine*, vol. 100.

[3] Berthollet, ii. 267.

Dyeing bath.

In the preparation of the dyeing bath, from twelve to eighteen pounds of powdered quercitron bark are inclosed in a bag for every hundred pounds of the stuff, varying the proportion according to the intensity of the shade desired. The bark is put into the water while it is cold; and immediately after, the stuff is immersed and agitated or turned for an hour or an hour and a half, during which the water should be gradually heated, and the temperature raised to about 120°. At the end of this time the heat is increased, and the dyeing liquor brought to a boiling temperature; but at this temperature the stuff must remain in it only for a few minutes, because otherwise the yellow assumes a brownish shade. The stuff having thus acquired a sufficient colour, is taken out, rinsed, and dried.

Advantage of a diluted mordant.

Dr Bancroft observes, that when the aluminous mordant is employed without the addition of water, one soaking only, and an immersion in lime water, may be sufficient; but he thinks that greater advantage is derived from the application of a more diluted mordant at two different times, or even by the immersion of the stuff a greater number of times, alternately in the diluted aluminous mordant, and lime water, and drying it after each immersion. By this treatment he found that the colour always acquired more body and durability.

Nankeen yellow.

Chaptal has proposed a process for communicating to cotton a nankeen yellow, which, at the same time that it affords a durable colour, has the advantage of being cheap and simple. When cotton is immersed in a solution of any salt of iron, it has so strong an affinity for the oxide, that it decomposes the salt, combines with the iron, and assumes a yellow colour. The process recommended by Chaptal is the following: The cotton to be dyed is put into a cold solution of copperas (sulphate of iron), of the specific gravity 1·02. It is afterwards wrung out, and immediately immersed in a ley of potash of the specific gravity 1·01. This ley must have been previously saturated with a solution of alum. When the stuff has been kept for four or five hours in this bath, it may be taken out, washed, and dried. By varying the proportion of sulphate of iron, every variety of shade of nankeen yellow may be obtained.

By another process.

We shall lay before our readers another process for dyeing nankeen colour, which is proposed and followed by Mr Brewer, a practical dyer. It is as follows:—

"Mix as much sheep's dung in clear water as will make it appear of the colour of grass; and dissolve in clear water one pound of best white soap for every ten pounds of cotton yarn, or in that proportion for a greater or lesser quantity.

"Observe:—The tubs, boards, and poles, that are used in the following preparations must be made of deal; the boiling pan of either iron or copper.

First operation.—"Pour the soap liquor prepared as above into the boiling pan; strain the dung liquor through a sieve; add as much thereof to the soap liquor in the pan as will be sufficient to boil the yarn intended to be dyed, for five hours. When the liquors are well mixed in the pan, enter the yarn, light the fire under the pan, and bring the liquor to boil in about two hours, observing to increase the heat regularly during that period. Continue it boiling for three hours; then take the yarn out of the pan, wash it, wring it, and hang it in a shed on poles to dry. When dry, take it into a stove or other room where there is a fire; let it hang there until it be thoroughly dry.

N. B.—"The cotton yarn, when in the shed, should not be exposed either to the rain or sun. If it is, it will be unequally coloured when dyed.

Second operation.—"In this operation use only one half of the soap that was used in the last, and as much dung liquor (strained as before directed) as will be sufficient to cover the cotton yarn, when in the pan, about two inches. When these liquors are well mixed in the pan, enter the yarn, light the fire, and bring the liquor to boil in about one hour; then take the yarn out, wring it out without washing, and hang it to dry, as in the former operation.

Third operation.—"This operation the same as the second in every respect.

Fourth operation.—"For every ten pounds of yarn make a clear ley from half a pound of pot or pearl ashes. Pour the ley into the boiling pan, and add as much clear water as will be sufficient to boil the yarn for two hours; then enter the yarn, light the fire, and bring it to boil in about an hour. Continue it boiling about an hour, then take the yarn out, wash it very well in clear water, wring it, and hang it to dry, as in former operations.

N. B.—"This operation is to cleanse the yarn from any oleaginous matter that may remain in it after boiling in the soap and dung liquors.

Fifth operation.—"To every gallon of iron liquor[1] add half a pound of ruddle or red chalk (the last the best) well pulverized.

"Mix them well together, and let the liquor stand four hours, in order that the heavy particles may subside; then pour the clear liquor into the boiling-pan, and bring it to such a degree of heat as a person can well bear his hand in; divide the yarn into small parcels, about five hanks in each; soak each parcel or handful very well in the above liquor, wring it, and lay it down on a clean deal board. When all the yarn is handed through the liquor, the last handful must be taken up and soaked in the liquor a second time, and every other handful in succession, till the whole is gone through; then lay the yarn down in a tub, wherein there must be put a sufficient quantity of ley, made from pot or pearl ashes, as will cover it about six inches. Let it lie in this state about two hours, then hand it over in the ley, wring it, and lay it down on a clean board. If it does not appear sufficiently deep in colour, this operation must be repeated till it has acquired a sufficient degree of darkness of colour. This done, it must be hung to dry, as in former operations.

N. B.—"Any degree of red or yellow hue may be given to the yarn, by increasing or diminishing the quantity of ruddle or red chalk.

Sixth operation.—"For every ten pounds of yarn make a ley from half a pound of pot or pearl ashes; pour the clear ley into the boiling pan; add a sufficient quantity of water thereto, that will cover the yarn about four inches; light the fire, and enter the yarn when the liquor is a little warm; observe to keep it constantly under the liquor for two hours; increase the heat regularly till it come to a scald; then take the yarn out, wash it, and hang it to dry, as in former operations.

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[1] Iron liquor is what the linen-printers use.

Seventh operation.—"Make a sour liquor of oil of vitriol and water. The degree of acidity may be a little less than the juice of lemons; lay the yarn in it for about an hour, then take it out, wash it very well, and wring it; give it a second washing and wringing, and lay it upon a board.

N. B.—"This operation is to dissolve the metallic particles, and remove the ferruginous matter that remains on the surface of the thread after the fifth operation.

Eighth operation.—"For every ten pounds of yarn dissolve one pound of best white soap in clear water, and add as much water to this liquor in your boiling-pan as will be sufficient to boil the yarn for two hours. When these liquors are well mixed, light the fire, enter the yarn, and bring the liquor to boil in about an hour. Continue it boiling slowly an hour; take it out, wash it in clear water very well, and hang it to dry, as in former operations. When dry, it is ready for the weaver.

N. B.—"It appears to me, from experiments that I have made, that less than four operations in the preparation of the yarn will not be sufficient to cleanse the pores of the fibres of the cotton, and render the colour permanent."[1]

Pro s foll d in the st.

A method of giving a very fixed yellow to cotton and linen is practised in the East. It is precisely similar to the plan followed in dyeing Turkey red. The cloth is first impregnated with the oleaginous soap. It is then passed through a decoction of nutgalls, or of some substance containing tannin. The aluminous mordant is then applied. After all these preliminary steps have been accomplished, the cloth is dyed in the usual way with quercitron bark. These complicated processes being precisely similar to those followed by the Turkey-red dyers, we refer the reader for particulars to the fourth division of the first section of the present chapter.

Such processes, however, are unnecessary in this country, because as permanent and beautiful a colour can be given at once to cotton by impregnating it with acetate or nitrate of lead, and then passing the cloth through a solution of bichromate of potash.

SECT. III.—*Of Blue.*

We shall follow the same method in giving an account of the blue dye, as we did when giving an account of the red and yellow dyes; that is to say, we shall first notice the dyestuffs, and then describe the processes followed by the dyers.

I.—*Description of the Dyestuffs.*

The only dyestuff used for giving a blue colour to cloth is *indigo*, a blue pigment obtained from various species of plants. The most common plant yielding indigo is the *Indigofera*, of which there are three species, the *tinctoria*, the *disperma*, and the *argentea*. The *nerium tinctorium*, or rose bay, a tree which is a native of India, also yields it. The method of procuring indigo from these plants, the nature and properties of indigo, and its composition, have been detailed in the article CHEMISTRY in this Encyclopædia, to which therefore we refer the reader.

Co itu- ent f in- dig

Mr Crum has shown that the atomic constituents of indigo are,

16 atoms carbon	12
4 atoms hydrogen	0·5
1 atom azote	1·75
2 atoms oxygen	2
	16·25

Indigo in its perfect state is insoluble in water and alcohol, and has not the property of combining with bases. But when deprived of one atom of oxygen, it assumes a yellow colour, and in that state is capable of combining with lime or potash, and doubtless with other bases, and of forming with them compounds which dissolve in water. When cloth to be dyed is dipt into the indigo vat, rendered soluble by being deprived of an atom of oxygen, and united to a base, it comes out stained yellow. But the basis of the indigo begins immediately to attract oxygen from the atmosphere, and to resume its blue colour. This causes the cloth speedily to become *green* by the mixture of yellow and blue, and finally to assume a deep-blue colour. No mordant is necessary, as there is a strong affinity between indigo and the fibres of the cloth.

Cerulin.

When indigo is digested in concentrated sulphuric acid it undergoes a remarkable change, being converted into a peculiar blue substance, with which the Saxon blue is dyed. To this substance Mr Crum, to whom we are indebted for the first accurate examination of it, has given the name of *cerulin.* Mr Crum has shown that it is a compound of one integrant particle of indigo, and four integrant particles of water.

The mixture of cerulin with sulphuric acid is semifluid, which requires a considerable quantity of water to dissolve it. When potash is added to this solution, a deep-blue precipitate falls, which is a compound of sulphate of potash and cerulin. To this compound Mr Crum has given the name of cerulio-sulphate of potash. All the neutral salts have the property of combining with cerulin, and of precipitating it from its aqueous solution.

Phenicin.

Mr Crum discovered that if the action of sulphuric acid on indigo be stopped at a certain point, a new substance is formed, different from cerulin. To this new substance he gave the name of *phenicin.* It may be obtained by the following process: Digest indigo in sulphuric acid diluted with thrice its weight of water. By this process the indigo is deprived of the greater part of its impurities. Mix one part of this purified indigo with seven or eight parts of concentrated sulphuric acid in a stoppered phial, and agitate the mixture occasionally till it becomes of a bottle-green colour. Then mix it with a large quantity of distilled water, and throw it upon a filter. By continuing to wash the filter, the liquid, which at first passes through colourless, becomes more and more blue, and after some time all the indigo which has been changed passes through. The colourless washings must be thrown away. The blue liquid contains the phenicin in solution, which on the addition of chloride of potassium precipitates of a most beautiful reddish-purple colour, exactly similar to the colour of the vapour of indigo. Its solution is of a fine blue colour like cerulin, but when a neutral salt is added it is precipitated of a fine purple colour. Hence the origin of the term *phenicin.*[2] Mr Crum has shown that it is a compound of one integrant particle of indigo and two integrant particles of water.

Indigo is not confined to plants growing within the torrid zone. The *isatis tinctoria* and *isatis lusitanica*, plants which are cultivated in England and France, yield, when treated in the same way with the leaves of the indigofera, a little indigo; but the quantity is too small to make it worth while to employ these plants for the preparation of this valuable dyestuff. But those plants under the names of *pastel* or *woad* were formerly employed for dyeing blue in all parts of Europe; and it was to prevent any supposed injury to the cultivators of woad that the employment of indigo in dyeing was prohibited in Queen Elizabeth's time in England. The limitations of the use of indigo in France and Saxony were owing to the same cause. So little at that time were the first principles of political economy understood by the rulers of the different kingdoms of Europe.

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[1] *Edinburgh Magazine*, xxii.

[2] From *φοινιξ, purple.*

Woad is still used by the dyers in some of their processes, but merely for the purpose of de-oxidyzing indigo, and thus rendering it soluble in water.

II.—*Methods of dyeing Wool Blue.*

Preparation of the vat.

The preparation for dyeing blue is made in a large wooden vessel or vat, which should be so constructed as to retain the heat, which is a matter of considerable importance in the process. The vat is therefore set up in a separate place from the coppers, and is sunk so far in the ground as to be only breast-high above it. Before the introduction of indigo, blue was dyed with woad, which furnished a permanent but not a deep colour; but a very rich blue is obtained by mixing indigo with the woad, and these are almost the only substances which are now employed for dyeing woollen stuffs. The proportions of these substances are varied by different dyers, and according to the shade which is required. The following is the account of the preparation of a vat, as it is given by Quatremere. Into a vat of about seven and a half feet deep, and five and a half in diameter, are thrown two balls of pastel or woad, which are previously broken, and together amount to about 400 pounds weight; thirty pounds of weld are boiled in a copper for three hours in a sufficient quantity of water to fill the vat. To this decoction are added twenty pounds of madder and a basket full of bran. The boiling is then continued half an hour longer. This bath is cooled with twenty buckets of water, and after it is settled, and the weld taken out, it is poured into the vat, which must be stirred with a rake all the time that it is running in, and for fifteen minutes longer. The vat is then covered up very hot, and allowed to stand for six hours, when it is uncovered, and raked again for thirty minutes. The same operation must be repeated every three hours. When the appearance of blue streaks is perceived on the surface of the vat, eight or nine pounds of quicklime are added; the colour then becomes of a deeper blue, and the vat exhales more pungent vapours. Immediately after the lime, or along with it, the indigo, which has been previously ground in a mill, with the smallest possible quantity of water, is put into the vat. The quantity is to be regulated by the intensity of the shade required. From ten to thirty pounds may be put into a vat such as we have now described. If on striking the vat with a rake a fine blue scum arises, no other previous preparation is required than to stir it with the rake twice in the space of six hours, to mix the ingredients completely. Great care should be taken not to expose the vat to the air, except during the time of stirring it. When that operation is finished, it is covered with a wooden lid, on which are spread thick cloths, to retain the heat as much as possible; but after all these precautions, at the end of eight or ten days it is greatly diminished, and is at last entirely dissipated, so that the liquor must be again heated, by pouring the greater part of the liquor of the vat into a copper under which a large fire is made. When the liquor has acquired a sufficient temperature, it is returned into the vat, and carefully covered up.

Accidents to which the vat is liable.

Vats of this description are sometimes liable to accidents. A vat is said to be repelled when, having previously afforded fine shades of blue, it appears black, without any blue streaks; and if it be stirred, the black colour becomes deeper; the vat at the same time exhales, instead of a sweetish smell, a pungent odour; and the stuff dyed in a vat in this state comes out of a dirty gray colour. These effects are ascribed to an excess of lime.

Different means are employed to recover a repelled vat. Some are satisfied with merely reheating it, while others add tartar, bran, urine, or madder. Hellot recommends bran and madder as the best remedy. If the excess of lime be not very great, it is sufficient to leave it at rest five or six hours, putting in a quantity of bran and three or four pounds of madder, which are to be sprinkled on the surface, and then it is to be covered up, and after a certain interval to be tried again. But if the vat has been so far repelled as to afford a blue only when it is cold, it must be left at rest to recover, and sometimes must remain whole days without being stirred with the rake. When it begins to afford a tolerable pattern, the bath must be reheated. In general this revives the fermentation. The addition of bran or madder, or a basket or two of fresh woad, produces the same effect.

This vat sometimes runs into the putrefactive process. When this happens, the colour of the vat becomes reddish, the paste rises from the bottom, and a fetid smell is exhaled. This accident is owing to a deficiency of lime, and it must be corrected by adding a fresh quantity. The vat is then to be raked; after two hours more lime is added, and the process of raking again performed. These operations are to be repeated till the vat is recovered.

Nothing requires more attention in treating a vat of this kind than the distribution of the lime, the principal use of which is to moderate the tendency to putrefaction, and to limit the fermentation to that degree which is necessary to deprive the indigo of its oxygen. If too much lime be added, the necessary fermentation is retarded; and if there be too little, the putrefactive process commences.

Two hours previous to the dyeing operation, the vat should be raked; and to prevent the stuff coming in contact with the sediment, which would produce inequalities in the colour, a cross of wood is introduced. The stuff is then to be completely wetted with pure water a little heated, and being wrung out, it is dipped into the vat, where it is moved about for a longer or a shorter time, according to the depth of shade required. During this operation, it is taken out occasionally to be exposed to the air, the action of which is necessary to change the green colour of the bath into a blue. Stuffs dyed blue in this manner must be carefully washed, to carry off the loose particles of colouring matter; and when the shade of blue is deep, they ought even to be cleansed by fulling with soap. This operation does not alter the colour.

What happens in vats of this kind is the separation of an atom of oxygen from the indigo by the action of the fermenting woad. The base of the indigo thus evolved unites to the quicklime, and this compound dissolving in the water, forms the dyestuff. The reason why the air must be so cautiously excluded is, that, by reviving the indigo, it precipitates it from the liquid, and thus deprives the vat of its colouring matter.

Instead of woad, and the other ingredients just mentioned, indigo is deprived of an atom of oxygen, and the base of it dissolved in water by a mixture of bran and potash. Orpiment is also occasionally employed, which has the property of absorbing an atom of oxygen from indigo, and rendering it capable of combining with a base, and of dissolving in water.

The indigo vat employed by the calico-printers is formed by mixing the indigo with the requisite quantity of sulphate of iron to reduce it to its base, and of quicklime to combine with the base evolved, and to cause it to dissolve in water. Such vats are made very deep. The surface, in consequence of exposure to the air, has a blue colour, the indigo being revived. But the liquor, at a little distance from the surface, has a yellow colour. This indeed is the case with all indigo vats. The green colour which they exhibit near the surface is merely the consequence of the mixture of revived indigo with the yellow coloured liquid.

Disco ry of Sa n blue.

The colour which is obtained by dyeing with a solution of indigo in sulphuric acid is known under the name of *Saxon blue*, because the process was first carried on at Grossenhayn, in Saxony, by Counsellor Barth, who made the discovery about the year 1740. This discovery was for some time kept secret, and the method seems to have been originally very complicated. Alumina, antimony, and some other substances, were previously added to the sulphuric acid. These, however, are now omitted, and the indigo alone is dissolved in the acid.

For wol- len st fs.

To produce a Saxon blue colour on woollen stuffs, they are prepared with alum and tartar; and in proportion to the shade required, the quantity of solution of indigo put into the bath must be regulated. When a deep shade of Saxon blue is wanted, the stuff must be passed different times through vessels containing such a quantity of colouring matter as is sufficient to give light colours. In this way, by repeated applications, the colours become more uniform.

We are not aware that Prussian blue is employed as a dyeing material for wool; but it is used to a considerable extent in calico-printing, and has an exceedingly good effect when skilfully used. We shall notice its employment in a subsequent part of this article.

III.—*Processes for dyeing Silk Blue.*

Wit ndi- go.

Silk is dyed blue with indigo alone, without any proportion of woad. The proportion of indigo mentioned in the preparation of the indigo vat, and sometimes a larger proportion, is employed, with six pounds of bran and about twelve ounces of madder. According to Macquer, half a pound of madder for each pound of potash renders the vat greener, and produces a more fixed colour in the silk. When the vat is come to, it should be refreshed with two pounds of potash and three or four ounces of madder, and, after being raked, in the course of four hours it is fit for dyeing. The temperature should be so moderated that the hand may be held in it without uneasiness.

Pre a- tion the

The silk, after being boiled with soap, in the proportion of thirty pounds of soap to a hundred of silk, and well cleaned by repeated beetlings in a stream of water, must be dyed in small portions, because it is apt to take on an uneven colour. When it has been turned once or oftener in the bath, it is wrung out and exposed to the air, that the green colour may change to a blue. When the change is complete, it is thrown into clear water, and afterwards wrung out. Silk dyed blue should be speedily dried. In damp weather and in winter it is necessary to conduct the drying in a chamber heated by a stove. The silk should be hung on a frame kept constantly in motion. To dye light shades, some dyers employ vats that are somewhat exhausted; but it ought to be observed that the colour thus obtained is less beautiful and less permanent than when fresh vats, containing a smaller quantity of indigo, are employed.

For ur- key ue.

Some addition is required to be made to the indigo, to give silk a deep blue. A previous preparation is necessary, by giving it another colour or ground. For the Turkey blue, which is the deepest, a strong bath of archil is first prepared. Cochineal is also sometimes used instead of archil, for the ground, to render the colour more permanent. A blue is given to silk by means of verdigris and logwood, but it possesses little durability. It might be rendered more permanent by giving it a lighter shade in this bath, then dipping it in a bath of archil, and finally in the indigo vat.

Dyeing raw silk.

When raw silk is to be dyed blue, such as is naturally white should be selected. Being previously soaked in water, it is put into the bath in separate hanks, as already directed for scoured silks; and as raw silk is found to combine more readily with the colouring matter, the scoured silk, when it can be conveniently done, should be first put into the bath. If archil, or any of the other ingredients which have been already mentioned, are required to give more intensity to the colour, the mode of application is the same as that directed for scoured silk.

IV.—*Processes for dyeing Cotton and Linen Blue.*

Preparation of the vat.

For dyeing cotton and linen blue, Pileur d'Apligny recommends a vat containing about 120 gallons. From six to eight pounds of indigo, reduced to powder, are boiled in a ley drawn off from a quantity of lime equal in weight to the indigo, and a quantity of potash double its weight. During the boiling, which is to be continued till the indigo is completely penetrated with the ley, the solution must be constantly stirred, to prevent the indigo from being injured by adhering to the bottom of the vessel.

During this process another quantity of quicklime, equal in weight to the indigo, is to be slaked. Twenty quarts of warm water are added, in which is to be dissolved a quantity of sulphate of iron equal to twice the weight of the lime. The solution being completed, it is poured into the vat, which is previously half filled with water. To this the solution of indigo is added, with that part of the ley which was not employed in the boiling. The vat must now be filled up to within two or three inches of the top. It must be raked twice or thrice a day till it is completely prepared, which is generally the case in forty-eight hours, and sometimes sooner, as it depends on the temperature of the atmosphere. A small proportion of bran, madder, and woad, is recommended by some to be added to such a vat as we have now described.

A simpler process.

The process which is followed at Rouen, and described by Quatremere, is simpler. The vats, which are constructed of a kind of flint, are coated within and without with fine cement, and are arranged in one or more parallel lines. Each vat contains four hogsheads of water. The indigo, to the amount of eighteen or twenty pounds, being macerated for a week in a caustic ley strong enough to bear an egg, is ground in a mill; three hogsheads and a half of water are put into the vat, and afterwards twenty pounds of lime. The lime being thoroughly slaked, the vat is raked, and thirty-six pounds of copperas are added; and when the solution is complete, the ground indigo is poured in through a sieve. It is raked seven or eight times the same day, and after being left at rest for thirty-six hours, it is in a state fit for dyeing.

Process on a larger scale.

In extensive manufactories it is necessary to have vats set at different times. In conducting the process of dyeing, the stuffs are first dipped in the most exhausted vat, and then regularly proceeding from the weakest to the strongest, if they have not previously attained the desired shade. The stuffs should remain in the bath only about five or six minutes, for in that time they combine with all the colouring matter they can take up. After the stuffs have been dipped in a vat, it should not be used again till it has been raked, and has stood at least twenty-four hours, unless it has been lately set, when a shorter period is sufficient.

After the stuffs have been dipped three or four times in a vat, it begins to change. It becomes black, and no blue or copper-coloured streaks are seen on the surface after raking it. It must then be renewed by adding four pounds of copperas with two of quicklime, after which it must be raked twice. In this way a vat may be renewed three or four times; but the additional quantity of ingredients must be diminished as the strength of the vat is exhausted.[1]

Process of Bergman. A vat which is still more simple and more easily prepared has been recommended by Bergman. The proportion of the ingredients which he has directed to be employed is the following. To three drachms of indigo reduced to powder, three drachms of copperas, and three of lime, add two pints of water. Let it be well raked, and in the course of a few hours it will be in a proper state for dyeing.

Haussmann's. Haussmann employs a still smaller proportion of indigo. For 3000 lbs. of water he takes thirty-six lbs. of quicklime slaked in 200 lbs. of water, with which the indigo in the proportion of from ten to twenty lbs. well ground is to be mixed. He then dissolves thirty lbs. of copperas in 120 lbs. of hot water. The whole being left at rest for fifteen minutes, the vat is filled, and gently and constantly stirred. When a deeper shade is wanted, and particularly when linen is to be dyed, the proportion of indigo should be greater; but the shade depends very much on the time the stuffs remain in the vat, and the times it has been used. When the vat becomes turbid, the process of dyeing must be interrupted till it has been again raked, and the supernatant liquor become transparent. If the effects of the lime fail, a new quantity, fresh slaked, must be added; and if the iron cease to produce the effect on the indigo, a new portion must be also added, observing the precaution to have a greater quantity of lime than what is necessary to saturate the sulphuric acid. When the indigo seems to be exhausted, fresh portions ground in water are also to be added; the vat is to be raked several times, and allowed to settle, after which it is again fit for use. In this way Mr Haussmann informs us he preserved a vat for the space of two years; and had it not been for the accumulation of sediment, which prevented the stuffs from being immersed to a sufficient depth, it might have been continued in use for a much longer time. It is worth while to add, that Mr Haussmann found that a pattern of cloth dipped in water acidulated with sulphuric acid, immediately after it was taken out of the bath, became of a much deeper blue than a similar pattern exposed to the air, or another dipped in river water.

Another convenient and expeditious vat is mentioned by Bergman and described by Scheffer. Indigo reduced to fine powder, in the proportion of three drachms to a quart, is added to the strong ley of the soap boiler. After a few minutes, when the colouring matter is well penetrated by the ley, six drachms of coloured orpiment are to be added. In a few minutes after the bath has been well raked it becomes green, and the blue streaks appear on the surface. Heat is to be applied, when the operation of dyeing may commence.

The preparation employed for printing cottons is similar to the above bath, excepting in the proportions of orpiment and indigo, which are greater in the former; but these proportions are very different in different manufactories.

English blue. The colour denominated *English blue* is produced by the solution of indigo in sulphuric acid, to which Bancroft gave the improper name of *sulphate of indigo*. To give silk this colour, it is first to be dyed a light blue; and, when taken out of this bath, it is dipped in hot water, washed in a stream, and left in a bath composed of the sulphate of indigo, to which a little of the solution of tin has been added, until the proper shade is obtained, or the bath is exhausted. Previous to its being put into this bath, it may be dipped in a solution of alum, in which it should remain only a very short time. Silk which has been dyed according to thir process is free from the reddish shade which it derives from the blue vat, as well as from the greenish cast of the Saxon blue.[2]

The sulphate of indigo has been hitherto only applied for the purpose of dyeing wool and silk. The affinity of indigo for vegetable substances is not sufficiently strong to effect the decomposition of the sulphate. It cannot, therefore, be employed with advantage in dyeing cotton and linen.

SECT. IV.—*Of Black.*

Though black, considered optically, is not a colour, but the absence of the power of reflecting light, it constitutes a very important colour in the estimation of the dyer.

I.—*Description of the Dyestuffs.*

There are few substances which have the property of producing a permanent black colour without any addition. The juice of some plants produces this effect on cotton and linen. A black colour is obtained from the juice of the *cashew nut*, which will not wash out, and even resists the process of boiling with soap or alkalies. The cashew nut of India is employed for marking linen. That of the West Indies (*anacardium occidentale*, Lin.) also yields a permanent dye, but the colour has a brownish shade. The juice of some other plants, as that of the toxicodendron, or sloes, affords a durable bluish black colour; but these substances cannot be obtained in sufficient quantity, even if they afforded colours equal to those produced by the common processes.

The principal substances which are employed to give a black colour are gallnuts, which contain the astringent principle or tan, and the red oxide of iron.[3] These have been described either in a preceding part of this article, or under the article CHEMISTRY, to which therefore we refer the reader. The black colour is produced by the combination of the astringent principle with the oxide of iron, held in solution by an acid, and fixed on the stuff. When the particles are precipitated from the mixture of tan and a solution of iron, they have only a blue colour; but after they are exposed for some time to the air, and moistened with water, the colour becomes deeper, although the blue shade is still perceptible. After the particles are fixed on the stuff, the shade becomes much deeper.

Logwood is not to be considered as affording a black dye, but is much employed to give a lustre to black colours. We have already described its nature and properties among the substances from which red colouring matters are obtained.

Black colours are rarely produced by a simple combination between the colouring matter and the stuff, but are usually fixed by means of mordants, as in the case of the black particles which are the result of a combination of

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[1] Berthollet, ii. 90.

[2] *Ibid.* ii. 319.

[3] Oak bark has been recommended as a substitute for gallnuts in dyeing black, and particularly in dyeing hats; and it is said that the colour thus obtained is fuller, more beautiful and durable, while the operation is easier, and less liable to accident. It was first proposed in the year 1782, by Stephanopoli, a Corsican, and a surgeon in the French army. The examination of the process was referred by the French government to Macquer, who gave a favourable report of it; and afterwards to Berthollet, who gave a different opinion. The process has since been examined, and promises to be more economical and advantageous, especially for dyeing hats. (*Phil. Mag.* vi. 176.)

S ple C rs.

the astringent principle and the oxide of iron, held in solution by an acid. But when the particles are precipitated from the mixture of an astringent and a solution of iron, they have only a blue colour. By being exposed to the air, and moistened with water, the colour becomes deeper, although the blue shade is still perceptible. No fine black colour is ever obtained, unless the stuffs are freely exposed to the air. In dyeing black, therefore, the operations must be conducted at different intervals. Berthollet has observed that black stuffs, when brought in contact with oxygen gas, diminish its volume, so that some portion of it is absorbed.

II.—*Of the Processes for dyeing Woollen Black.*

Mu be first-yed blue

In dyeing woollen stuffs black, if a full and fine deep colour is wanted, it is necessary that they be previously dyed of a deep blue colour. To remove all the particles of colouring matter which happen to be loosely attached to the stuff, it should be washed in a river as soon as it is taken out of the vat, and afterwards cleansed at the fulling mill. After these preliminary processes, the stuffs are ready to receive the black colouring matter. The process of Hellot is the following.

He t's pro s.

For every hundred pounds of stuff, ten pounds of logwood, and ten pounds of galls reduced to powder, are put into a bag, and boiled in a middle-sized copper, with a sufficient quantity of water, for twelve hours. A third of this bath is put into another copper, along with two pounds of verdigris. The stuff is immersed in this bath, and continually stirred for two hours. The bath should be kept hot, but it ought not to boil. At the end of two hours the stuff is taken out, and a similar portion of the bath is put into the copper, with eight pounds of copperas (sulphate of iron). During the solution of the copperas the fire is diminished, and the bath is allowed to cool for half an hour, stirring it well the whole time. The remainder of the bath is then to be added, and after making this addition, the bag containing the astringent matters should be strongly pressed, to separate the whole. A quantity of sumach, from fifteen to twenty pounds, is now to be added, and the bath is just raised to the boiling temperature; and when it has given one boil it is to be immediately stopped with a little cold water. A fresh quantity of sulphate of iron, to the amount of two pounds, is then added, and the stuff is kept in it for another hour, after which it is taken out, washed, and aired; it is again put into the copper, and constantly stirred for an hour. It is then carried to the river, well washed, and fulled. To soften the black colour, and make it more firm, another bath is prepared with weld. This is made to boil for a moment, and when it has cooled, the stuff is passed through it. By this process, which is indeed somewhat complicated, a beautiful black colour is produced.

Co on pro s.

But the processes usually followed for dyeing black are more simple. Cloth which has been previously dyed blue is merely boiled in a vat of galls for two hours. It is then kept two hours, but without boiling, in the bath of logwood and sulphate of iron, and afterwards washed and fulled. According to Hellot's process, a bath is to be prepared of a pound and a half of yellow wood, five pounds of logwood, and ten pounds of sumach, which is the proportion of the ingredients for every fifteen yards of deep blue cloth; and the cloth having boiled in this bath for three hours, ten pounds of sulphate of iron are added; the cloth is allowed to remain for two hours longer, when it is taken out to be aired, after which it is again returned to the bath for an hour, and then washed and fulled.

A eaper pro s.

When stuffs are to be dyed at a less expense, instead of the blue ground, a brown or root-coloured ground may be substituted. This brown or fawn colour is communicated by means of the root of the walnut tree, or green walnut peels. The stuffs are then to be dyed black, according to some of the processes already described.

Process of the English dyers.

The proportions of the ingredients employed by the English dyers are, for every hundred pounds of cloth previously dyed a deep blue, about five pounds of sulphate of iron, five pounds of galls, and thirty of logwood. The first step in the process is to gall the cloth, after which it is passed through the decoction of logwood, to which the sulphate of iron has been added.

Arbutus used for galls.

The leaves of the *arbutus uva ursi* have been recommended and employed as a substitute for galls. The leaves must be carefully dried, so that the green colour may be preserved. A hundred pounds of wool are boiled with sixteen pounds of sulphate of iron and eight of tartar for two hours. The day following the cloth is to be rinsed, as after aluming. A hundred and fifty pounds of the leaves of *uva ursi* are then to be boiled for two hours in water, and after being taken out, a small quantity of madder is to be added to the liquor, putting in the cloth at the same time, which is to remain about an hour and a half. It is then taken out and rinsed in water.[1] By this process, it is said, blue cloth receives a pretty good black, but white cloth becomes only of a deep brown. It is said, too, that the madder and tartar are useless ingredients.

Last operation.

After the different operations for dyeing the cloth have been finished, it is washed in a river, and fulled, till the water comes off clear and colourless. Soap suds are recommended by some in fulling fine cloths, but it is found difficult to free the cloth entirely from the soap. After the cloth has come from the fulling-mill, some propose to give it a dip in a bath of weld, by which it is said to be softened, and the colour better fixed; but, according to Lewis, this operation, which in other cases is of some advantage, is useless after the cloth has been treated with the soap suds.

III.—*Of the Processes for dyeing Silk Black.*

In communicating a black colour to silk, different operations are necessary, such as boiling, galling, repairing the bath, dyeing, and softening.

To give a deeper shade to silk, it is necessary to deprive it of the gummy substance to which its stiffness and elasticity are owing. This is done by boiling the silk four or five hours with one fifth its weight of white soap, and afterwards beetling and carefully washing it.

Galling.

In conducting the process of galling silk, three fourths of its weight of galls are to be boiled for three or four hours; but the proportion of galls must depend on their quality. After the boiling, the liquor is allowed to remain at rest for two hours; the silk is then put into the bath, and left there from twelve to thirty-six hours, when it is to be taken out, and washed in the river. But as silk is capable of combining with a great proportion of the astringent principle, or tan, from which it receives a considerable increase of weight, it is allowed to remain for a longer or shorter time, as the silk is required to have more or less additional weight. To communicate, therefore, to silk, what is called a *heavy* black, it is allowed to remain longer in the gall liquor: the process is repeated oftener, and the silk is also dipped in the dye a greater number of times.

Dyeing.

While silk is preparing for the process of dyeing, the bath is to be heated, and should be occasionally stirred, that the grounds which fall to the bottom may not acquire too much heat. It should always be kept under the boiling temperature. Gum and solution of iron are added in different proportions, according to the different processes.

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[1] *Stockholm Trans.* 1753.

When the gum is dissolved, and the bath near the boiling temperature, it is left to settle for about an hour. The silk, which in general is previously divided into three parts, that each may be successively put into the bath, is immersed in it. Each part is then to be three times wrung, and after each wringing hung up to air. The silk being thus exposed to the action of the air, acquires a deeper shade. This operation being finished, the bath is again heated, with the addition of gum and sulphate of iron; and this is repeated two or three times, according as the black required is light or heavy. When the process of dyeing is finished, the silk is rinsed in a vessel with some cold water, by turning or shaking it over.

Softening.

Silk, after it has been taken out of the dye, is extremely harsh, to remove which it is subjected to the operation of softening. A solution of four or five pounds of soap for every hundred pounds of silk is poured through a cloth into a vessel of water. The solution being completed, the silk is immersed, and allowed to remain in it for about fifteen minutes; it is then to be wrung out and dried.

Dyeing raw silk.

When raw silk is to be dyed, that which has a natural yellow colour is preferred. The galling operation must be performed in the cold, if it be proposed to preserve the whole of the gum, and the elasticity which it gives to the silk; but if part only of the gum is wished to be preserved, the galling is to be performed in the warm bath.

The dyeing operation is also performed in the cold. All that is necessary is to add the sulphate of iron to the water in which the stuff is rinsed. By this simple process the black dye is communicated. It is then washed, once or twice beetled, and dried without wringing, that its elasticity may not be destroyed. Raw silk may be dyed by a more speedy process. After galling, it may be turned or shaken over in the cold bath; and thus, by alternately dipping and airing the stuff, the operation may be completed. It is then to be washed and dried, as in the former process.

A speedier process.

Improved process for velvet.

The method of dyeing velvet at Genoa, which has been simplified and improved in France, is thus described by Macquer. For every hundred pounds of silk, twenty pounds of Aleppo galls, reduced to powder, are boiled in a sufficient quantity of water for an hour. The bath is allowed to settle till the galls have fallen to the bottom; they are then taken out, and two pounds and a half of sulphuric acid, twelve pounds of iron filings, and twenty pounds of gum, are put into a copper vessel, or cullender, furnished with two handles. This vessel is immersed in the bath, and supported that it may not touch the bottom. The gum, which is allowed to dissolve for an hour, is to be occasionally stirred; and if it appear that the whole of the gum is dissolved, three or four pounds more are to be added. Excepting during the operation of dyeing, the cullender is to remain in the copper, which must be kept hot the whole time, but at a temperature below the boiling point. In galling the silk, one third of Aleppo galls is employed, and the stuff should remain six hours in the liquor the first time, and twelve hours the second. By frequent additions of sulphate of iron, and repeated immersions of the stuff, a fine black, according to Lewis, has been obtained. In the above process, the proportion of sulphate of iron is too small; and the gum, according to some, being carried off in the washing, may be considered as useless. Berthollet thinks, that although the quantity be excessive, it has some effect in keeping up the bath; and he adds, if it is to be diminished, it would be useful to add the sulphate of iron in separate portions during each interval.

To diminish the quantity of galls, which are an expensive ingredient in dyeing silk black, other substances have been proposed as substitutes. With this view the following process is recommended.

The silk being boiled and washed, is immersed in a strong decoction of green walnut peels, and allowed to remain till the colouring matter of both is exhausted. It is then to be slightly wrung out, dried, and washed.[1] To give the silk a blue ground, logwood and verdigris are employed, in the proportion of one ounce of the latter for every pound of silk. The verdigris is dissolved in cold water, and the silk is allowed to remain two hours in this solution. It is then immersed in a strong decoction of logwood, slightly wrung out, dried, and afterwards washed at the river. The bath is prepared by macerating two pounds of galls and three of sumach in twenty-five gallons of water, over a slow fire, for twelve hours. The liquid being strained, three pounds of sulphate of iron and the same quantity of gum-arabic are to be dissolved in it. The silk is dipped in this solution at two different times; it is to remain in the bath two hours each time, and it must be aired and dried between each dip. After being twice beetled at the river, it is dipped a third time, and left in the bath four or five hours, after which it is to be dried, washed, and beetled, as before. The temperature of the bath should not exceed 120°. After the first dipping, it may be necessary to add half a pound of sulphate of iron, and an equal quantity of gum-arabic.

Silk which has been previously dyed blue with indigo, it is said, takes only a mealy black; but when it has been prepared with logwood and verdigris, it acquires a velvety lustre. A fine black may be obtained from green walnut peel; but the addition of logwood and verdigris renders a smaller quantity of sulphate of iron necessary, and this is of importance, because it is apt to weaken the silk. The only use of galls, according to some, is to increase the weight of the silk; for the purposes of dyeing, sumach is considered sufficient.[2]

IV.—*Of the Processes for dyeing Cotton and Linen Black.*

It is more difficult to communicate a fine black to linen or cotton than to silk or woollen stuffs. To succeed in producing a black colour of that degree of intensity which will resist soap, it is necessary to adopt particular processes. In dyeing animal matters black, as silk and wool, the best colours are obtained on those which have been previously dyed blue. This also is an essential preliminary process in dyeing linen and cotton black; for it is found that the process which succeeds best is first to give a deep blue grain to the cotton or linen.

The first part of the process is the operation of galling. The stuffs, which have been previously dyed blue, wrung out, and dried, are kept twenty-four hours in the gall liquor, composed of four ounces of galls to every pound of thread. A bath is then prepared of a solution of iron in acetic acid. This solution is obtained by saturating the acid with oxide of iron. In France, vinegar, small beer, or small wine, is employed for this purpose. To promote the acid fermentation, rye meal, or some other substance, is added, and pieces of old iron are thrown into the liquid, which are allowed to remain for six weeks or two months, that the acid may be saturated with the iron. This solution, called *iron liquor* in this country, is prepared from fermented worts, to which old iron is added, as is described above. Five quarts of the iron liquor for every pound of stuffs are put into a vessel. In this the stuffs are wrought with the hand, pound by pound, for fifteen minutes; they are then wrung out and aired. This operation is to be again repeated, taking care to add a fresh quantity of the iron liquor, which should be carefully scummed, after which the stuffs are to be wrung out, aired, and washed at the river. In the next operation, a pound of alder bark for every pound of stuff is boiled in a sufficient quantity of water for an hour. One half of the bath which was employed in the galling, and about one half the quantity of sumach as of alder bark, are then added. The whole is boiled together for two hours, and strained through a sieve. When this liquid is cold, the stuffs are immersed, wrought pound by pound, and occasionally aired. They are afterwards put into the bath, and, after remaining for twenty-four hours, are wrung out and dried. The above is the process which, according to D'Apligny, is followed at Rouen for dyeing cotton and linen.

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[1] The decoction of walnut peels is prepared by boiling for fifteen minutes, after which it is taken from the fire. After it has subsided, the silk, which has been previously immersed in warm water, is dipped in it.

[2] Berthollet, ii. 20.

The process followed at Manchester, which is described by Mr Wilson, is the following. For the operation of galling, galls or sumach are employed. The stuff is afterwards dyed in a bath consisting of a solution of iron in acetic acid. This bath is also frequently composed of alder bark and iron. After having passed through this bath, the stuff is dipped in a decoction of logwood, to which a small quantity of verdigris has been added. This process is to be repeated till a black of sufficient intensity is obtained, observing to wash and dry after each operation.

According to Guhliche, a solution of iron may be prepared by the following process. A pound of rice is to be boiled in twelve or fifteen quarts of water, till the whole is dissolved. A sufficient quantity of old iron made red hot, to reach half way to the surface of the liquor, is thrown into the solution. The vessel in which the solution is kept must be under cover, but exposed to the air and light, at least for a week. In another vessel, containing a quantity of warm vinegar equal to the solution of rice, an equal quantity of red-hot iron is to be put. This vessel must also be exposed in the same way to the air and light. After several days, the contents of both vessels are mixed together, and the mixture is to be exposed for a week to the open air, after which it is to be decanted and kept for use in a close vessel. To give a sufficient black to linen and cotton, it is only necessary, it is said, to steep them twenty-nine hours in this solution; and if it should appear that the liquor is exhausted of colouring matter, a fresh portion is to be employed. In this way a fine permanent black is obtained. According to the same author, this solution may be advantageously employed as a substitute for sulphate of iron, in dyeing silk and wool. But to give them a fine black, silk and woollen stuffs must be dipped in a decoction of logwood after they are taken from the bath.

SECT. V.—*Of Brown.*

The last of the simple colours is brown. This is also known under the name of *fawn* colour (*fauve*, Fr.). It is that brown colour which has a shade of yellow, and might perhaps be considered as a compound colour, although it is communicated to stuffs by one process.

I.—*Of the Substances employed in Dyeing Brown.*

The vegetable substances which are capable of inducing a fawn or brown colour on different stuffs are very numerous, but those chiefly employed for this purpose are walnut peels and sumach. The peels constitute the green covering of the nut; they are internally of a white colour, which is converted into brown or black by exposure to the air. The skin, when impregnated with the juice of walnut peels, becomes of a brown or almost black colour. When the inner part of the peel, taken fresh, is put into weak oxymuriatic acid, it assumes a brown colour. If the decoction of walnut peels be filtered and exposed to the air, its colour becomes of a deep brown; the pellicles on evaporation are almost black; the liquor detached from these yields a brown extract, completely soluble in water. The colouring particles are precipitated from a decoction of walnut peels by means of alcohol, and they are soluble in water. No apparent change is at first produced by a solution of potash; but it gradually becomes turbid, and the colour is deepened. A copious precipitate, of a fawn colour, approaching to an ash colour, is produced in a decoction of walnut peels, by means of a solution of tin, and the remaining liquor has a slightly yellow tinge.

Properties.

A decoction of walnut peels yields a small quantity of fawn-coloured precipitate by means of a solution of alum, and the liquor remains of the same colour. Sulphate of copper renders it slowly turbid, and throws down a small quantity of precipitate of a brownish-green colour, leaving the supernatant liquor of the same colour. Sulphate of iron deepens the colour; when diluted, the colour becomes brownish green, without the deposition of any sediment. Sulphate of zinc also deepens the colour, and produces no precipitate. The same properties are exhibited by a decoction of the walnut-tree wood, but the colouring matter is not obtained from it in such abundance as from the peels; and the bark may also be used with advantage in dyeing.

Advantages.

The affinity of the colouring matter of walnut peels for wool is very strong; and it readily imparts to it a durable colour, which even mordants do not seem capable of increasing, but they are generally understood to give it additional brightness. A lively and very rich colour is obtained with the assistance of alum. Walnut peels afford a great variety of pleasing shades; and as they require not the intervention of mordants, the softness of the wool is preserved, and the process of dyeing becomes both cheap and simple.

Preparation.

Walnut peels are not gathered till the nuts are completely ripe, when they are put into large casks, along with as much water as is sufficient to cover them. When used in dyeing at the Gobelins in Paris, Berthollet informs us, they are kept for upwards of a year, and very extensively used; but if not made use of till the end of two years, they yield a greater quantity of colouring matter, at which time their odour has become peculiarly disagreeable and fetid. The peels separated from the nuts before they arrive at maturity, may likewise be used in dyeing, but in this state they do not keep so long.

Sumach.

Sumach (*rhus coriaria*, Lin.) is a shrub produced naturally in Palestine, Syria, Portugal, and Spain, being carefully cultivated in the last two of these countries. Its shoots are annually cut down, dried, and reduced to powder in a mill, by which process they are prepared for the purposes of dyeing.

Properties.

The infusion of sumach, which is of a fawn colour with a greenish tinge, is changed into a brown by exposure to the air. A solution of potash has little action on the recent infusion of sumach; its colour is changed to yellow by the action of acids; the liquor becomes turbid by means of alum, a small quantity of precipitate being at the same time formed, and the supernatant liquor remaining yellow. A copious precipitate of a yellowish-green colour is thrown down by sulphate of copper, and the liquor remains clear. No change is speedily produced by muriate of soda (common salt), but it becomes rather turbid at the end of some hours, and its colour is rather clearer. Sulphate of copper produces a copious precipitate of a yellowish green, which after standing some hours changes to a brownish green; the supernatant liquor, which is slightly

Simple Colours.

yellow, remains clear. Sulphate of zinc renders the liquor turbid, darkens its colour, and produces a deep blue precipitate; but when the sulphate of zinc is pure, the precipitate, which is of a brownish fawn colour, is in very small quantity. Acetate of lead gives a copious precipitate of a yellowish colour; the supernatant liquor is of a clear yellow colour. No astringent has so strong a resemblance to galls as sumach; but the precipitate thrown down from an infusion of it by a solution of iron, is not so copious as that which is yielded by an equal quantity of galls, on which account sumach may be generally employed as a substitute for galls, only its quantity will require to be increased.

Bark of birch.

The bark of the birch tree (*betula alba*, Lin.) yields a decoction of a clear fawn colour, but it soon becomes turbid and brown. The addition of a solution of alum, in the open air, produces a copious yellow precipitate; a solution of tin gives also a copious precipitate of a clear yellow colour. With solutions of iron the decoction of the birch tree strikes a black colour, and it dissolves in considerable quantity the oxide of iron, but in smaller proportion than the decoction of walnut peels. On account of this property, it is employed in the preparation of black vats for dyeing thread.

Sandal wood.

Sanders or sandal wood (*Petrocarpus sachtalinus*) is also employed for the purpose of giving a fawn colour. There are three kinds of sandal wood, the white, the yellow, and the red. The last only, which is a compact heavy wood, brought from the Coromandel coast, is used in dyeing. By exposure to the air it becomes of a brown colour; when employed in dyeing, it is reduced to fine powder, and it yields a fawn colour with a brownish shade, inclining to red. But the colouring matter which it yields of itself is in small quantity, and it is said that it gives harshness to woollen stuffs. When it is mixed with other substances, as sumach, walnut peels, or galls, the quantity of colouring matter is increased; it gives a more durable colour, and produces considerable modifications in the colouring matter with which it is mixed. Sandal wood yields its colouring matter to brandy, or diluted alcohol, more readily than to water.

Soot.

Soot communicates to woollen stuffs a fawn or brown colour, of a lighter or deeper shade, in proportion to the quantity employed; but the colour is fading, and its affinity for wool is not great; and besides leaving a disagreeable smell, it renders the fibres harsh. In some manufactories it is employed for browning certain colours, and it produces shades which could not otherwise be easily obtained.

II.—*Of the Processes for dyeing Woollen, &c. a Fawn or Brown Colour.*

With walnut peels.

In dyeing with walnut peels, a quantity proportioned to the quantity of stuff, and the intensity of shade wanted, is boiled for fifteen minutes in a copper. All that is necessary in dyeing with this substance is, to moisten the cloth or yarn with warm water previous to its immersion in the copper, in which it is to be carefully stirred till it has acquired the proper shade. This is the process if the aluminous mordant is not employed. In dyeing cloth, it is usual to give the deepest shades first, and the lighter ones afterwards; but in dyeing woollen yarn, the light shades are given first, and the deeper ones afterwards. An additional quantity of peels is joined to each parcel.

Berthollet's experiments.

Berthollet made a number of experiments to ascertain the difference of colour obtained from the simple decoction of walnut peels, and the addition of metallic oxides as mordants. The oxide of tin, he found, yielded a clearer and brighter fawn colour than that of the simple decoction. The oxide of zinc produced a still clearer colour, inclining to ash or gray. The colour from oxide of lead had an orange cast, while that from oxide of iron was of a greenish brown.[1]

Compo Colou

Dyeing with su mach.

A fawn colour, which has a shade of green, is obtained from sumach alone; but to cotton stuffs which have been impregnated with printers' mordant, or acetate of alumina, sumach communicates a good and durable yellow. Here, however, some precaution is necessary in the use of this substance for this purpose; for as the colouring matter is of so fixed a nature, the ground of the stuff cannot be bleached by exposure on the grass. This inconvenience is avoided by impregnating the whole of the stuff with different mordants, producing in this way a variety of colours, and leaving no part white.

With s dal wo

Vogler employed the tincture of sanders wood for dyeing patterns of wool, silk, cotton, and linen, having previously impregnated them with a solution of tin, and afterwards washing and drying them. Sometimes he used the solution unmixed, and at other times added six or ten parts of water, and in whatever way he employed it he obtained a poppy colour. When the mordant employed was the solution of alum, the colour was a rich scarlet; with sulphate of copper it was a clear crimson, and with sulphate of iron a beautiful deep violet.[2]

CHAPTER V.

OF COMPOUND COLOURS.

Natur compo colours

A mixture of two colouring substances, it is well known, produces a very different shade from that of either of the uncombined colouring matters; hence compound colours are obtained, which are merely mixtures of simple colours. It would undoubtedly be a desirable thing to ascertain with accuracy the peculiar shade produced by the combination of two colouring matters; but these results can only be certainly known by experiment, because by the action of different substances in the bath they are subject to great variations in their effects, according to the affinities which are brought into action, and the new combinations which are formed. What is natural to colouring particles is not to be considered as a constituent part of compound colours, but only the difference of shade which they ought to assume with a particular mordant, or in a particular bath. The effects, therefore, of the chemical agents employed in these processes, and the result of different combinations, ought to be particularly attended to. It is in dyeing compound colours that skill and ingenuity are most conspicuous, and their application of greatest utility, to enable the dyer to vary his processes according to the shade desired, and at the same time to accomplish his operations by the shortest and cheapest means.

Great riety shade

As compound colours are obtained by the mixture of simple colours, very different shades will be obtained from different proportions of the simple colours; hence compound colours exhibit an indefinite variety of shade, and the processes by which they are produced are very numerous. It would extend this treatise to an unusual length were we to attempt to describe every variety of shade which is obtained from the mixture of simple colours. We shall therefore limit our observations to some of the principal compound colours, and an account of the processes by which they are obtained, leaving it to our readers, who have made themselves familiar with the principles already detailed, to vary these colours by employing different proportions and different combinations of simple colouring matters.

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[1] *Elements of Dyeing*, ii. 296.

[2] *Crell. Ann.* 1790

Compound colours have been usually divided into four classes, namely, green, purple, orange, and gray or drab colour. These are obtained from mixtures of the following simple colours:

1. Blue and yellow produce a green.
2. Red and blue produce a purple, &c.
3. Red and yellow produce orange.
4. Black and other colours produce gray, &c.

The following sections will be occupied in a short detail of the methods which are usually employed in producing these different compound colours.

Sect. I.—*Of the Mixture of Blue and Yellow, or Green.*

Var us shad of gree

Green colours, from the great variety of shades which they exhibit, have been long known by different names, by which the intensity of shade is characterized, such as sea-green, apple-green, meadow or grass-green, pea-green, parrot-green, &c. Many plants afford a green colour, such as brome grass (*bromus secalinus*, Lin.) green berries of *rhamnus frangula*, wild chervil (*chærophyllum sylvestre*, Lin.), purple clover (*trifolium pratense*), common reed (*arundo phragmites*). These colours, however, do not possess sufficient permanency. According to D'Ambourney, indeed, a permanent green may be obtained from the fermented juice of the berries of the berry-bearing alder (*rhamnus frangula*). Having previously prepared the cloth with tartar, solution of nitrate of bismuth, and common salt, he added to the fermented juice of the berries, after it was warmed, a small proportion of acetate of lead; and in this bath he communicated to the cloth an intermediate shade between parrot and grass green. But it is usually from the mixture of blue and yellow that green is obtained; and it may be observed, that it requires much skill and experience, especially in giving light shades, to produce a colour which is uniform and entirely without spots.

I.—*Of the Processes for dyeing Woollen Stuffs Green.*

Co on pr ss.

To dye woollen green, either the yellow or the blue dye may be given to it first. But when the stuff is first dyed yellow, and in this state is introduced into the blue vat, part of the yellow colouring matter being dissolved in the vat, communicates to it a green colour, which renders it unfit for dyeing any other colour than green. To avoid this inconvenience, therefore, the blue colour is first given, and afterwards the yellow. It would be quite unnecessary to resume the account of any part of the processes for dyeing blue, which have been already detailed. It is proper, however, to add, that the intensity of the blue shade must be proportioned to the green, or to the depth of the green colour which is wished to be obtained. Thus, for instance, to produce a parrot green, a ground of sky blue is given, and for the green like that of a drake's neck, a deep blue is required. When the blue dye has been communicated, the yellow is afterwards given, according to some of the processes which have been already described for dyeing yellow. The proper ground being communicated to the cloths, they are washed in the fulling mill, and boiled as for the common process of welding; but when the shade is light, the proportion of salts should be less. Cloths which are to receive light shades are first boiled, and when these are taken out, tartar and alum are added in fresh portions till the cloths which are intended for the darkest shades are boiled. The process of welding is conducted in the same way as for dyeing yellow, with this difference, that a larger proportion of weld is employed, excepting for lighter shades, when the proportion must be smaller. In dyeing green, it is usual to have a succession of shades at the same time; the process is begun with the deepest and ends with the lightest. Between each dip there should be an interval of one half or three quarters of an hour, and at each interval water is added to the bath. It is the practice of some dyers to give each parcel two dips, beginning the first time with the deep shades, and the second with the lighter ones; but when this practice is followed, the time of immersion should be shortened. In dyeing very light shades, the bath should never be permitted to reach the boiling temperature. For deep greens, a browning is given with logwood and a small proportion of sulphate of iron.

Saxon green.

For some kinds of green, sulphate of indigo is employed; and in this case either the blue and yellow are dyed separately, or the whole of the ingredients are mixed together in the bath, and the whole process is finished at a single operation. The colour thus obtained has been distinguished by the name of *Saxon green*. The following is the process recommended by Dr Bancroft.

"The most beautiful Saxon green," says he, "may be produced very cheaply and expeditiously, by combining the lively yellow which results from quercitron bark, murio-sulphate of tin, and alum, with the blue afforded by indigo when dissolved in sulphuric acid, as for dyeing the Saxon blue.

"To produce this combination most advantageously, the dyer, for a full-bodied green, should put into the dyeing vessel after the rate of six or eight pounds of powdered bark in a bag for every 100 pounds weight of cloth, with only a small proportion of water as soon as it begins to grow warm; and when it begins to boil, he should add about six pounds of murio-sulphate of tin (with the usual precautions), and a few minutes after, about four pounds of alum. These having boiled together five or six minutes, cold water should be added, and the fire diminished so as to bring the heat of the liquor nearly down to what the hand is able to bear; and immediately after this, as much sulphate of indigo is to be added as will suffice to produce the shade of green intended to be dyed, taking care to mix it thoroughly with the first solution by stirring, &c.; and this being done, the cloth, previously scoured and moistened, should be expeditiously put into the liquor, and turned very briskly through it for a quarter of an hour, in order that the colour may apply itself equally to every part, which it will certainly do in this way with proper care. By these means, very full, even, and beautiful greens may generally be dyed in half an hour; and during this space it is best to keep the liquor at rather less than a boiling heat. Murio-sulphate of tin is infinitely preferable for this use to the dyer's spirit, because the latter consists chiefly of nitric acid, which, by its highly injurious action upon indigo, would render that part of the green colour very fugitive, as I have found by repeated trials. But no such effect can result from the murio-sulphate of tin, since the muriatic acid has no action upon indigo; and the sulphuric is that very acid which alone is proper to dissolve it for this use.

"Respecting the beauty of the colour thus produced, those who are acquainted with the unequalled lustre and brightness of the quercitron yellows, dyed with the tin basis, must necessarily conclude that the greens composed therewith will prove infinitely superior to any which can result from the dull muddy yellow of old fustic; and in point of expense it is certain that the bark, murio-sulphate of tin, and alum, necessary to dye a given quantity of cloth in this way will cost less than the much greater quantity (six or eight times more) of fustic, with the alum necessary for dyeing it in the common way, the sulphate of indigo being the same in both cases. But in dyeing with the bark, the vessel is only to be filled and heated once, and the cloth, without any previous preparation, may be completely dyed in half an hour: whilst in the common way of producing Saxon greens, the copper is to be twice filled; and to this must be joined the fuel and labour of an hour and a half's boiling and turning the cloth in the course of preparation, besides nearly as much boiling in another vessel to extract the fustic; and after all, the dyeing process remains to be performed, which will be equal in time and trouble to the whole of the process for producing a Saxon green with the bark; so that this colour obtained from bark will not only prove superior in beauty, but in cheapness, to that dyed as usual with old fustic."[1]

II.—*Of the Processes for dyeing Silk Green.*

Preparation.

In giving silk a green colour, greater precaution is necessary, to preserve uniformity of colour, and to prevent spots and stripes. Silk which is intended to receive a green colour is scoured in the same way as for other colours; but for light shades the scouring must be as complete as for blue. Silk which is to be dyed green is first dyed yellow, and being well alumed, it is slightly washed at the river, and divided into small parcels, that it may receive the colouring matter uniformly, and then carefully turned in the weld bath. When the ground is supposed to have acquired a sufficient degree of intensity, a pattern is put into the blue vat to ascertain the proper shade. When this is the case, the silk is taken out of the bath, washed, and immersed in the blue vat. To produce a deeper colour, and at the same time to give variety of shade, a decoction of logwood, fustic, or anotta is added to the yellow bath, after the weld has been taken out. For very light shades, such as apple and sea green, it is scarcely necessary to add, that a weaker ground is to be given. For all light shades, except sea-green, the process is found to succeed better when the yellow is communicated by baths which have been already used; but these baths should not contain any logwood or fustic.

Saxon green.

Saxon green is produced by means of sulphate of indigo. This is a brighter but less durable colour than the former. This process is conducted by boiling as for welding, after which the cloth is washed. Fustic in chips is enclosed in a bag, put into the same bath, and boiled for an hour and a half, when it is taken out, and the bath allowed to cool till the hand can bear it. A pound and a quarter of sulphate of indigo for each piece of cloth of eighteen yards is added. The cloth is at first to be turned quickly, and afterwards more slowly, and it should be taken out before the bath boils. Some dyers put in only two thirds of the solution at first, and after two or three turns take out the cloth and add the other one third. By this means the colour is more uniform.

By one operation.

To produce Saxon green at one operation, the following process is recommended by Dr Bancroft. A bath is prepared of four pounds of quercitron bark, three pounds of alum, and two pounds of murio-sulphate of tin, with a sufficient quantity of water. The bath is boiled ten or fifteen minutes, and when the liquor is so far reduced in temperature as the hand can bear it, it is fit for dyeing. By adding different proportions of sulphate of indigo, various and beautiful shades of green may be obtained, and the colour thus produced is both cheap and uniform. Care should be taken to keep the bath constantly stirred, to prevent the colouring matter from subsiding. Those shades which are intended to incline most to the yellow should be dyed first; and by adding sulphate of indigo, the green having a shade of blue may be obtained. This process, Dr Bancroft observes, is the most commodious and certain for dyeing most beautiful Saxon greens upon silk.[2]

Englis green.

To produce English green, which is more beautiful than common green, and is said to be more durable than the Saxon green, Guhliche gives the following process. He first dyes the silk of a light blue in the cold vat already described, then soaks it in warm water, washes it in a stream, and dips it in a weak solution of alum. He then prepares a bath of sulphate of indigo, one ounce of solution of tin, with the tincture of French berries made with aceto-citric acid. The silk is kept in this bath till it has obtained the desired colour. It is then washed and dried in a shady place. Lighter shades may be dyed afterwards.[3]

III.—*Of the Processes for dyeing Cotton and Linen Green.*

Blue given.

Cotton and linen, after being scoured in the usual way, are first dyed blue, and after being cleansed, they are dipped in the weld bath, to produce a green colour. The strength of the blue and yellow is proportioned to the shade of green which is wanted. But as it is difficult to give to cotton velvet a uniform colour in the blue vat, it is first dyed yellow with turmeric, and the process is completed by giving it a green with sulphate of indigo. The same result, however, will be obtained by commencing the process either with the yellow or the blue.

Proce cotton vet.

The process which D'Apligny describes for dyeing cotton velvet, or cotton thread, a sea or apple green, in one bath, is the following. A quantity of verdigris is dissolved in vinegar, and the mixture is kept excluded from the air in the heat of a stove for fifteen days. A quantity of potash equal in weight to the verdigris employed is dissolved in water, and, four hours before dyeing, it is added to the solution of verdigris. The mixture is to be kept hot. One ounce of alum in five quarts of water for each pound of stuff being prepared, the cotton thread or velvet is soaked in this solution. It is then taken out, and the verdigris being added to the solution of alum, it is again introduced to be dyed.

Olive green.

The different shades of olive green, and drake's neck green, are given to thread after it has received a blue ground, by galling it, and dipping it in a weaker or stronger bath of iron liquor, then in the weld bath, to which verdigris has been added, and afterwards in the bath with sulphate of copper. The colour is lastly to be brightened with soap.

Green from sian b

Cotton dyed with Prussian blue may be dyed green by previously aluming while it is still wet with the blue, and then dipping in a weld bath, the strength of which is proportioned to the shade required. The colour from weld is more lively than that obtained from fustic. But fustic, which gives a deeper shade than weld, and diminishes the brightness of the blue, is to be preferred when a green with an olive shade is wanted.

Gene remar

The shade of green given to any stuff, it is obvious, must vary according to the intensity of the blue shade, the strength of the yellow bath, and the nature of the yellow colouring matter employed. Yellow colours are rendered more intense by means of alkalies, sulphate of lime, and ammoniacal salts; but become fainter by means of acids, alum, and solutions of tin. In dyeing Saxon green the result will be different according to the process which is followed. The effects will be different by adding a yellow to a Saxon blue, from the process in which the sulphate of indigo is mixed with the yellow ingre-

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[1] *Phil. of Perm. Col.* 336.

[2] *Ibid.* 346.

[3] Berthollet, ii. 319.

Com und Col rs.

dients; because in the latter case the sulphuric acid has a considerable action on the colouring matter, and thus diminishes the intensity of the yellow. As the particles of indigo have a stronger affinity for the stuff than the yellow colouring matter, in dyeing a succession of shades in a bath in which both are mixed, the bath being first exhausted of the indigo, the last shades incline more to the yellow, on account of the predominance of the yellow colouring matter.

Sect. II.—*Of the Mixture of Red and Blue, or Purple, &c.*

By the mixture of red and blue, violet, purple, dove-colour, lilac, and a great variety of other shades, according to the proportion of the substances employed, or the predominance of the blue or the red, are produced. In stuffs which are to be dyed violet, a deeper blue must be given; for purple colours, the ground requires to be of a lighter blue; but in lilac and other light colours, it is necessary that both the blue and the red have a light shade.

I.—*Of dyeing Wool Violet, Purple, &c.*

In the attempts which have been made to communicate a violet or purple colour to a scarlet ground, according to the observations of Hellot, the colour is very unequal. It becomes therefore necessary to give the blue colour first; and for violets or purples, the shade of blue ought not to be deeper than that of sky blue. The stuff being dyed blue, is boiled with alum, and two fifths of tartar, and is afterwards dipped in a bath composed of nearly two thirds the quantity of cochineal required for scarlet, with the addition of tartar. The same process, indeed, as for dyeing scarlet, is followed. It is a common practice to dye these colours after the reddening for scarlet, making such additions of cochineal and tartar as the intensity of the shade may require.

Lil &c.

For lighter shades, as lilacs, dove-colours, &c. the stuff may be dipped in the bath which has served for violet and purple, and is now somewhat exhausted, taking care to add a quantity of alum and tartar. For reddish shades, such as a peach-blossom, a small proportion of solution of tin is added. It may be observed in general, that although the proportion of cochineal is less in dyeing lighter shades, the quantity of tartar must not be diminished.

Ch per an horter pro ss.

To obtain the same colours, a shorter and less expensive process is recommended by Poerner. In this process he employs sulphate of indigo. He boils the stuff in a solution of alum, in the proportion of three ounces of the latter to one pound of the former, for an hour and a half, and afterwards allows it to remain in the liquid for a night after it has cooled. The dyeing bath is prepared with an ounce and a half of cochineal, and two ounces of tartar, which are boiled for three quarters of an hour: two ounces and a half of sulphate of indigo are then added, the whole is stirred, and boiled gently for fifteen minutes. The dyeing operation is conducted in the usual way, and a beautiful violet is thus obtained. To have all the variety of shades which are produced by the mixture of red and blue, the proportion of the sulphate of indigo is increased or diminished. It is sometimes increased to five ounces, and diminished to five drachms, for each pound of stuff. The quantity of cochineal is also varied, but when it is less than an ounce the colour is dull. Different proportions of tartar are also employed. To produce variety of shades, the stuff is also prepared with different proportions of solution of tin.

Pu le fr log. wo

To communicate a purple colour to wool, as well as some other shades, logwood, with the addition of galls, has been employed. The stuff is previously dyed blue, and, to give a brown shade, sulphate of iron is used; but the colours thus obtained are not permanent. By the following process, described by Decroizille, a durable dye is produced by means of this wood. He dissolved tin in sulphuric acid, to which were added common salt, red acidulous tartrite of potash, and sulphate of copper; or it may be more conveniently done by making a solution of tin in a mixture of sulphuric acid, common salt, and water, to which are to be added the tartrite and sulphate in the state of powder. Of this mordant not less than 1500 quarts were made in twenty-four hours, in a leaden vessel to which a moderate heat was applied. A very lucrative trade was carried on for three years by Decroizille, who sold it at the rate of 1s. 3d. sterling per pound.

Compound Colours.

Process.

If wool in the fleece is to be dyed, it will require a third of its weight of this mordant, while a fifth is a proportion sufficient for stuffs. A bath is prepared of such a degree of temperature as the hand can bear, with which the mordant is properly mixed, and the wool or stuff dipped in it and stirred; the same degree of temperature being kept up for two hours, and increased a little towards the end; after which it is taken out, aired, and well washed. A fresh bath of pure water is prepared at the same temperature, to which is added a sufficient quantity of the decoction of logwood; the stuff is then immersed, stirred, and the heat increased to the boiling temperature, which is to be continued for fifteen minutes, after which, the stuff being taken out, aired, and carefully rinsed, the process of dyeing is completed. If for every three pounds of wool one pound of decoction of logwood has been used, and a proportionate quantity for stuffs which require less, a fine violet colour is produced, to which a sufficient quantity of Brazil wood imparts the shade known in France by the name of *prune de Monsieur*.

Different shades from other substances.

Logwood and Brazil, fustic and yellow wood, are colouring substances which may be fixed with advantage upon wool by means of this mordant. The colour communicated by the two first of these is liable to be changed in the fulling by the action of the soap or urine employed for that purpose; but this change, which is always produced by alkaline substances, is remedied by a slightly acid bath a little hot, called *brightening*, for which the sulphuric acid has the preference. The colour becomes as deep, and frequently much brighter than before the change. Wools which have been dyed by means of this mordant are said to admit of being spun into a finer and more beautiful thread than by the use of alum. If the use of sulphate of copper is omitted, more beautiful colours are produced by fustic and yellow wood, as well as by weld. An orange-red colour is communicated by madder, but not so deep as with a similar quantity of alum. When sulphate of copper is omitted, the wool is said to become much harsher, and the mordant thus prepared yields but indifferent colours with logwood, and in particular with Brazil wood. The use and carriage of this mordant are inconvenient, on account of the heavy sediment by which the vessel is half filled under a corrosive liquor, capable only of being kept in stone ware. These inconveniences may be remedied by the omission of the water in the receipt, which leaves only a paste more conveniently used, and the carriage of it two fifths cheaper.

Nature of the process.

The above process is thus explained by Berthollet. The decomposition of the muriate of soda is effected by the action of the sulphuric acid; and the muriatic acid being thus disengaged, dissolves the tin, part of which is precipitated by means of the tartaric acid, producing the sediment already mentioned. The oxide of copper produces the blue with the colouring particles of the logwood; the violet is formed by the oxide of tin with the same wood, and the red with the colouring matter of the Brazil wood. The same ingenious chemist farther observes, that as an excess of acid is retained in the liquor, it might probably be of advantage to employ acetate as a substitute for sulphate of copper, in which case the action of the free acid would be moderated. He thinks it would still be more advisable to make use of verdigris; because the uncombined part of the oxide of copper would in that case unite with the excess of acid, on which account a smaller quantity of acid would remain in the liquor; and probably the quantity of tartar might be diminished, as a smaller quantity of tin would thus be precipitated.[1]

II.—*Of dyeing Silk Violet or Purple.*

Two kinds of violet. Silk is capable of receiving two kinds of violet colours, denominated the fine and the false, the latter of which is produced by means of archil or Brazil wood. When the fine violet colour is required, the silk must first be passed through cochineal, and dipped afterwards in the vat. The preparation and dyeing of the silk with cochineal are the same as for crimson, with the omission of tartar and solution of tin, by means of which the colour is heightened. The quantity of cochineal made use of is always proportioned to the required shade, whether it is more or less intense; but the usual proportion for a fine violet colour is two ounces of cochineal for each pound of silk. When the silk is dyed it is washed at the river, twice beetled, dipped in a vat more or less strong in proportion to the depth of the violet shade, and then washed and dried with precautions similar to those which all colours require that are dyed in the vat. If the violet is to have greater strength and beauty, it is usual to pass it through the archil bath; a practice which, though frequently abused, is not to be dispensed with for light shades, which would otherwise be too dull.

Purple. When silk has been dyed with cochineal according to the above directions, only a very light shade is requisite for purple; the shades which are deepest are dipped in a weak vat, while dipping them in cold water is sufficient for such as are lighter, the water having been incorporated with a small quantity of the liquor of the vat, because in the vat itself, however weak it might be, they would acquire too deep a tinge of blue. In this manner are the light shades of this colour, such as gilly-flower, peach-blossom, &c. produced by diminishing the quantity of cochineal.

False violets. There are various ways of imparting to silk what are denominated the false violets; but those which are most frequently used, and possessed of greatest beauty, are prepared with archil, the bath of which is, in point of strength, to be suited to the colour required. Having been beetled at the river after scouring, the silk is turned in the bath on the skein sticks; and when the colour is deemed sufficiently deep, a pattern is tried in the vat, to ascertain whether it takes the violet colour intended to be produced. If the shade is found to have acquired the proper depth, the silk is beetled at the river and dipped in the vat, in the same way as for the fine violet colours; and less either of the blue or of the archil colour is given, according as it is meant that the red or blue shade of the violet colour should predominate.

Process of Guhliche. The process recommended by Guhliche for communicating a violet colour to silk is the following. A pound of silk is to be soaked in a bath of two ounces of alum and a like quantity of solution of tin, after having carefully poured off the sediment formed in the mixture. The dye-bath is prepared with two ounces of cochineal reduced to powder, with a drachm of tartar, and the remaining part of the bath, which has answered the purpose of a mordant, with the addition of a sufficient quantity of water. When slightly boiled, such a quantity of solution of indigo is added as may communicate to the bath a proper shade of violet; after which the silk is immersed, and boiled till it has acquired the intended shade. It is then wrung, washed in a stream, and, like every other delicate colour, must be dried in the shade. The light shades exhaust the bath. But it ought to be observed that this colour, which is said to be a beautiful violet, possesses but little durability, and is apt to assume a reddish tinge, owing to the colour of the indigo fading first.

Anoth A violet colour may be imparted to silks by immersing them in water impregnated with verdigris, as a substitute for aluming, and next giving them a bath of logwood, in which they assume a blue colour, which is converted to a violet, either by the addition of alum to the bath, or by dipping them in a weaker or stronger solution of that substance, which communicates a red colour to the particles of logwood. This violet possesses but a small degree of beauty, and little durability; but if alumed silk be immersed in a bath of Brazil wood, and next in a bath of archil, after washing it at the river, a colour is obtained possessing a much higher degree of beauty and intensity. The process described above for dyeing wool succeeds equally well, according to M. Decroizille, in communicating to silk a violet colour.

III.—*Of dyeing Cotton and Linen Violet.*

Comm proces The most ordinary mode by which a violet colour is communicated to cotton and linen stuffs, is first to give them a blue ground in the vat, proportioned to the required shade, and to dry them. They are afterwards galled, in the proportion of three ounces of galls to a pound of stuff, and being left in this bath for twelve or fifteen hours, are wrung out and dried again. They are next passed through a decoction of logwood, and when thoroughly soaked and taken out, the bath receives an addition of two drachms of alum and one of dissolved verdigris for each pound of cotton or thread. The skeins are then dipped again on the skein sticks, and turned for about fifteen minutes, when they are taken out and aired. They are next immersed in the bath for fifteen minutes, taken out, and wrung. To complete the process, the vat employed is emptied; half of the decoction of logwood not formerly made use of is now poured in, with the addition of two drachms of alum, and the thread is again dipped in it till it has acquired the shade proposed, which must always regulate the strength or weakness of the decoction of logwood. This colour resists in a considerable degree the action of the air, but in point of permanency is much inferior to that which is obtained from the use of madder.

SECT. III.—*Of the Mixtures of Yellow and Red, or Orange.*

Orange is the usual result of a composition of yellow and red colours; but an almost endless variety of shades may be produced, according as we vary the proportion of the ingredients, and the particular nature of the yellow made use of. It is sometimes the practice of dyers to combine blue with yellow and red, the result of which is the colour denominated *olive*. Many varieties may be obtained from the use of weld, saw-wort, dyers-weed, and other yellows, and by employing tartar, alum, sulphate of zinc, or sulphate of copper, in the bath, or in the preparation of the cloth.

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[1] Berthollet, ii. 340.

Com und Col rs.

I.—*Of dyeing Wool Orange.*

Ora e by the s rlet proc .

By a process exactly the same as that which is followed in communicating to stuffs a scarlet colour, an orange may be given to wool; but the quantity of red must be diminished, and that of the yellow increased. If wool is dyed a red colour by means of madder, and afterwards yellow with weld, the resulting compound is a cinnamon colour, and the most proper mordant in this case is a mixture of alum and tartar. The shades may be varied at pleasure by substituting other yellow dyestuffs instead of weld, and by varying the proportions as circumstances may require. Wool may receive a reddish yellow colour by passing it through a madder bath, after it has undergone the usual process for yellow, which has already been described. The strength of the madder bath is always to be proportioned to the shade required. Brazil wood is sometimes employed with yellow substances, or mixed with cochineal and madder. Snuff, chestnut, musk, and other shades are produced by substituting walnut-tree root, walnut peels, or sumach, for weld.

II.—*Of Dyeing Silk Orange, &c.*

Mar e, &c.

Logwood, Brazil wood, and fustic, communicate to silk a marone and cinnamon colour, together with all the intermediate shades. The silk is scoured in the usual manner, alumed, and a bath is prepared by mixing together decoctions of the three different woods mentioned above, made separately, varying the quantity of each according to the shade intended to be given; but the proportion of fustic should be greatest. The silk is turned in the bath on the skein sticks, and when it is taken out, if the colour be uniform, it is wrung and again dipped in a second bath of these three ingredients, according to the effect produced by the first, in order to obtain the shade required.

Oli

The blue vat is not made use of when an olive colour is to be communicated to silk. After being alumed, it is dipped in a bath of weld, which is made very strong. To this is afterwards added the juice of logwood, with a small quantity of solution of alkali when the silk is dipped. This converts it into green, and gives the olive colour. It is dipped again in this bath till it has acquired the shade wanted.

To communicate to it the colour known by the name of *rotten olive*, fustic and logwood are added to the bath after welding, without any alkali. If the colour wanted is to incline more to a red, the addition of logwood alone is sufficient. A sort of reddish olive may likewise be obtained by dyeing the silk in a fustic bath, to which a greater or less quantity has been added of sulphate of iron and logwood.

III.—*Of dyeing Cotton and Linen Orange, &c.*

Cin on colo

A cinnamon colour is communicated to thread and cotton by commencing the process for dyeing them with verdigris and weld; they are afterwards to be dipped in a solution of sulphate of iron, denominated by the French *bain d'assurage*, and then wrung out and dried. As soon as they are dried, they are galled in the proportion of three ounces to the pound of stuff; then dried again, alumed as for red colours, and maddered. After being washed and dried, they are put into hot soap suds, and turned till they have acquired a sufficient degree of brightness. It is the practice of some dyers to add to the aluming a decoction of fustic.

Oliv

By boiling four parts of weld and one of potash in a sufficient quantity of water, M. d'Apligny informs us, a fine olive colour is communicated to cotton and thread. Brazil wood which has been steeped for a night is boiled separately with a small quantity of verdigris, and these solutions are mixed together in various proportions, according to the particular shade required. The thread or cotton is dipped in the compound solution in the usual way.

Compound Colours.

SECT. IV.—*Of the mixture of Black with other Colours.*

Brown.

The compound colours which are obtained from the mixture of black and other colours, are brown, gray, drab, &c. according to the nature and proportions of the simple colours employed.

I.—*Of dyeing Woollen Stuffs Brown, Gray, &c.*

To give a browning to cloth, as soon as it has been dyed, it is dipped in a solution of sulphate of iron, with the addition of an astringent, which makes a *black bath.* It is more common to mix a small quantity of solution of iron with a bath of water, adding more till the dyed stuff dipped in it has received the intended shade. Sulphate of iron is sometimes added to the dye bath; but by dipping the dyed stuff in a solution of this salt, the end is more easily attained. It is the usual practice of M. Poerner to soak the stuff in a solution of sulphate of iron, to which other ingredients are sometimes added; and after having taken it out of the mordant, it is dipped in the dye bath.

Coffee colour.

In order to obtain coffee and damascene colours, with other shades of browns of the common dye, the first method is adopted; a colour more or less deep is communicated to them, according to the shade intended to be obtained by the browning; and a bath is made of galls, sumach, and alder bark, with the addition of sulphate of iron. Those stuffs are first dipped to which the lightest shades are to be communicated, and when these are finished, the browner ones are dipped, a quantity of sulphate of iron being added for each operation, proportioned to the effect intended to be produced.

Gray.

Bluish grays are communicated to stuffs, according to Poerner, by the solution of indigo in sulphuric acid, combined with a mixture of decoction of galls and sulphate of iron, varying the shades according to the different quantities of these ingredients made use of. If to a bath composed of cochineal, fustic, and galls, sulphate of iron be added, other shades are obtained.

For marone, and such other colours as bear a strong resemblance to it, sanders and galls are employed, and sometimes a browning with the addition of logwood. If dyed in the remains of a cochineal bath, these colours may be made to incline to a crimson or purple; and the same effect is produced by adding a small quantity of madder or cochineal to the bath. A little tartar gives a greater degree of brightness to the colour. With a mixture of galls, fustic, and logwood, and a greater or smaller quantity of madder, with the addition of a little alum; those colours may be communicated to stuffs which are known by the name of *hazel.*

Hazel.

Puce colour.

M. Guhliche produces what is called a *puce* colour, by boiling for fifteen minutes a pound of woollen stuff with two ounces of alum, a certain proportion of vinegar and solution of iron, after which he leaves it in the mordant for twelve hours. He then makes a bath with the decoction of two ounces of white galls carefully poured off from the sediment, and mixed with four ounces of madder, in which, when it grows hot, the stuff is immersed, after being taken out of the mordant, allowing it to remain there, while the temperature is gradually increased, till the colour intended has been imparted to it; after which it is boiled for two minutes, washed, and dried in the sun. The colour thus obtained possesses a great degree of durability. It is of a deeper brown by the omission of the alum and vinegar in the mordant; and after these colours the lighter shades are dyed. Sumach may be employed as a substitute for

Compound Colours.

half of the madder. Different brown colours, possessing considerable permanency, may likewise be produced by the use of Brazil and logwood, if more or less of a solution of iron be mixed with a decoction of these substances. The wool being previously alumed and galled, is dyed in it.

II.—*Of dyeing Silk with Mixtures of Black, &c.*

Purple violet.

M. Guhliche imparts to silk a purple violet without a blue ground, with a mixture of one part of galls dissolved in white wine, with three parts of water, in which a pound of silk is macerated for twelve hours, soaked in a mordant made up of two ounces of alum, one ounce of solution of tin, and half an ounce of muriatic acid. After wringing the stuff, it is dyed in a bath composed of two ounces of cochineal and a small quantity of solution of iron, till the intended shade has been communicated; and for shades which are lighter, the residua of these baths are sufficient, either separately or mixed together. Madder may be used in the same way, macerating a pound of silk in a solution of alum mixed with an ounce of muriatic acid and a quantity of solution of iron. When the stuff is wrung out, it is dyed in a bath made of eight ounces of madder. When deeper colours are wanted, some of the solution of galls in white wine is mixed with the madder and cochineal baths.

Silk may be dyed in a bath made of equal parts of Brazil and logwood juice, adding a certain quantity of solution of iron after the stuff has been soaked in a solution of two ounces of alum and an ounce of muriatic acid. If solution of galls be added, the colour becomes deeper.

Brick colour.

Colours resembling that of brick may be produced by immersing silk in an anotta bath, after preparing it with a solution of galls mixed with a certain quantity of solution of iron. By the mixture of Brazil, logwood, archil, and galls, and by a browning with sulphate of iron, a number of different shades are produced; but the whole of them have more or less a tendency to fade, although their brightness is very pleasing to the eye.

III.—*Of dyeing Cotton and Linen with Mixtures of Black, &c.*

With black cask.

A permanent violet colour may be given to thread and cotton, when scoured in the ordinary way, by preparing a mordant with two quarts of the bath of what is called the *black cask*, and four quarts of water, for each pound of stuff, which is made to boil, and the scum is removed which forms on the surface, till it wholly disappears. The liquor is poured into a vat, and, when warm, four ounces of sulphate of copper and one ounce of nitre are dissolved in it. The skeins are left to soak in it for ten or twelve hours, wrung out, and dried. If it is required to produce a deep violet colour, two ounces of verdigris must be added to the bath; and if the nitre be omitted, the colour becomes still deeper by galling the thread more or less prior to its being put into the mordant. If the nitre be increased, and the sulphate of copper be diminished, the violet colour becomes more inclined to lilac. A number of various shades may be produced by different modifications of the mordants employed.

Marone colour.

Cotton is galled, dipped, and wrought in the common way, when different shades of marone colour are wanted. To the bath employed must be added more or less of the liquor of the black cask. The cotton is then washed in a bath mixed with verdigris, next welded, and dyed to a fustic bath, to which a solution of soda and alum is sometimes added. When the cotton prepared in this manner has been thoroughly washed, it is next well maddered, dipped in a weak solution of sulphate of copper, and last of all in soap suds.

Hazel

For some hazel and snuff colours, a browning is communicated to stuffs by means of soot, after the welding and madder bath, to which galls and fustic have been added; sometimes soot is mixed with this bath, and a browning is likewise imparted by means of a solution of sulphate of iron; and for browning colours, walnut peels are sometimes employed as a substitute for solutions of iron. For such wools as are designed for the manufacture of tapestry they are very advantageous, because the colour is not changed into yellow by exposure to the air, as is the case in browning, which is imparted by means of iron, but remains a considerable time without any sensible change. The hue is indeed rather dull, but its goodness and very moderate price are sufficient to recommend a more extensive use of it for grave colours, which in common stuffs are sometimes fashionable.

CHAPTER VI.

OF CALICO-PRINTING.

Calico-printing is the art of communicating different colours to particular parts of the surface of cotton or linen cloth, while the rest of the cloth retains its white colour; or the whole of the cloth may be dyed one colour, as *red* or *blue*, except particular parts, to which some other colours, as yellow, orange, green, &c. are given. The process is not confined to linen and cotton cloth; it may be applied also to silk and woollen cloth; but as the nature of the processes is in all cases the same, it will answer our purpose sufficiently if we give a sketch of the methods followed by the *calico-printers*.

There is a curious passage in Pliny's Natural History, from which it is evident that calico-printing in his time (the first century) was understood and practised in Egypt. The following is a translation of this passage.

"There exists in Egypt a wonderful method of dyeing. The white cloth is stained in various places, not with dye-stuffs, but with substances which have the property of absorbing *(fixing)* colours. These applications are not visible upon the cloth; but when the pieces are dipt into a hot caldron containing the dye, they are drawn out an instant after dyed. The remarkable circumstance is, that though there be only one dye in the vat, yet different colours appear on the cloth; nor can the colours be afterwards removed."[1] It is evident enough that the substances employed to stain the cloth, as Pliny expresses it, were different mordants, which served to fix the dye upon the cloth. Thus if we suppose certain parts of a piece of cotton cloth to be impregnated with alumina, and the cloth afterwards dyed with madder, after the clearing, those parts only impregnated with the mordant would retain their red colour, while the remaining parts will continue white.

The general opinion is, that this ingenious art originated in India, and from that country made its way into Egypt. Whether this notion be well or ill founded, it is certain that calico-printing was known and executed by the Indians at a very early period. Their colours were beautiful and fast, and the varieties of pattern and the number of colours which they understood to fix on different parts of the cloth gave to their printed calicoes a beauty and a value of no ordinary kind; but their processes are so tedious and so clumsy that they could be put in practice only where labour was exceedingly cheap.

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[1] Plinii *Hist. Nat.* xxxv. 11.

Cico-Prting. Intlu-ced to Eupe.

It is not more than a century and a half since calico-printing was transferred from India to Europe, and little more than a century since it became common in Great Britain. The nations with whom it has made the greatest progress are Switzerland; France, especially in Alsace; some parts of Germany; and Great Britain. In Europe the art has been in a great measure created anew. By the application of machinery, and by the light thrown on the processes by the improvements in chemistry, the tedious methods of the Indians have been wonderfully simplified; and the processes are remarkable for the rapidity with which they are executed, and for the beauty and fastness and variety of the colours which are applied on the surface of cotton and linen cloth.

We shall endeavour in this chapter to give a sketch of the different processes of calico-printing, such as they are at present practised by the most scientific printers in Lancashire, and in the neighbourhood of Glasgow.

The different processes to which the cotton cloth destined to be printed is subjected, are the following: singeing, bleaching, callendering, printing, stoving, dunging, dyeing, brightening.

1. The singeing is intended to remove the fibres of cotton which protrude on the surface of the cloth. This is done by passing the cloth rapidly over the surface of a red-hot iron plate, which burns off all the hairs or protruding fibres of cotton without injuring the cloth. Of late years singeing has been effected by a very ingenious coal gas apparatus. But we need not dwell upon this preliminary process, because the *singeing* has been described already in this Encyclopædia under the article BLEACHING, to which we refer the reader.

2. The methods of *bleaching* and *callendering* cotton have been already given at sufficient length under the article BLEACHING.

Mods of nting.

3. There are two modes of printing; namely, *block-printing* and *cylinder-printing*. The former has been practised from time immemorial; the latter is a modern invention, and originated probably after the introduction of the art of printing into Great Britain. The figure intended to be communicated to the cloth is cut out upon a block of sycamore, the parts which are to make the impression being left prominent, and the rest of the block cut away, just as practised for wooden engravings. When the figure is too complicated, and the lines too fine, to admit of being cut in wood, it is made by means of small pieces of copper, which are very ingeniously driven into the block, and the intervals are filled up with felt. Great patience and ingenuity are displayed in making these blocks for use, and calico-printers are under the necessity of keeping a number of workmen at high wages for that express purpose.

The cylinder is a large circular copper plate, being a circular ruler, several feet long, and several inches in diameter, upon which the different figures to be given to the cloth are engraved; and by its circular motion the whole of these figures are impressed upon the cloth as it moves through under the cylinder. But the usual method of cylinder-printing is to have the intended figures engraven upon a flat copper plate about a square yard (or more) in size. Upon this plate the colour to be applied is spread. It is then pulled. As it passes along, an elastic steel plate called a *doctor* takes off all the colour except that which fills the engraving. It is then pressed against the white cloth, on which it thus leaves exactly the impression of the engraving. This is a very common method of printing pocket handkerchiefs.

Whether the printing is applied by the block, the cylinder, or by flat copper plates, the treatment of the goods is nearly the same.

Calico-Printing.

Most commonly the printing process is applied to fixing mordants on the cloth, which is afterwards dyed in the common way, those parts only retaining the colour which have imbibed the mordant, while the other parts of the cloth remain white. Sometimes it is applied to cloth already dyed, in order to remove the colour from certain portions of it which are either intended to remain white, or to receive some other colour afterwards.

Sometimes it is applied to cloth before it is dyed blue, in order to prevent the indigo from being fixed on those parts to which it is applied, that they may remain white, or be afterwards made to receive other colours. Substances possessed of this property are called resist pastes.

Finally, it is frequently employed to communicate mordants and colouring matter at once to the cloth. Let us take a view of all these different uses.

I.—*Mordants.*

The principal mordants employed by the calico-printers are the following:

How made.

1. *Alumina.*—The usual aluminous mordant of the calico-printers is alum, partly decomposed by acetate of lime. The liquid is made by dissolving alum in water, and adding acetate of lime to the solution. The liquid has a specific gravity of 1·08, and contains about as much alum undecomposed as the liquid can hold in solution.

For particular purposes calico-printers make a mordant by mixing three parts of acetate of lead with four of alum. This mordant consists of a mixture of acetate of alumina and alum, for about a third part of the alum remains undecomposed.

When cloth to be dyed *red* is impregnated with this mordant, it is not thickened. When applied only to particular parts of the cloth by the block or the cylinder, it is thickened with flour or calcined starch, or gum senegal, according to the nature of the style of work.

Chemical colours what.

2. *Oxide of tin.*—Perchloride of tin is very much used as a mordant. The colouring matter is previously mixed with it, and both are applied at once. Such applications are called *chemical colours.* The mixture is allowed to dry on the cloth, which is then merely washed with water. Colours so applied are easily altered by light, soap, &c. Hence, in common language, a *chemical colour* means a fugitive colour. The colours produced in this way are, *pink*, from Brazil wood, peach wood, and cochineal; *purple*, from logwood; and *yellow*, with Persian berries.

Steam colours.

Perchloride of tin is much used in another and pretty common process of the calico-printers, known technically by the appellation of *steam colours.* It is decomposed and converted into stannate of potash. The whole piece of cloth is immersed in the liquid containing the stannate of potash, and dried. The peroxide of tin is then precipitated upon the cloth, by immersing it into a solution of sal ammoniac or sulphate of magnesia, but most commonly into a very weak solution of free sulphuric acid. The different colouring matters previously thickened with starch are then printed on the cloth, and the whole subjected to the action of steam. The consequence is, that by the joint action of moisture and heat, a combination takes place between the colouring matter and the oxide, which is thus rendered insoluble; and no considerable quantity of water is ever present to carry off the colouring matter before it has combined with the mordant.

In this way *pink*, *purple*, and *yellow* are obtained of every variety of shade that can be produced by mixture of these colours with each other, or with Prussian blue.

How used.

3. *Peroxide of iron.*—This metallic oxide is much used as a mordant. It is employed in the state of acetated protoxide of iron, by dissolving metallic iron in pyrolignic

acid.[1] In a few days after being applied to the cloth, especially if exposed to a moist atmosphere, it loses its acid, and the iron becomes peroxidized.

Acetate of iron, of specific gravity 1·05, gives a black with madder. Various shades of purple are obtained by adding different proportions of the mordant and dyestuff. Various shades of *red*, from *brown red* to *pink*, are obtained in the same way, substituting the aluminous mordant of various strengths for the iron. *Chocolates* are got by mixing the aluminous and iron mordants, and then dyeing with madder.

These are the principal mordants employed by the calico-printers. Several substances have so strong an affinity for the cloth that they require no mordant. This is the case with *indigo, sesquioxide of manganese, peroxide of iron,* and *chromate* and *dichromate of lead.*

II.—*Substances used for discharging Colours.*

Most colours are fixed in the cloth, either by means of mordants or by being in a particular state of oxidizement. Thus madder is fixed by means of alumina, and cochineal by means of oxide of tin. Sesquioxide of manganese loses its fixity and is washed away by water the moment that it is converted into protoxide. Hence, when the printers wish to discharge a colour from cloth, they employ something that will dissolve the mordant, or, if no mordant be present, will de-oxidize the colouring matter, which in that case is a metallic oxide. The *dischargers*, then, are either acids, or substances having a strong affinity for oxygen. We shall point out the chief of these, and the way of applying them.

Method of using.

1. *Citric acid* is much used by printers to dissolve alumina and peroxide of iron, and thus to prevent the colours which these mordants would fix from remaining on the cloth. It is obtained by evaporating lemon juice, and thickening it with gum-senegal for the cylinder, or with gum and pipe-clay for the block. It is occasionally assisted by bisulphate of potash or sulphuric acid.

Sometimes the citric acid is printed on white cloth, and the aluminous or iron mordant slightly thickened and dried immediately, to prevent the swelling of the acid figures. At other times the mordants are first applied, and the acids printed over them.

In both cases the goods are afterwards passed through hot water containing cow's dung, and well washed before drying. By this means all the mordant is removed from those parts on which the acid was applied, which of course remains white when the cloth is dyed.

2. *Tartaric acid* thickened with gum is applied by the block or cylinder to cloth previously dyed Turkey red. It is then passed through an aqueous solution of bleaching powder. The acid disengaging the chlorine, the red colour is discharged from those places to which it had been applied, while all the other parts of the cloth retain their red colour.

When oxide of lead is deposited on the cloth along with the acid, and the cloth, after passing through the aqueous solution of bleaching powder, is made to pass through water impregnated with bichromate of potash, the parts which would otherwise have become white are changed into a fine yellow. This beautiful process is not confined to Turkey red.

To discharge manganese.

3. *Protochloride of iron* is used to discharge the manganese brown and substitute a buff. This it does by depriving the manganese of its oxygen, and thus rendering it soluble; while the protochloride of iron converted into perchloride deposites peroxide of iron on the cloth, which combines and produces the characteristic buff or orange colour of that oxide.

Sulphate of iron is used in a variety of ways. It deoxidizes indigo in the indigo vat, and renders it soluble in lime water. It produces *gold, buff,* &c. colours, and makes a good chemical black with logwood.

4. *Protochloride of tin,* when applied to cloth dyed brown by sesquioxide of manganese, immediately reduces it to the state of protoxide, and thus discharges the colour and leaves the parts white. If it be mixed with Brazil wood or cochineal, it discharges the manganese as before, but leaves a pink. When mixed with logwood it leaves a purple, and when with Prussian blue, a blue.

To for yellow.

To produce a yellow upon manganese, ground chloride of tin is mixed with sulphate of lead. The mixture thickened with calcined starch is printed on the manganese brown. As soon as it is dry, the manganese being reduced to the state of protoxide, may be washed off; but the sulphate of lead adheres to the cloth, from an affinity which exists between them. The cloth being now passed through a solution of bichromate of potash, those parts containing the sulphate of lead are dyed a beautiful yellow by the formation of chromate of lead.

To rem iron.

Chloride of tin is capable also of removing peroxide of iron from cloth, by reducing it to protoxide, as it does the sesquioxide of manganese. For this purpose it is printed on a deep colour, composed of peroxide of iron and quercitron yellow. The protochloride of iron is formed and washed away, while the oxide of tin remaining, constitutes a mordant for the quercitron. And thus the parts to which the protochloride of tin was applied become yellow.

The protochloride of tin is also employed occasionally to discharge the orange, consisting of dichromate of lead fixed upon cloth. This it does by reducing the chromic acid to protoxide. As the green oxide of chrome still continues attached to the cloth, the discharged parts do not assume a good white colour. But this does not much affect the blue and purple colours substituted for the orange, by mixing the protochloride of tin with Prussian blue or with logwood.

When protochloride of tin is decomposed by carbonate of soda, protoxide of tin is obtained. This protoxide is used along with potash to render indigo soluble. The protoxide de-oxidizes the indigo, and the potash dissolves the yellow base. It is then applied to the cloth in the way that will be explained afterwards.

III.—*Resist Pastes.*

These pastes are substances which have the property of restoring the blue colour to dissolved indigo, and thus of preventing it from being fixed to those parts of the cloth on which the resist pastes have been applied. Any substance which has the property of parting with oxygen readily answers this purpose. Thus sulphate of copper, or any salt containing black oxide of copper, when put into the indigo vat, instantly revives the indigo, by communicating oxygen to it. The hydrated black oxide has the same effect, and so have the sesquioxide and the deutoxide of manganese.

Nature resist pastes.

The calico-printer's indigo vat is a very deep large vessel filled with water, into which indigo, sulphate of iron, and an excess of lime are put. The lime decomposes the sulphate of iron, and the protoxide of iron thus disengaged coming in contact with the indigo at the bottom of the vat, deprives it of an atom of oxygen, and thus renders it capable of combining with the lime, and of forming a compound which dissolves in water and forms a yellowish-coloured solution. Where this solution is in contact with the atmosphere the indigo is revived, assumes its blue colour, and loses its solubility. Hence the blue scum which always covers the surface; but this scum in some measure protects the rest of the vat. When cloth is dipt into this vat it comes out yellow; but the indigo, from its exposure to the air, gradually absorbs oxygen, so that the cloth becomes at first green, and finally blue. But if to any parts of the cloth before dipping something has been applied which has the property of giving out oxygen to the indigo, all the indigo which would have been imbibed by these parts has been revived before it has had time to come in contact with the cloth; and in the blue state it has not the property of uniting with the cloth, but may be easily washed off. Hence the parts to which the *resist pastes*, as they are called, have been applied, remain white. The principal resist pastes are the following:

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[1] An impure *acetic acid*, obtained by distilling wood.

Enu era-tion.

1. *Blue paste*, or *vitriol paste*, consists of a mixture of sulphate and acetate of copper, and the solution is thickened with gum-senegal and pipe-clay for the block, and with flour for the cylinder. When the cloth on which this paste has been printed is dipt into the indigo vat, the indigo is oxidized before it reaches the surface of the cloth. After dyeing, the piece is passed through weak sulphuric acid, to remove the oxide of copper which has been precipitated.

2. *Mild paste* consists of sulphate of zinc, gum, and pipe-clay. It is used along with other colours which copper would injure, or which would be destroyed by immersion in sulphuric acid. It resists a pale blue, and the removal of the oxide of zinc afterwards by an acid is not necessary, as when copper is employed.

Sulphate of zinc, as well as all the other metallic salts, and all the acids, precipitate indigo from its solution in lime. It does not revive indigo like the salts of copper; but when the base of indigo is precipitated, it is not so readily fixed as when in a state of solution. The oxide of zinc, with the gum and pipe-clay, act mechanically in keeping it at a distance.

3. *Red paste* consists of the aluminous mordant already described, mixed with acetate of copper, gum, and pipe-clay. It resists pale blues; and the alumina remains upon the portions which are white, to be afterwards dyed with madder and produce a red, or with quercitron for a yellow.

4. *Neutral paste* is the name given by calico-printers to a compound of lime juice, sulphate of copper, gum, and pipe-clay. It resists during a short dip in the blue vat; and the lime juice gives it the property of remaining white when the piece is dyed in madder, even where the preceding aluminous paste goes over it. This acid also prevents the lime of the blue vat from precipitating copper upon the cloth, which would give the cloth a deep-brown tinge in the madder vessel.

5. *Chrome yellow resist paste* consists of a mixture of a salt of copper to resist the blue vat, with a salt of lead to produce a yellow with bichromate of potash after having been dyed blue in the blue vat.

These five constitute the principal resist pastes. There are indeed a few others, but they are of little importance, and they will easily suggest themselves to those who understand the principles of chemistry.

Me ds of g ng the ious colo .

Instead of describing the mode of printing mordants and colouring matters at once, or of applying *chemical colours*, as they are called, we think it will be better to make a few observations on each particular colour in succession, without minding whether it be applied by *dyeing* or *printing*.

1. *Red.*

The usual dyestuff for red among the calico-printers is *madder*. Goods which have received the aluminous mordant applied in figures either by the cylinder or the block, are first passed through hot water containing cow-dung, and well washed. They are then put into a dye vessel along with madder and cold water, to which heat is gradually applied either by means of steam or fire. The pieces are kept constantly moving in the vessel till they have gained the requisite depth of shade, when they are taken out and washed again. The colour given by the madder to those parts of the cloth which have received no mordant, is removed by boiling the cloth in water containing either bran or soap, both of which substances have the property of removing it without injury to the red figure. Afterwards the white portion of the cloth is farther improved by rinsing it in a weak warm solution of bleaching powder.

When *Brazil* wood or *peach* wood is used instead of madder, the mordant and method of dyeing are the same. The cloth, however, does not bear the same treatment after dyeing, and does not require it, because these colours are much more easily removed from the parts of the cloth destitute of mordant.

2. *Pink.*

The most beautiful *pink* to be seen on calico is given by means of cochineal. The mordant is alumina, and the method of proceeding similar to that already described. Madder, when mixed with bran to remove the brown colouring matter, gives what is called a *brown pink.*

Safflower cannot be applied to cloth in figures, but it is frequently employed for giving a uniform pink dye to pieces of cloth. It is first steeped in water containing a carbonated alkali, which dissolves its colouring matter. The solution freed from the fibrous part of the dyestuff is then saturated by an acid, which is commonly *lime juice.* A piece of cloth immersed in this saturated solution extracts the pink colouring matter from it, which is afterwards heightened by immersion in weak cream of tartar. By this means a very beautiful but fugitive colour is communicated.

3. *Yellow.*

The most usual substance now employed by the calico-printers for communicating this colour is *chromate of lead.* The use of this very beautiful and fixed colour does not go farther back than ten or twelve years. The writer of this article endeavoured about fourteen years ago to prevail upon some of the calico-printers in the neighbourhood of Glasgow to try it, but unsuccessfully. At last, after much entreaty, Mr Ramsay, at that time an extensive manufacturer of colours for calico-printers, was induced to make a small quantity of bichromate of potash, so as to put it in the power of those who chose it to try how it would answer. Soon afterwards the use of it was introduced into some of the printing works of France. From that country it soon made its way to Lancashire, and thence to Glasgow. The bichromate of potash, when first prepared, sold as high as a guinea per pound. Of late years it has been as low as tenpence. The method of using this beautiful dyestuff is this:

Acetate or nitrate of lead is applied to the cloth, either by means of the block or cylinder. The cloth is either immediately passed through a solution of bichromate of potash, or the oxide of lead is in the first place set free from its acid by immersing the cloth in lime water, or in some cases into an aqueous solution of bleaching powder. Indeed the processes for applying chromic acid are varied in a great many ways, to suit the different colours which are applied along with the yellow; as in the yellow discharge for bronze, and the yellow resist on blue already described, the yellow discharge on Turkey red, &c. &c.

Quercitron bark is also often employed to communicate a yellow by the calico-printers. The alumina mordant is first applied, and the cloth is cleaned in the dung vessel in the way described when giving an account of madder dyeing. Quercitron bark gives out its colouring matter at a lower heat than madder; and the parts of the cloth to which no mordant has been applied remain tolerably white after the cloth has been washed in cold water.

A decoction of Persian berries constitutes likewise a common yellow dyestuff for calico-printers. The decoction is mixed with the requisite portion of alum to act as a mordant; but a combination between the alumina and the yellow colouring matter takes place without the intervention of a third agent. It is effected either by exposing the cloth to the action of steam, or by putting the piece into water containing an alkali or its carbonate.

4. *Blue.*

The usual dyestuffs for giving a blue colour to calicoes are *indigo* and *Prussian blue.*

The method of forming the indigo vat has been already mentioned. The cloth is dipped in the clear solution. When taken out it is yellow, and gradually becomes blue by absorbing oxygen from the atmosphere. If a deep shade is wanted, the cloth is immersed again, when it receives an additional quantity of indigo, which must be oxidized, as the former was, by exposure to the air. These alternate dips and airings are repeated till the requisite shade is attained.

What is called *pencil blue,* is a solution of indigo in caustic potash or soda, the indigo being de-oxidized by means of orpiment. The solution is thickened by means of British gum, or gum-senegal, and printed upon the cloth either by the block or cylinder. When upon the cloth, the indigo attracts oxygen from the air, and thus becomes blue and fixed. The gum, alkali, loose indigo, &c. are washed away in water.

Prussian blue may be applied to cloth in various ways. We shall mention some of the principal of these.

1. An iron mordant is first applied to the cloth, and allowed to remain untouched till the iron has had time to be peroxidized, and in that way become fixed. The piece is then cleaned as for dyeing, and dipt into a solution of prussiate of potash mixed with sulphuric acid, to disengage the acid or cyanogen which it contains.

2. Prussian blue is dissolved in muriatic acid, oxalic acid, perchloride of tin, or nitrate of iron, and the solution applied immediately to the cloth in the usual way.

3. Ferrocyanic acid is printed upon the cloth, and decomposed by means of a steam heat, hydrocyanic acid escapes, and cyanodide of iron remains in the cloth. It becomes blue by exposure to the air, or by being put into a weak solution of bleaching powder, or of bichromate of potash.

Logwood forms a bluish compound with the salts of copper; but this colour is exceedingly fugitive, and the use of it has been long laid aside.

5. *Black.*

Various methods are employed by the calico-printers to produce a black upon cotton. An iron mordant of the specific gravity 1·05 gives a black with madder. The common aluminous mordant gives a black when cloth impregnated with it is dyed in logwood. A chemical black is made from a decoction of nutgalls mixed with nitrated peroxide of iron. Another chemical black is formed by mixing a decoction of logwood with a solution of sulphate of iron.

If cloth be dyed successively *blue, red,* and *yellow,* it becomes *black.*

6. *Buff.*

To produce this colour, the cloth is printed with a mixture of sulphate and acetate of iron. After having had time to be partly peroxidized and partially decomposed, it is washed in water; or if a stronger buff is wanted, it is rinsed in cream of lime till the protoxide is converted into the red. No mordant is required, as the peroxide of iron has a strong affinity for cotton cloth.

7. *Gold.*

For this colour the process is the same as for buff. The only difference is, that the solution is stronger.

8. *Orange.*

The most beautiful orange is given by means of dichromate of lead. It is obtained by saturating bichromate of potash with potash or lime, and immersing in it while hot, cloth printed with a salt of lead. Nitric acid changes this orange into yellow, by uniting with half the oxide of lead.

9. *Green.*

The fast green, discovered by Mr James Thomson of Primrosehill, near Clitheroe, and commonly known by the name of *Warwick's green,* is a mixture of the pencil blue already described, and aluminated potash. The mixture is thickened and applied as the blue is. The alumina is then precipitated from its alkaline solution by being passed through a weak solution of sal ammoniac or sulphate of magnesia. The cloth is then dyed yellow in quercitron bark. It is sufficiently known that the two colours blue and yellow form a green.

Carbonate of copper makes a poor faint *green* upon cloth, while the hydrated black oxide forms a bright *blue.* It is obtained by printing on a strong solution of copper, and dipping the cloth, when dry, into strong caustic potash or soda.

The colour called *Scheele's green* is a mixture of arsenite of copper and the hydrated black oxide. It is obtained by printing on the cloth a strong solution of copper thickened with gum, and then dipping it into a mixture of arsenite of potash and caustic potash. Hot water destroys this colour, by depriving the oxide of copper of its water.

A *green* is obtained from Prussian blue and yellow berries, by mixing together ferrocyanic acid, yellow berries, and an aluminous mordant, and subjecting them to the action of steam.

Various other greens are attained by printing yellows over blues previously produced.

Saxon green is produced by printing a solution of cerulin over a yellow formed by dyeing the aluminous mordant with quercitron bark or weld. The cerulin adheres to those parts of the cloth which have been dyed yellow, but very slightly to the white cloth, from which it is easily washed away.

10. *Lilac.*

This colour is communicated to cloth by printing on a much diluted mixture of the iron and aluminous mordants thickened with gum-senegal. The cloth is then dyed in madder exactly as described for producing a red.

11. *Chocolate.*

The same mordants, but much stronger, and dyeing in madder in the same way, produces this colour.

12. *Purple.*

The iron mordant, diluted to the shade required, is printed on the cloth, which is then dyed in madder in the usual way.

When the cloth, after a weak aluminous mordant has been printed on it, is dyed in logwood, a *purple* colour is obtained.

13. *Brown.*

By far the finest and most fixed brown is communicated to cotton by means of the sesquioxide of manganese. The process is rather a recent one, but of late years it has become very general. A neutral solution of sulphate of manganese is thickened with gum, and printed on the cloth. It is then dipped into rather strong caustic potash ley, which precipitates the protoxide of manganese. By exposure to the air, or by immersion in bleaching powder solution, or in bichromate of potash, this protoxide absorbs more oxygen, and becomes fixed on the cloth. Though the state of oxidizement has not been determined by experiment, yet it is probable that the manganese is in the state of red oxide, which is a compound of two atoms sesquioxide and one atom protoxide.

14. *Drab.*

This is made by printing on an iron mordant, and then dyeing in quercitron bark.

15. *Olive.*

Formed by printing on a mixture of the iron and aluminous mordants, and dyeing in quercitron bark.

16. *Dove.*

A weak iron mordant dyed in cochineal.

17. *Slate.*

A weak iron mordant dyed in nutgalls or in sumach.

18. *Cinnamon.*

The aluminous mordant, with the addition of a little iron, dyed in a mixture of madder and quercitron bark.

Such are the principal colours given to calicoes, and such are the methods of applying and fixing them.

We have now finished our account of calico-printing; for the dunging and brightening processes have been described while treating of the various colours; and the *stoving*, which consists simply in drying the goods in a room raised by artificial heat to a temperature higher than the boiling point of water, requires no description.

(L.)

DYER, Sir James, an eminent English lawyer, chief judge of the court of common pleas in the reign of Queen Elizabeth. He died in 1581; and about twenty years afterwards was published his large collection of Reports, which have been highly esteemed for their succinctness and solidity. He also left other writings behind him relative to his profession.

Dyer, *John*, the son of Robert Dyer, a Welsh solicitor of great capacity, was born in 1700. He passed through Westminster school under the care of Dr Freind, and was then called home to be instructed in his father's profession. His genius, however, led him a different way; for besides his early taste for poetry, he had a passion no less strong for the arts of design, and determined to make painting his profession. With this view, having studied some time under a master, he became, as he tells his friend, an itinerant painter, and wandered about South Wales and the parts adjacent. About 1727 he printed *Grongar Hill*. Being probably dissatisfied with his own proficiency, he made the tour of Italy, where, besides the usual study of the remains of antiquity, and the works of the great masters, he frequently spent whole days in the country about Rome and Florence, sketching those picturesque prospects with facility and spirit. Images drawn from thence naturally transferred themselves into his poetical compositions; the principal beauties of *The Ruins of Rome* are perhaps of this kind; and the various landscapes in *The Fleece* have been particularly admired. On his return to England he published *The Ruins of Rome*, 1740; but soon found that he could not relish a town life, nor submit to the assiduity required in his profession. As his turn of mind was rather serious, and his conduct and behaviour were always irreproachable, he was advised by his friends to enter into holy orders; and it is presumed, though his education had not been regular, that he found no difficulty in obtaining them. He was ordained by the Bishop of Lincoln, and had a law degree conferred on him.

About the same time he married a lady of Coleshill, named Ensor, "whose grandmother," says he, "was a Shakspeare, descended from a brother of every body's Shakspeare." His ecclesiastical provision was a long time but slender. His first patron, Mr Harper, gave him, in 1741, Calthorpe, in Leicestershire, of L.80 a year, on which he lived ten years; and in April 1751 he exchanged it for Belchford, in Lincolnshire, of L.75, which was given him by Lord Chancellor Hardwicke, on the recommendation of a friend to virtue and the muses. His condition now began to mend. In 1752 Sir John Heathcoate gave him Coningsby, of L.140 a year, and, in 1756, when he was created LL.B. without any solicitation of his own, obtained for him from the chancellor, Kirby-on-Bane, of L.110. In 1757 he published *The Fleece*, his greatest poetical work, of which Dr Johnson relates this ludicrous story. Dodsley the bookseller was one day mentioning it to a critical visitor, with more expectation of success than the other could easily admit. In the conversation the author's age was asked; and being represented as advanced in life, "He will," said the critic, "be buried in woollen." He did not indeed long outlive that publication, nor enjoy the increase of his preferments; for a consumptive disorder, with which he had long struggled, carried him off at length in 1758.

Mr Dyer's character as a writer has been fixed by three poems, *Grongar Hill*, *The Ruins of Rome*, and *The Fleece*; in which a poetical imagination perfectly original, a natural simplicity connected with, and often productive of the true sublime, and the warmest sentiments of benevolence and virtue, have been universally observed and admired. These pieces were published separately in his lifetime; but after his death were collected and published in one volume 8vo, 1761, with a short account of himself prefixed.

DYNAMICS.

Dynamics.
Definition.

1. THIS name marks that department of physico-mathematical science which contains the abstract doctrine of *moving forces;* that is, whatever necessarily results from the relations of our ideas of motion, and of the immediate causes of its production and changes.

Object of dynamics is change of that condition of a thing which we call its *motion.*

2. All *changes* of motion are considered by us as the indications, the characteristics, and the measures of changing causes. This is a physical law of human thought, and therefore a principle to which we may refer, and from which we must derive all our knowledge of those causes. When we appeal to our own thoughts or feelings, we do not find in ourselves any disposition to refer mere existence to any cause, although the beginning of existence certainly produces this reference in an instant. Had we always observed the universe in motion, it does not appear that we should have ascribed it to a cause, till the observation of relative rest, or something leading to it, had enabled us to separate, by abstraction, the notion of matter from that of motion. We might then perceive that rest is not incompatible with matter; and we might even observe, by means of relative motions, that absolute rest might be produced by the concourse of equal and opposite motions. But all this requires reflection and reasoning, whereas we are now speaking of the first suggestions of our minds.

3. We cannot have any notion of motion *in abstracto,* without considering it as a state or condition of existence which would remain if not changed by some cause. It is from changes alone, therefore, that we infer any agency in nature; and it is in these that we are to find all that we know of their causes.

Mechanical relation, what.

4. When we look around us, we cannot but observe that the motions of bodies have in most cases, if not always, some relation to the situation, the distance, and the discriminating qualities of other bodies. The motions of the moon have a palpable relation to the earth; the motions of the tides have as evident a relation to the moon; the motions of a piece of iron have a palpable dependence on a magnet. The vicinity of the one seems to be the occasion at least of the motions of the other. The causes of these motions have an evident connection with or dependence on the other body. We are even disposed to imagine that they are inherent in that body, and that it possesses certain qualities which are the causes of those modifications of motion in other bodies. These serve to distinguish some bodies from others, and may therefore be called *properties;* and since the condition of other bodies so evidently depends on them, these properties express very interesting relations of bodies, and are chiefly attended to in the enumeration of the circumstances which ascertain what we call the *nature* of any thing. We do not mean to say that these inferences are always just; nay, we know that many of them are ill founded; but they are real, and they serve abundantly for informing us what we may expect from any proposed situation of things. It is enough for us to know, that when a piece of iron is so and so situated in relation to a magnet, it will move in a certain manner.

Dyna

This mutual relation of bodies is differently considered, according to the interest that we chance to take in the phenomenon. The cause of the approach of the iron to a magnet is generally ascribed to the magnet, which is said to attract the iron, because we commonly employ the magnet in order that these motions may take place. The similar approach of a stone to the earth is ascribed to the stone, and we say that it tends to the earth. In all probability the procedure of nature is the same in both; for they are observed in every instance to be mutual between the related bodies. As iron approaches a magnet, so the magnet approaches the iron. The same thing is observed in the motions of electrified bodies; also in the case of the stone and the earth. Therefore the cause of the motions may be conceived as inherent in either, or in both.

Force
Action
figurat
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The qualities thus inherent in bodies constituting their mechanical relations, have been called the *mechanical affections of matter.* But they are more commonly named *powers* or *forces;* and the event which indicates their presence is considered as the effect and mark of their agency. The magnet is said to *act* on the iron, the earth is said to *act* on the stone; and the iron and the stone are said to *act* on the magnet and on the earth.

All this is figurative or metaphorical language. All languages have begun with social union, and have improved along with it. The first collections of words expressed the most familiar and the most interesting notions. In the process of social improvement, the number of words did not increase in the same proportion with the notions that became interesting and familiar in their turn: for it often happened that relations of certain ideas so much resembled the relations of certain other ideas, that the word expressing one of them served very well for expressing the other; because the dissimilar circumstances of the two cases prevented all chance of mistake. Thus we are said to *surmount* a difficulty, without attaching to the word the notion of *getting over* a steep hill. Languages are thus filled with figurative expressions.

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5. *Power, Force,* and *Action,* are words which must have appeared in the language of the most simple people; because the notions of personal ability, strength, and exertion, are at once the most familiar and the most interesting that can have a place in the human mind. These terms, when used in their pure, primitive sense, express the notions of the power, force, and action of a sentient, active being. Such a being only is an agent. The exertion of his power or force is (exclusively) action; but the relation of cause and effect so much resembles in its results the relation between this force and the work performed, that the same term may be very intelligibly employed for both. Perhaps the only case of pure unfigurative action is that of the mind on the body. But as this is always with the design of producing some change on external bodies, we think only of them; the instrument or tool is overlooked, and we say that we act on the external body. Our *real* action therefore is but the first movement in a long train of successive events, and is but the remote cause of the interesting event. The resemblance to such actions is very strong indeed in many cases of mechanical phenomena. A man throws a ball by the motion of his arm. A spring impels a ball in the same manner by unbending. These two events resemble each other in every circumstance but the action of the mind on the corporeal organ; the rest of it is a train of pure mechanism. In general, because the ultimate results of the mutual influence of bodies on each other greatly resemble the ultimate results of our actions on bodies, we have not invented appropriated terms, but have contented ourselves with those already employed for expressing our own actions, the exertions of our own powers or forces. The relation of physical cause and effect is expressed metaphorically in the words which belong properly to the relation of agent and action. This has been attended by the usual consequences of poverty

of language, namely, ambiguity, and sometimes mistake, both in our reflections (which are generally carried on by mental discourse), our reasonings, and our conclusions. It is necessary to be on our guard against such mistakes; for they frequently amount to the confounding of things totally different. Many philosophers of great reputation, on no better foundation than this metaphorical language, have confounded the relations of activity and of causation, and even denied that there is any difference; and they have affirmed that there is the same invariable relation between the determinations of the will and the inducements that prompt them, as there is between any physical power and its effect. Others have maintained that the first mover in the mechanical operations, and indeed through the whole train of any complicated event, is a percipient and intending principle, in the same manner as in our actions. According to these philosophers, a particle of gravitating matter perceives its relation to every other particle in the universe, and determines its own motion according to fixed laws, in exact conformity to its situation. But the language, and even the actions of all men, show that they have a notion of the relation of an agent to the action, easily distinguishable (because all distinguish it) from the relation between the physical cause and its effect. This metaphorical language has affected the doctrines of mechanical philosophy, and has produced a dispute about some of its first principles; the only way to decide this dispute is to avoid most scrupulously all metaphorical language, though at the expense of much circumlocution.

Dir ions for t safe emp- me of this a- logy.

6. When we speak of powers or forces as residing in a body, and the effect as produced by their exertion, the body, considered as possessing the power, is said to *act* on the other. A magnet is said to act on a piece of iron; a billiard ball in motion is said to act on one that is hit by it; but if we attempt to fix our attention on this action, as distinct both from the agent and the thing acted on, we find no object of contemplation; the exertion or procedure of nature in producing the effect does not come under our view. When we *speak* of the action as distinct from the agent, we find that it is not the action, properly speaking, but the act, that we speak of. In like manner the action of a mechanical power can be conceived only in the effect produced.

Act imp s cha ; and ere mot is not tion.

7. A man is not said to act unless he produces some effect. Thought is the act of the thinking principle; motion of the limb is the act of the mind on it. In mechanics also, there is action only in so far as there is mechanical effect produced. I must act violently in order to begin motion on a slide. I must exert force, and this force exerted produces motion. I conceive the production of motion in all cases as the exertion of force; but it requires no exertion to continue the motion along the slide; I am conscious of none; therefore I ought to infer that no force is necessary for the continuation of any motion. The continuation of motion is not the production of any new effect, but the permanency of an effect already produced. We indeed consider motion as the effect of an action; but there would be no effect if the body were not moving. Motion is not the action, but the effect of the action.

Pre on, imp ion.

8. Mechanical actions have been usually classed under two heads. They are either *pressures* or *impulsions*. They are generally considered as of different kinds—the exertions of different powers. *Pressure* is supposed to differ essentially from *impulse*.

Instead of attempting to define, or describe, these two kinds of forces and actions, we shall just mention some instances. This will give us all the knowledge of their distinctions that we can acquire.

Examples of pression.

When a ball lies on a table, and I press it gently on one side, it moves toward the other side of the table. If I follow it with my finger, continuing my pressure, it accelerates continually in its motion. In like manner, when I press on the handle of a common kitchen jack, the fly *begins* to move. If I continue to urge or press round the handle, the fly accelerates continually, and may be brought into a state of very rapid motion. These motions are the effects of genuine pressure. The ball would be urged along the table in the same manner, and with a motion continually accelerated, by the unbending of a spring. Also, a spring coiled up round the axis of the handle of the jack would, by uncoiling itself, urge round the fly with a motion accelerating in the same way. The more I reflect on the pressure of my finger on the ball, and compare it with the effect of the spring on it, the more clearly do I see the perfect similarity; and I call these influences, exertions, or actions, by one name, *pressure*, taken from the most familiar instance of them.

Again, the very same motion may be produced in the ball or fly, by pulling the ball or the machine by means of a thread, to which a weight is suspended. As both are motions accelerated in the same manner, I call the influence or action of the thread on the ball or machine by the same name, *pressure*, and *weight* is considered as a pressing power. Indeed I feel the same compression from the real pressure of a man on my shoulders that I would feel from a load laid on them. But the weight in our example is acting by the intervention of the thread. By its pressure it is pulling at that part of the thread to which it is fastened; this part is pulling at the next by means of the force of cohesion; and this pulls at a third, and so on, till the most remote pulls at the ball or the machine. Thus may elasticity, weight, cohesion, and other forces, perform the office of a genuine power; and since their result is always a motion beginning from nothing, and accelerating by perceptible degrees to any velocity, this resemblance makes us call them by one familiar name.

But further, I see that if the thread be cut, the weight will fall with an accelerated motion, which will increase to any degree, if the fall be great enough. I ascribe this also to a pressing power acting on the weight. Nay, after a very little refinement, I consider this power as the cause of the body's weight; which word is but a distinguishing name for this particular instance of pressing power. Gravitation is therefore added to the list of pressures; and for similar reasons the attractions and repulsions of magnets or electric bodies may be added to the list; for they produce actual compressions of bodies placed between them, and they produce motions gradually accelerated, precisely as gravitation does. Therefore all these powers may be distinguished by this descriptive name, *pressures*, which, in strict language, belongs to one of them only.

Gravity, attractions, and repulsions, are considered as pressions.

Several writers, however, subdivide this great class into pressions and solicitations. Gravity is a solicitation *ab extra*, by which a body is urged downward. In like manner the forces of magnetism and electricity, and a vast variety of other attractions and repulsions, are called *solicitations*. We see little use for this distinction, and the term is too like an affection of mind.

Examples of impulsion.

9. *Impulsion* is exhibited when a ball in motion puts another ball into motion by hitting, or (to speak metaphorically) by striking it. The appearances here are very different. The body that is struck acquires, in the instant of impulse, a sensible quantity of motion, and sometimes a very rapid motion. This motion is neither accelerated nor retarded after the stroke, unless it be affected by some other force. It is also remarked that the rapidity of the motion depends, *inter alia*, on the previous velocity of the striking body. For instance, if a clay ball,

moving with any velocity, strike another equal ball which is at rest, the struck ball moves with half the velocity of the other. And it is farther remarkable that the striking body always loses as much motion as the struck body gains. This universal and remarkable fact seems to have given rise to a confused or indistinct notion of a sort of transference of motion from one body to another. The phraseology in general use on this subject expresses this in the most precise terms. The one ball is not said to cause or produce motion in the other, but to *communicate* motion to it; and the whole phenomenon is called the *communication of motion.* We call this an *indistinct* notion; for surely no one will say that he has any clear conception of it. We can form the most distinct notion of the communication of heat, or of the cause of heat; of the communication of saltness, sweetness, and a thousand other *things;* but we cannot conceive how part of that identical motion which was formerly in A, is now infused into B, being given up by A. It is in our attempt to form this notion that we find that motion is not a *thing,* not a substance which can exist independently, and is susceptible of actual transference. It appears in this case to be a state, or condition, or mode of existence, of which bodies are susceptible, which is producible, or (to speak without metaphor) causable, in bodies, and which is the effect and *characteristic* of *certain* natural qualities, properties, or powers. We are anxious to have our readers impressed with clear and precise notions on this subject, being confident that such, and only such, will carry them through some intricate paths of mechanical and philosophical research.

Communication of motion not a good expression.

Inherent force is the distinctive character of impulsion,

10. The remarkable circumstance in this phenomenon is, that a rapid motion, which requires for the effecting it the action of a pressing power, continued for a sensible, and frequently a long time, seems to be affected in an instant by impulsion. This has tended much to support the notion of the actual transference of something formerly possessed exclusively by the striking body, inhering in it, but separable, and now transfused into the body stricken. And now room is found for the employment of metaphor, both in thought and language. The *striking* body affects the body which it thus impels: it therefore possesses the *power* of impulsion, that is, of *communicating* motion. It possesses it only while it is in motion. This *power,* therefore, is the efficient distinguishing cause of its motion, and its only office must be the continuation of this motion. It is therefore called the *inherent force,* the force inherent in a moving body, VIS INSITA *corpori moto.* This force is transfused into the body impelled; and *therefore* the transference is instantaneous, and the impelled body continues its motion till it is changed by some other action. All this is at first sight very plausible; but a scrupulous attention to those feelings which have given rise to this metaphorical conception should have produced very different notions. I am conscious of exertion in order to begin motion on a slide; but if the ice be very smooth, I am conscious of no exertion in order to slide along. My power is felt only while I am conscious of exerting it; therefore I have no primitive feeling or notion of power while I am sliding along. I am certain that no exertion of power is necessary here. Nay, I find that I cannot think of my moving forward without effort otherwise than as a certain mode of my existence. Yet we imagine that the partizans of this opinion did really deduce it in some shape from their feelings. We must continue the *exertion* of walking in order to walk on; our power of walking must be continually exerted, otherwise we shall stop. But this is a very imperfect, incomplete, and careless observation. Walking is much more than mere continuance in progressive motion. It is a continually repeated lifting our body up a small height, and allowing it to come down again. This renewed ascent requires repeated exertion.

11. We have other observations of importance yet to make on this force of moving bodies, but this is not the most proper occasion. Meanwhile we must remark, that the instantaneous production of rapid motion by impulse has induced the first mechanicians of Europe to maintain that the power or force of impulse is unsusceptible of any comparison with a pressing power. They have asserted that impulse is infinitely great when compared with pressure; not recollecting that they held them to be things totally disparate, that have no proportion more than weight and sweetness. But these gentlemen are perpetually enticed away from their creed by the similarity of the ultimate results of pressure and impulse. No person can find any difference between the motion of two balls moving equally swift, in the same direction, one of which is descending by gravity, and the other has derived its motion from a blow. This struggle of the mind to maintain its faith, and yet accommodate its doctrines to what we see, has occasioned some other curious forms of expression. Pressure is considered as an *effort* to produce motion. When a ball lies on a table, its weight, which they call a *power,* continually and repeatedly *endeavours* (mark the metaphorical word and thought) to move the ball downward. But these efforts are ineffectual. They say that this ineffectual power is *dead,* and call it a *vis mortua:* but the force of impulsion is called a *vis viva,* a living force. But this is very whimsical and very inaccurate. If the impelling ball falls perpendicularly on the other lying on the table, it will produce no motion, any more than gravity will; and if the table be annihilated, gravity becomes a *vis viva.*

We must now add, that in order to prove that impulse is infinitely greater than pressure, these mechanicians turn our attention to many familiar facts which plead strongly in their favour. A carpenter will drive a nail into a board with a very moderate blow of his hammer. This will require a pressure which seems many hundred times greater than the impelling effort of the carpenter. A very moderate blow will shiver into pieces a diamond which would carry the weight of a mountain. Seeing this prodigious superiority in the impulse, how shall they account for the production of motion by means of pressure; for this motion of the hammer might have been acquired by its falling from a height; nay, it is actually acquired by means of the continued pressure of the carpenter's arm. They consider it as the aggregate of an infinity of succeeding pressures in *every* instant of its continuance; so that the insignificant smallness of each effort is compensated by their inconceivable number.

On the whole, we do not think that there is clear evidence that there are two kinds of mechanical force essentially different in their nature. It is virtually given up by those who say that impulse is infinitely greater than pressure. Nor is there any considerable advantage to be obtained by arranging the phenomenon under those two heads. We may perhaps find some method of explaining satisfactorily the remarkable difference that is really observed in the two modes of producing motion; namely, the gradual production of motion by acknowledged pressure, and the instantaneous production of it by impulse. Indeed we should not have taken up so much of our readers' attention with this subject, had it not been for some inferences that have been made from these premises, which meet us in our very entry on the consideration of first principles, and that are of extensive influence on the whole science of mechanical philosophy, and, indeed, on the whole study of nature.

Is Imp- ion t ole c se of mo n?

12. Mechanicians are greatly divided in their opinion about the nature of the sole moving force in nature. Those whom we are now speaking of seem to think that all motion is produced by pressure; for when they consider impulse as equivalent to the aggregate of an infinity of repeated pressures, they undoubtedly suppose any pressure, however insignificant, as a moving force. But there is a party, both numerous and respectable, who maintain that impulsion is the sole cause of motion. We see bodies in motion, say they, and we see them impel others; and we see that this production of motion is regulated by such laws, that there is but one absolute quantity of motion in the universe which remains unalterably the same. It must therefore be transfused in the acts of collision. We also see, with clear evidence, in some cases, that motion can produce pressure. Euler adduces some very whimsical and complicated cases, in which an action precisely similar to pressure may be produced by motion. Thus, two balls connected by a thread may be so struck that they shall move forward, and at the same time wheel round. In this case the connecting thread will be stretched between them. Now, say the philosophers, since we see motion, and see that pressure may be produced by motion, it is preposterous to imagine that it is any thing else than a result of certain motions; and it is the business of a philosopher to inquire and discover what motions produce the pressures that we observe.

They then proceed to account for those pressing powers, or solicitations to motion, which we observe in the acceleration of falling bodies, the attractions of magnetism and electricity, and many other phenomena of this kind, where bodies are put in motion by the vicinity of other bodies, or, in the popular language, by the action of other bodies at a distance. To say that a magnet can act on a piece of remote iron, is to say that it can act *where* it is not, which is as absurd as to say that it can act *when* it is not. *Nihil movetur*, says Euler, *nisi a contiguo et moto.*

How oes it pr uce pres e?

The bulk of these philosophers are not very anxious about the way in which these motions are produced, nor do they fall upon such ingenious methods of producing pressure as the one already mentioned, which was adduced by Euler. The piece of iron, say they, is put in motion when brought into the neighbourhood of a magnet, because there is a stream of fluid issuing from one pole of the magnet, which circles round the magnet, and enters at the other pole. This stream impels the iron, and arranges it in certain determined positions, just as a stream of water would arrange the flote grass. In the same manner, there is a stream of fluid continually moving towards the centre of the earth, which impels all bodies in lines perpendicular to the surface; and so on with regard to other like phenomena. These motions are thus reduced to very simple cases by impulsion.

Inco a- tible ith the es of phil . phis .

It is unnecessary to refute this doctrine at present: it is enough that it is contrary to all the dictates of common sense. To *suppose* an agent that we do not see, and for whose existence we have not the smallest argument; with equal propriety we might suppose ministering spirits, or any thing that we please.

Oth mai in that es- sure the sole ov- ing ce.

13. Other philosophers are so dissatisfied with this notion of the production of pressure, that they, on the other hand, affirm that pressure is the only moving force in nature; not according to the popular notion of pressure, by the mutual contact of solid bodies, but that kind of pressure which has been called *solicitation*, such as the power of gravity. They affirm that there is no such thing as contact on instantaneous communication of motion by real collision. They say, and they prove it by very convincing facts, that the particles of solid bodies exert very strong repulsions to a small distance; and therefore, when they are brought by motion sufficiently near to another body, they repel it, and are equally repelled by it. Thus is motion produced in the other body, and their own motion is diminished. And they then show, by a scrupulous consideration of the state of the bodies while the one is advancing and the other retiring, in what manner the two bodies attain a common velocity, so that the quantity of motion before collision remains unchanged, the one body gaining as much as the other loses. They also show cases of such mutual action between bodies, where it is evident that they have never come into contact; and yet the result has been precisely similar to those cases where the motion appeared to be changed in an instant. Therefore they conclude that there is no such thing as instantaneous *communication*, or transfusion of motion, by contact in collision or impulse. The reason why previous motion of the impelling body is necessary, is not that it may have a *vis insita corpori moto*, a force inherent in it *by its being in motion*, but that it may continue to follow the impelled and retiring body, and exert on it a force inherent in itself, whether in motion or at rest. According to these philosophers, therefore, all moving forces are of that kind which has been named *solicitation*, such as gravity. We shall know it afterwards by the more familiar and descriptive name of *accelerating* or *retarding* force.

Action, re-sistance, re-action.

14. The exertions of mechanical forces are differently termed, according to the reference that we make to the result. If in boxing or wrestling I strike, or endeavour to throw my antagonist, I am said to *act;* but if I only parry his blows, or prevent him from throwing me, I am said to *resist.* This distinction is applied to the exertions of mechanical powers. When one body, A, changes the motion of another, B, we may consider the change in the motion of B either as the indication and measure of A's power of producing motion, or as the indication and measure of A's resistance to the being brought to rest, or having its motion any how changed. The distinction is not in the thing itself, but only in the reference that we are disposed, by other considerations, to make of its effect. They may be distinguished in the following manner: If a change of motion follow when one of the powers ceases to be exerted, that power is conceived as having resisted. The whole language on this subject is metaphorical. Resistance, effort, endeavour, &c. are words which cannot be employed in mechanical discussions without figure, because they all express notions which relate to sentient beings; and the unguarded indulgence of this figurative language has so much affected the imagination of philosophers, that many have almost animated all matter. Perhaps the word *reaction*, introduced by Newton, is the best term for expressing that mutual force which is perceived in all the operations of nature that we have investigated with success. As the magnet attracts iron, and in so doing is said to *act* on it; so the iron attracts the magnet, and may be said to *re-act* on it.

We need not suppose action at a distance. Tendency.

15. With respect to the difficulty that has been objected to the opinion of those who maintain that all the mechanical phenomena are produced by the agency of attracting or repelling forces; namely, that this supposes the bodies to act on each other at a distance, however small those distances may be, which is thought to be absurd, we may observe, that we may ascribe the mutual approaches or recesses to tendencies to or from each other. What we call *the attraction of the magnet* may be considered as a tendency of the iron to the magnet, somewhat similar to the gravitation of a stone toward the earth. We surely (at least the unlearned) can and do conceive the iron to be affected by the magnet, *without thinking* of any intermedium. The thing is not therefore inconceivable, which is all that we know about absurdity; and we do not

know any thing about the nature or essence of matter which renders this tendency to the magnet impossible. That we do not see intuitively any reason why the iron should approach the magnet, must be granted; but this is not enough to entitle us to say that such a thing is impossible, or inconsistent with the nature of matter. It appears, therefore, to be very hasty and unwarrantable to suppose the impulse of an invisible fluid, of which we know nothing, and of the existence of which we have no proof. Nay, if it be true that bodies do not come into contact, even when one ball hits another, and drives it before it, this invisible fluid will not solve the difficulty, because the same difficulty occurs in the action of any particle of the fluid on the body. We are obliged to say that the production of motion without any *observed* contact, is a much more familiar phenomenon than the production of motion by impulsion. More motion has been produced in this way by the gravitation of a small stream of water, running ever since the creation, than by all the impulses in the world twice told. We do not mean by this to say, that the giving to this observed mutual relation between iron and a loadstone the name *tendency* makes it less absurd than when we say that the loadstone attracts the iron; it only makes it more conceivable. It suggests a very familiar analogy; but both are equally figurative expressions, at least as the word tendency is used at present. In the language of ancient Rome, there was no metaphor when Virgil's hero said, *Tendimus in Latium. Tendere versus solem* means, in plain Latin, to *approach the sun.* The safe way of conceiving the whole is to say that the condition of the iron depends on the vicinity of the magnet.

Attraction, repulsion, are figurative terms.

16. When the exertions of a mechanical power are observed to be always directed toward a body, that body is said to attract; but when the other body always moves off from it, it is said to repel. These also are metaphorical expressions. I attract a boat when I pull it toward me by a rope; this is purely *Attraction:* and it is pure, unfigurative *Repulsion,* when I push any body from me. The same words are applied to the mechanical phenomena, merely because they resemble the results of real attraction or repulsion. We must be much on our guard to avoid metaphor in our conceptions, and never allow those words to suggest to our mind any opinion about the *manner* in which the mechanical forces produce their effects. It is plain, that if the opinion of those who maintain the existence and action of the above-mentioned invisible fluid be just, there is nothing like attraction or repulsion in the universe. We must always recur to the simple phenomenon, the motion to or from the attracting or repelling body; for this is all we see, and generally all that we know.

Forces are conceived as measurable quantities.

17. We conceive one man to have twice the strength of another man, when we see that he can withstand the united effort of two others. Thus animal force is conceived as a quantity, made up of and measured by its own parts. But we doubt exceedingly whether this be an accurate conception. We have not a distinct notion of one strain added to another, though we have of their being joined or combined. We want words to express the difference of these two notions in our own minds, but we imagine that others perceive the same difference. We conceive clearly the addition of two lines or of two minutes; we can conceive them apart, and perceive their boundaries, common to both, where one ends and the other begins. We cannot conceive thus of two forces combined; yet we cannot say that two equal forces are *not* double of one of them. We measure them by the effects which they are known to produce. Yet there are not wanting many cases where the action of two men, equally strong, does not produce a double motion.

How sured.

In like manner, we conceive all mechanical forces as measurable by their effects; and thus they are made the subjects of mathematical discussion. We talk of the proportions of gravity, magnetism, electricity, &c.; nay, we talk of the proportion of gravity to magnetism: yet these, considered in themselves, are disparate, and do not admit of any proportion; but they produce effects, some of which are measurable, and whose assumed measures are susceptible of comparison, being quantities of the same kind. Thus, one of the effects of gravity is the acceleration of motion in a falling body: magnetism will also accelerate the motion of a piece of iron; these two accelerations are comparable. But we cannot compare magnetism with heat, because we do not know any measurable effects of magnetism that are of the same kind with any effects of heat.

By th effects

When we say that the gravitation of the moon is the 3600th part of the gravitation at the sea-shore, we mean that the fall of a stone in a second is 3600 times greater than the fall of the moon in the same time. But we also mean (and this expresses the proportion of the *tendency* of gravitation more purely), that if a stone, when hung on a spring steelyard, draw out the rod of the steelyard to the mark 3600, the same stone, taken up to the distance of the moon, will draw it out no farther than the mark 1. We also mean, that if the stone at the sea-shore draw out the rod to any mark, it will require 3600 such stones to draw it out to that mark when the trial is made at the distance of the moon. It is not, therefore, in consequence of any immediate perception of the proportion of the gravitation at the moon to that at the surface of the earth that we make such an assertion; but these motions, which we consider as its effects in these situations, being magnitudes of the same kind, are susceptible of comparison, and have a proportion which can be ascertained by observation. It is these proportions that we contemplate; although we speak of the proportions of the unseen causes, the forces, or endeavours to descend. It will be of material service to the reader to peruse the judicious and acute dissertation on *quantity* in the works of Dr Reid (vol. ii.), where he will see clearly how force, velocity, density, and many other magnitudes of very frequent occurrence in mechanical philosophy, may be made the subjects of mathematical discussion, by means of some of those proper quantities, measurable by their own parts, which are to be assumed as their measures. Pressures are measurable only by pressures. When we consider them as moving powers, we should be able to measure them by *any* moving powers, otherwise we cannot compare them; therefore it is not as pressures that we then measure them. This observation is momentous.

One circumstance must be carefully attended to. That those assumed measures may be accurate, they must be invariably connected with the magnitudes which they are employed to measure, and so connected that the degrees of the one must change in the same manner with the degrees of the other. This is evident, and is granted by all. But we must also *know* this of the measure we employ; we must see this constant and precise relation. How can we know this? We do not perceive force as a separate existence, so as to see its proportions, and to see that these are the same with the proportions of the measures, in the same manner that Euclid sees the proportions of triangles and those of their bases, and that these proportions are the same when the triangles are of equal altitudes. How do we discover that to every magnitude which we call *force* is invariably attached a corresponding magnitude of acceleration or deflection? Clearly. In fact, the very existence of the force is an inference that we make from the observed acceleration; and the degree of the force is, in like manner, an inference from the observed magnitude of the acceleration. Our measures are therefore necessarily connected with the magnitudes which they measure, and their proportions are the same; because the one is always an inference from the other, both in species and in degree.

Dynamics is a demonstrative science.

18. It is now evident that these disquisitions are susceptible of mathematical accuracy. Having selected our measures, and observed certain mathematical relations of those measures, every inference that we can draw from the mathematical relations of the proportions of those representations is true of the proportions of the motions, and therefore of the proportions of the forces. And thus dynamics becomes a demonstrative science, one of the *disciplinæ accuratæ*.

19. But moving forces are considered as differing and in kind; that is, in direction. We assign to the force the direction of the observed change of motion, which is not only the indication, but also the characteristic, of the changing force. We call it an *accelerating*, *retarding*, *deflecting force*, according as we observe the motion to be accelerated, retarded, or deflected.

These denominations show us incontestably that we have no knowledge of the forces different from our knowledge of the effects. The denominations are all either descriptive of the effects, as when we call them accelerating, penetrating, protrusive, attractive, or repulsive forces; or they are names of reference to the substances in which the accelerating, protrusive, &c. forces are supposed to be inherent, as when we call them *magnetism*, *electricity*, *corpuscular*, &c.

Forces are discovered by their opposition to other forces.

20. When I struggle with another, and feel, that in order to prevent being thrown, I must exert force, I learn that my antagonist is exerting force. This motion is transferred to matter; and when a moving power which is *known* to operate produces no motion, we conceive it to be opposed by another equal force, the existence, agency, and intensity of which is detected and measured by these means. The quiescent state of the body is considered as a change on the state of things that would have been exhibited in consequence of the known action of one power, had this other power not acted; and this change is considered as the indication, characteristic, and measure, of another power, detected in this way. Thus forces are recognised not only by the changes of motion which they produce, but also by the changes of motion which they prevent. The cohesion of matter in a string is inferred not only by its giving motion to a ball which I pull toward me by its intervention, but also by its suspending that ball, and hindering it from falling. I know that gravity is acting on the ball, which, however, does not fall. The solidity of a board is equally inferred from its stopping the ball which strikes it, and from the motion of the ball which it drives before it. In this way we learn that the particles of tangible matter cohere by means of moving forces, and that they resist compression with force; and in making this inference, we find that this corpuscular force exerted between the particles is mutual, opposite, and equal; for we must apply force equally to *a* or to *b*, in order to produce a separation or a compression. We learn their equality, by observing that no motion ensues while these mutual forces are known to act on the particles; that is, each is opposed by another force, which is neither inferior nor superior to it.

OF THE LAWS OF MOTION.

Such, then, being our notions of mechanical forces, the causes of the sensible changes of motion, there will result certain consequences from them, which may be called axioms or laws of motion. Some of these may be intuitive, offering themselves to the mind as soon as the notions which they involve are presented to it. Others may be as necessary results from the relations of these notions, but may not readily offer themselves without the mediation of axioms of the first class. We shall select those which are intuitive, and may be taken for the first principles of all discussions in mechanical philosophy.

First Law of Motion.

FIRST LAW OF MOTION.

Every body continues in a state of rest, or of uniform rectilineal motion, unless affected by some mechanical force.

21. This is a proposition, on the truth of which the whole science of mechanical philosophy ultimately depends. It is therefore to be established on the firmest foundation; and a solicitude on this head is the more justifiable, because the opinions of philosophers have been extremely different, both with respect to the truth of this law, and with respect to the foundation on which it is built. These opinions are, in general, very obscure and unsatisfactory; and, as is natural, they influence the discussions of those by whom they are held through the whole science. Although of contradictory opinions one only can be just, and it may appear sufficient that this one be established and uniformly applied; yet a short exposition, at least, of the rest is necessary, that the greatest part of the writings of the philosophers may be intelligible, and that we may avail ourselves of much valuable information contained in them, by being able to perceive the truth in the midst of their imperfect or erroneous conceptions of it.

Does continued motion indicate continued action?

22. It is not only the popular opinion that rest is the natural state of body, and that motion is something foreign to it, but it has been seriously maintained by the greatest part of those who are esteemed philosophers. They readily grant that matter will continue at rest unless some moving force act upon it. Nothing seems necessary for matter's remaining where it is, but its continuing to exist. But it is far otherwise, say they, with respect to matter in motion. Here the body is continually changing its relations to other things; therefore the continual agency of a changing cause is necessary (by the fundamental principle of all philosophical discussion), for there is here the continual production of an effect. They say that this metaphysical argument receives complete confirmation (if confirmation of an intuitive truth be necessary) from the most familiar observation. We see that all motions, however violent, terminate in rest; and that the continual exertion of some force is necessary for their continuance.

Whimsical notion of elemental minds.

23. These philosophers therefore assert, that the continual action of the moving cause is *essentially* necessary for the continuance of the motion; but they differ among themselves in their notions and opinions about this cause. Some maintain that all the motions in the universe are produced and continued by the immediate agency of Deity; others affirm, that in every particle of matter there is inherent a sort of mind, the φυσις and ὁσπερψυχη of Aristotle, which they call an *Elemental Mind*, which is the cause of *all* its motions and changes. An overweening reverence for Greek learning has had a great influence in reviving this doctrine of Aristotle. The Greek and Roman languages are affirmed to be more accurate expressions of human thought than the modern languages are. In those ancient languages, the verbs which express motion are employed both in the active and passive voice; whereas we have only the active verb *to move*, for expressing both the state of motion and the act of putting in motion. "The stone *moves* down the slope, and *moves* all the pebbles which lie in its way;" but in the ancient lan-

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guages, the mere state of motion is always expressed by the passive or middle voice. The accurate conception of the speakers is therefore extolled. The state of motion is expressed as it ought to be, as the result of a continual action. Κινειται, *movetur*, is equivalent to "it is moved." According to these philosophers, every thing which *moves* is mind, and every thing that *is moved* is body.

The argument is futile, and it is false; for the modern languages are, in general, equally accurate in this instance: "*se mouvoir*," in French; "*fich bewegen*," in German; "*dvigatsu*," in Slavonic; are all passive or reflected. And the ancients said that "rain falls, water runs, smoke rises," just as we do. The ingenious author of *Ancient Metaphysics* has taken much pains to give us, at length, the procedures of those elementary minds in producing the ostensible phenomena of local motion; but it seems to be merely an abuse of language, and a very frivolous abuse. This elemental mind is known and characterised only by the effect which we ascribe to its action; that is, by the motions or changes of motions. Uniform and unexcepted experience shows us that these are regulated by laws as precise as those of mathematical truth. We consider nothing as more fixed and determined than the common laws of mechanism. There is nothing here that indicates any thing like spontaneity, intention, purpose; none of those marks by which mind was first brought into view; but they are very like the effects which we produce by the exertions of our corporeal forces; and we have accordingly given the name *force* to the causes of motion. It is surely much more apposite than the name mind, and conveys with much more readiness and perspicuity the very notions that we wish to convey.

Action not necessary for the continuance of motion.

24. We now wish to know what reason we have to think that the continual action of some cause is necessary for continuing matter in motion, or for thinking that rest is its natural state. If we pretend to draw any argument from the nature of matter, that matter must be known, as far as is necessary for being the foundation of argument. Its very existence is known only from observation; all our knowledge of it must therefore be derived from the same source.

If we take this way to come at the origin of this opinion, we shall find that experience gives us no authority for saying that rest is the natural condition of matter. We cannot say that we have ever seen a body at rest; this is evident to every person who allows the validity of the Newtonian philosophy, and the truth of the Copernican system of the sun and planets; all the parts of this system are in motion. Nay, it appears from many observations, that the sun, with his attending planets, is carried in a certain direction, with a velocity which is very great. We have no unquestionable authority for saying that any one of the stars is absolutely fixed; but we are *certain* that many of them are in motion. Rest is therefore so rare a condition of body, that we cannot say, from any experience, that it is its natural state.

25. It is easy, however, to see that it is from observation that this opinion has been derived; but the observation has been limited and careless. Our experiments in this sublunary world do indeed always require continued action of some moving force to continue the motion; and if this be not employed, we see the motions slacken every minute, and terminate in rest after no long period. Our first notions of sublunary bodies are indicated by their operation in cases where we have some interest. Perpetually seeing our own exertions necessary, we are led to consider matter as something not only naturally quiescent and inert, but sluggish, averse from motion, and prone to rest (we must be pardoned this metaphorical language, because we can find no other term). What is expressed by it, on this occasion, is precisely one of the erroneous or inadequate conceptions that are suggested to our thoughts by reason of the poverty of language. We animate matter in order to give it motion, and then we endow it with a sort of moral character in order to explain the appearance of those motions.

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26. But more extended observation has made men gradually desert their first opinions, and at last allow that matter has no peculiar aptitude to rest. All the retardations that we *observe* have been discovered, one after another, to have a distinct reference to some external circumstances. The diminution of motion is always observed to be accompanied by the removal of obstacles, as when a ball moves through sand, or water, or air; or it is owing to opposite motions which are destroyed; to roughness of the path, or to friction, &c. We find that the more we can keep these things out of the way, the less are the motions diminished. A pendulum will vibrate but a short while in water; much longer in air; and in the exhausted receiver it will vibrate a whole day. We know that we cannot remove *all* obstacles; but we are led by such observations to conclude that, if they *could be completely removed*, our motions would continue for ever. And this conclusion is almost demonstrated by the motions of the heavenly bodies, to which we know of no obstacles, and which we really observe to retain their motions for many thousand years, without the smallest sensible diminution.

Inact y of ma r denie y Leibn .

27. Another set of philosophers maintain an opinion directly opposite to that of the inactivity of matter, and assert, that it is essentially active, and continually changing its state. Faint traces of this are to be found in the writings of Plato, Aristotle, and their commentators. Mr Leibnitz is the person who has treated this question most systematically and fully. He supposes every particle of matter to have a principle of individuality, which he therefore calls a *Monad*. This monad has a sort of *perception* of its situation in the universe, and of its relation to every other part of this universe. Lastly, he says that the monad acts on the material particle much in the same way that the soul of man acts on his body. It modifies the motion of the material atom (in conformity, however, to unalterable laws), producing all those modifications of motion that we observe. Matter, therefore, or at least particles of matter, are continually active, and continually changing their situation.

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It is quite unnecessary to enter on a formal confutation of Mr Leibnitz's system of monads, which differs very little from the system of elemental minds, and is equally whimsical and frivolous; because it only makes the unlearned reader stare, without giving him any information. Should it even be granted, it would not, any more than the action of animals, invalidate the general proposition which we are endeavouring to establish as the fundamental law of motion. Those powers of the monads, or of the elemental minds, are the causes of all the changes of motion; but the mere material particle is subject to the law, and requires the exertion of the monad in order to exhibit a change of motion.

28. A third sect of philosophers, at the head of which we may place Sir Isaac Newton, maintain the doctrine enounced in the proposition. But they differ much in respect of the foundation on which it is built.

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Some assert that this truth flows from the nature of the thing. If a body be at rest, and you assert that it will not remain at rest, it must move in some one direction. If it be in motion in any direction, and with any velocity, and do not continue its equable, rectilineal motion, it must either be accelerated or retarded; it must turn either to one side or to some other side. The event, whatever it be, is individual and determinate; but no cause which

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can determine it is supposed; therefore the determination cannot take place, and no change will happen in the condition of the body with respect to motion. It will continue at rest, or persevere in its rectilineal and equable motion.

But considerable objections may be made to this argument of *sufficient reason*, as it is called. In the immensity and perfect uniformity of space and time, there is no determining cause why the visible universe should exist in the place in which we see it rather than in another, or at this time rather than at another. Nay, the argument seems to beg the question. A cause of determination is required as essentially necessary—a determination may be without a cause, as well as a motion without a cause.

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29. Other philosophers, who maintain this doctrine, consider it merely as an experimental truth; and proofs of its universality are innumerable.

When a stone is thrown from the hand, we press it forward while in the hand, and let it go when the hand has acquired the greatest rapidity of motion that we can give it. The stone continues in that state of motion which it acquired gradually along with the hand. We can throw a stone much farther by means of a sling, because, by a very moderate motion of the hand, we can whirl the stone round till it acquire a very great velocity, and then we let go one of the strings, and the stone escapes, *by continuing* its rapid motion. We see it still more distinctly in shooting an arrow from a bow. The string presses hard on the notch of the arrow, and it yields to this pressure and goes forward. The string alone would go faster forward. It therefore *continues* to press the arrow forward, and accelerates its motion. This goes on till the bow is as much unbent as the string will allow. But the string is now a straight line. It came into this position with an accelerated motion, and it therefore goes a little beyond this position, but with a retarded motion, being checked by the bow. But there is nothing to check the arrow, therefore the arrow quits the string and flies away.

These are simple cases of perseverance in a state of motion, where the procedure of nature is so easily traced that we perceive it almost intuitively. It is no less clear in other phenomena which are more complicated; but it requires a little reflection to trace the process. We have often seen an equestrian showman ride a horse at a gallop, standing on the saddle, and stepping from it to the back of another horse that gallops alongside at the same rate; and he does this seemingly with as much ease as if the horses were standing still. The man has the same velocity with the horse that gallops under him, and keeps this velocity while he steps to the back of the other. If that other were standing still, the man would fly over his head. And if a man should step from the back of a horse that is standing still, to the back of another that gallops past him, he would be left behind. In the same manner, a slack-wire dancer tosses oranges from hand to hand while the wire is in full swing. The orange, swinging along with the hand, retains the velocity; and when in the air, follows the hand, and falls into it when it is in the opposite extremity of its swing. A ball dropped from the mast-head of a ship that is sailing briskly forward, falls at the foot of the mast. It retains the motion which it had while in the hand of the person who dropped it, and follows the mast during the whole of its fall.

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We also have familiar instances of the perseverance of a body in a state of rest. When a vessel filled with water is drawn suddenly along the floor, the water dashes over the posterior side of the vessel. It is left behind. In the same manner, when a coach or boat is dragged forward, the persons in it find themselves strike against the hinder part of the carriage or boat. Properly speaking, it is the carriage that strikes on them. In like manner, if we lay a card on the tip of the finger, and a piece of money on the card, we may nick away the card, by hitting it neatly on its edge; but the piece of money will be left behind, lying on the tip of the finger. A ball will go through a wall and fly onward; but the wall is left behind. Buildings are thrown down by earthquakes; sometimes by being tossed from their foundations, but more generally by the ground on which they stand being hastily drawn sidewise from under them, &c.

Common
experience
insufficient.

30. But common experience seems insufficient for establishing this fundamental proposition of mechanical philosophy. We must, on the faith of the Copernican system, grant that we never saw a body at rest, or in uniform rectilineal motion; yet this seems absolutely necessary before we can say that we have established this proposition experimentally.

What we imagine, in our experiments, to be putting a body, formerly at rest, into motion, is, in fact, only changing a most rapid motion, not less, and probably much greater, than 90,000 feet per second. Suppose a cannon pointed east, and the bullet discharged at noon day with sixty times greater velocity than we have ever been able to give it: it would appear to set out with this unmeasurable velocity to the eastward, to be gradually retarded by the resistance of the air, and at last brought to rest by hitting the ground. But, by reason of the earth's motion round the sun, the fact is quite the reverse. Immediately before the discharge, the ball was moving to the westward with the velocity of 90,000 feet per second nearly. By the explosion of the powder, and its pressure on the ball, some of this motion is destroyed, and at the muzzle of the gun the ball is moving slower, and the cannon is hurried away from it to the westward. The air, which is also moving to the westward 90,000 feet in a second, gradually communicates motion to the ball, in the same manner as a hurricane would do. At last (the ball dropping all the while) some part of the ground hits the ball, and carries it along with it.

Other observations must therefore be resorted to, in order to obtain an experimental proof of this proposition; and such are to be found. Although we cannot measure the absolute motions of bodies, we can observe and measure accurately their relative motions, which are the differences of their absolute motions. Now, if we can show experimentally that bodies show equal tendencies to resist the augmentation and the diminution of their relative motions, they, *ipso facto*, show equal tendencies to resist the augmentation or diminution of their absolute motions. Therefore let two bodies, A and B, be put into such a situation that they cannot (by reason of their impenetrability, or the action of their mutual powers) persevere in their relative motions. The change produced on A is the effect and the measure of B's tendency to persevere in its former state; and therefore the proportion of these changes will show the proportion of their tendencies to maintain their former states. Therefore let the following experiment be made at noon.

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Let A, apparently moving westward three feet per second, hit the equal body B apparently at rest. Suppose, 1*st*, that A impels B forward without any diminution of its own velocity. This result would show that B manifests no tendency to maintain its motion unchanged, but that A retains its motion undiminished.

2*dly*, Suppose that A stops, and that B remains at rest. This would show that A does not resist a diminution of motion, but that B retains its motion unaugmented.

3*dly*, Suppose that both move westward with the velocity of one foot per second. The change on A is a diminution of velocity, amounting to two feet per second.

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This is the effect and the measure of B's tendency to maintain its velocity unaugmented. The change on B is an augmentation of one foot per second made on its velocity; and this is the measure of A's tendency to maintain its velocity undiminished. This tendency is but half of the former; and this result would show that the resistance to a diminution of velocity is but half of the resistance to augmentation. It is perhaps but one quarter, for the change on B has produced a double change on A.

4thly, Suppose that both move westward at the rate of one and a half foot per second. It is evident that their tendencies to maintain their states unchanged are now equal.

5thly, Suppose A = 2 B, and that both move, after the collision, two feet per second; B has received an addition of two feet per second to its former velocity. This is the effect and the measure of A's whole tendency to retain its motion undiminished. Half of this change on B measures the persevering tendency of the half of A; but A, which formerly moved with the apparent or relative velocity three, now moves (by the supposition) with the velocity two, having lost a velocity of one foot per second. Each half of A therefore has lost this velocity, and the whole loss of motion is two. Now this is the measure of B's tendency to maintain its former state unaugmented; and this is the same with the measure of A's tendency to maintain its own former state undiminished. The conclusion from such a result would therefore be, that bodies have equal tendencies to maintain their former states of motion without augmentation and without diminution.

What is supposed in the fourth and fifth cases is really the result of all the experiments which have been tried; and this law regulates all the changes of motion which are produced by the mutual actions of bodies in impulsions. This assertion is true without exception or qualification. Therefore it appears that bodies have no preferable tendency to rest, and that no fact can be adduced which should make us suppose that a motion once begun should suffer any diminution without the action of a changing cause.

But experience is not the proper foundation of an axiom.

But we must now observe, that this way of establishing the first law of motion is very imperfect, and altogether unfit for rendering it the fundamental principle of a whole and extensive science. It is subject to all the inaccuracy that is to be found in our best experiments; and it cannot be applied to cases where scrupulous accuracy is wanted, and where no experiment can be made.

Let us therefore examine the proposition by means of principles which contain the foundation of all our knowledge of active nature. These will, we imagine, give a decision of this question that is speedy and accurate; showing the proposition to be an axiom or intuitive consequence of the relations of those ideas which we have of motion, and of the causes of its production and changes.

Logical proof.

31. It has been fully demonstrated that the powers or forces of which we speak so much are never the immediate objects of our perception. Their very existence, their kind, and their degree, are instinctive inferences from the motions which we observe and class. It evidently follows from this experimental and universal truth, 1*st*, that where no change of motion is observed, no such inference is made, that is, no power is *supposed* to act. But whenever any change of motion is observed, the inference is made; that is, a power or force is supposed to have acted.

In the same form of logical conclusion, we must say that, 2*dly*, when no change of motion is *supposed* or thought of, no force is *supposed;* and that whenever we *suppose* a change of motion, we in fact, though not in terms, suppose a changing force. And, on the other hand, whenever we suppose the action of a changing force, we suppose the change of motion; for the action of this force, and the change of motion, is one and the same thing. We cannot think of the action without thinking of the indication of that action; that is, the change of motion. In the same manner, when we do not think of a changing force, or suppose that there is no action of a changing force, we in fact, though not in terms, suppose that there is no indication of this changing force; that is, that there is no change.

Whenever, therefore, we suppose that no mechanical force is acting on a body, we in fact suppose that the body continues in its former condition with respect to motion. If we suppose that nothing accelerates, or retards, or deflects the motion, we suppose that it is not accelerated, nor retarded, nor deflected. Hence follows the proposition in express terms—*We suppose that the body continues in its former state of rest or motion, unless we suppose that it is changed by some mechanical force.*

Thus it appears that this proposition is not a matter of experience or contingency, depending on the properties which it has pleased the Author of nature to bestow on body; it is to us a necessary truth. The proposition does not so much express any thing with regard to body, as it does the operations of our mind when contemplating body. It may perhaps be essential to body to move in some particular direction. It may be essential to body to stop as soon as the moving cause has ceased to act; or it may be essential to body to diminish its motion gradually, and finally come to rest. But this will not invalidate the truth of this proposition. These circumstances in the nature of body, which render those modifications of motion essentially necessary, are the causes of those modifications; and in our study of nature they will be considered by us as changing forces, and will be known and called by that name. And if we should ever see a particle of matter in such a situation that it is affected by those essential properties alone, we shall, from observation of its motion, discover what those essential properties are.

This law turns out at last to be little more than a tautological proposition; but mechanical philosophy, as we have defined it, requires no other sense of it; for even if we should suppose that body, of its own nature, is capable of changing its state, this change must be performed according to some law which characterizes the nature of body; and the knowledge of the law can be had in no other way than by observing the deviations from uniform rectilineal motion. It is therefore indifferent whether those changes are derived from the nature of the thing or from external causes; for, in order to consider the various motions of bodies, we must first consider this nature of matter as a mechanical affection of matter, operating in every instance; and thus we are brought back to the law enounced in this proposition. This becomes more certain when we reflect that the external causes (such as gravity or magnetism), which are acknowledged to operate changes of motion, are equally unknown to us with this essential original property of matter, and are, like it, nothing but inferences from the phenomena.

The above very diffuse discussions may appear superfluous to many readers, and even cumbersome; but we trust that the philosophical reader will excuse our anxiety on this head, when he reflects on the complicated, indistinct, and inaccurate notions commonly had of the subject. We may include Sir Isaac Newton in the number of those who have at least introduced modes of expression which mislead the minds of incautious persons, and suggest inadequate notions, incompatible with the pure doctrine of the proposition. Although in words they disclaim the doctrine that rest is the natural state of body, and that force is necessary for the continuation of its motion,

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yet in words they (and most of them in thought) likewise abet that doctrine: for they say that there resides in a moving body a *power* or *force*, by which it perseveres in its motion. They call it the *vis insita*, the *inherent force, of a moving body.* This is surely giving up the question: for if the motion is supposed to be continued in consequence of a force, that force is *supposed* to be exerted; and it is supposed that if it were not exerted, the motion would cease; and therefore the proposition must be false. Indeed it is sometimes expressed so as seemingly to ward off this objection. It is said that the body continues in uniform rectilineal motion, unless affected by some *external cause.* But this way of speaking obliges us, at first setting out in natural philosophy, to assert that gravity, magnetism, electricity, and a thousand other mechanical powers, are external to the matter which they put in motion. This is quite improper. It is the business of philosophy to discover whether they be external or not; and if we assert that they are, we have no principles of argumentation with those who deny it. It is this one thing that has filled the study of nature with all the jargon of ethers, and other invisible, intangible fluids, which has disgraced philosophy, and greatly retarded its progress.

Vis insita, inherent force, are improper terms in the usual acceptation.

32. We must observe, that the terms *vis insita*, inherent force, are very improper. There is no dispute among philosophers in calling every thing a force that produces a change of motion, and in inferring the action of such a force whenever we observe a change of motion. It is surely incongruous to give the same name to what has not this quality of producing a change, or to infer (or rather to suppose) the energy of a force when no change of motion is observed. This is one among many instances of the danger of mistake when we indulge in analogical discussions. All our language, at least, on this subject is analogous. I feel that in order to oppose animal force I must exert force. But I must exert force in order to oppose a body in motion; therefore I imagine that the moving body possesses force. A bent spring will drive a body forward by unbending; therefore I say that the spring exerts force. A moving body impels the body which it hits; therefore I say that the impelling body possesses and exerts force. I imagine farther, that it possesses force only by being in motion, or because it is in motion; because I do not find that a quiescent body will put another into motion by touching it. But we shall soon find this to be false in many, if not in all cases, and that the communication of motion depends on the mere vicinity, and not on the motion of the impelling body; yet we ascribe the exertion of the *vis insita* to the circumstance of the continued motion. We therefore conceive the force as arising from or as consisting in the impelling body's being in motion; and, with a very obscure and indistinct conception of the whole matter, we call it *the force by which the body preserves itself in motion.* Thus, taking it for granted that a force resides in the body, and being obliged to give it some office, this is the only one that we can think of.

33. But philosophers imagine that they perceive the necessity of the exertion of a force in order to the continuation of a motion. Motion (say they) is a continued action; the body is every instant in a new situation; there is the continual production of an effect, therefore the continual action of a cause.

Motion is not the continual production of effect.

This, however, is a very inaccurate way of thinking. We have a distinct conception of motion; and we conceive that there is such a thing as a moving cause, which we distinguish from all other causes by the name *force.* It produces motion. If it does this, it produces the character of motion, which is a continual change of place. Motion is not action, but the effect of an action; and this action is as complete in the instant immediately succeeding the beginning of the motion as it is a minute after. The subsequent change of place is the continuation of an effect already produced. The *immediate* effect of the moving force is a *determination*, by which, if not hindered, the body would go on for ever from place to place. It is in this determination only that the state or condition of the body can differ from a state of rest; for in any instant the body does not describe any space, but has a determination by which it will describe a certain space uniformly in a certain time. Motion is a condition, a state, or mode of existence, and no more requires the continued agency of the moving cause than yellowness or roundness does. It requires some chemical agency to change the yellowness to greenness; and it requires a mechanical cause or a force to change this motion into rest. When we see a moving body stop short in an instant, or be gradually but quickly brought to rest, we never fail to speculate about a cause of this cessation or retardation. The case is no way different in itself although the retardation should be extremely slow. We should always attribute it to a cause. It requires a cause to put a body out of motion, as much as to put it into motion. This cause, if not external, must be found in the body itself; and it must have a self-determining power, and may as well be able to put itself into motion as out of it.

If this reasoning be not admitted, we do not see how any effect can be produced by any cause. Every effect supposes something *done;* and any thing done implies that the thing done may remain till it be *undone* by some other cause. Without this it would have no existence. If a moving cause did not produce continued motion by its instantaneous action, it could not produce it by any continuance of that action; because in no instant of that action does it produce continued motion.

We must therefore give up the opinion, that there resides in a moving body a force *by which it is kept in motion;* and we must find some other way of explaining that remarkable difference between a moving body and a body at rest, by which the first causes other bodies to move by hitting them, while the other does not do this by merely touching them. We shall see, with the clearest evidence, that motion is necessary in the impelling body, in order that it may permit the forces inherent in one or both bodies to continue this pressure long enough for producing a sensible or considerable motion. But these moving forces are inherent in bodies, whether they are in motion or at rest.

Communication of motion is an improper phrase;

34. The foregoing observations show us the impropriety of the phrase *communication of motion.* By thus reflecting on the notions that are involved in the general conception of one body being made to move by the impulse of another, we perceive that there is nothing individual transferred from the one body to the other. The determination to motion, indeed, existed only in the impelling body before collision; whereas, afterwards, both bodies are so conditioned or determined. But we can form no notion of the thing transferred. With the same metaphysical impropriety we speak of the communication of joy, of fever.

so is *vis inertiæ.*

35. Kepler introduced a term *inertia, vis inertiæ,* into mechanical philosophy; and it is now in constant use. But writers are very careless and vague in the notions which they affix to these terms. Kepler and Newton seem generally to employ it for expressing the fact, the perseverance of the body in its present state of motion or rest: but they also frequently express by it something like an indifference to motion or rest, *manifested by its requiring the same quantity of force to make an augmentation of its motion as to make an equal diminution of it.* The popular notion is

First Law of Motion.

like that which we have of actual resistance; and it always implies the notion of force *exerted* by the resisting body. We suppose this to be the exertion of the *vis insita*, or the *inherent force* of a body in motion. But we have the same notion of resistance from a body at rest which we set in motion. Now surely it is in direct contradiction to the common use of the word *force*, when we suppose resistance from a body at rest; yet *vis inertiæ* is a very common expression. Nor is it more absurd (and it is very absurd) to say, that a body maintains its state of rest by the exertion of a *vis inertiæ*, than to say that it maintains its state of motion by the exertion of an *inherent force*. We should avoid all such metaphorical expressions as *resistance*, *indifference*, *sluggishness*, or *proneness to rest* (which some express by *inertia*) because they seldom fail to make us indulge in metaphorical notions, and thus lead us to misconceive the *modus operandi*, or procedure of nature.

There is *no resistance whatever observed* in these phenomena, for the force employed always produces its *complete* effect. When I throw down a man, and find that I have employed no more force than was sufficient to throw down a similar and equal mass of dead matter, I know by this that he *has not* resisted; but I conclude that he *has* resisted if I have been obliged to employ much more force. There is therefore no resistance, properly so called, when the exerted force is observed to produce its full effect. To say that there *is* resistance, is therefore a real misconception of the way in which mechanical forces have operated in the collision of bodies. There is no more resistance in these cases than in any other natural changes of condition. We are guilty, however, of the same impropriety of language in other cases, where the cause of it is more evident. We say that colours in grain *resist* the action of soap and of the sun, but that Prussian blue does not. We all perceive that in this expression the word resistance is entirely figurative; and we should say that Prussian blue *resists* soap, if we are right in saying that a body resists any force employed to change its state of motion; for soap must be employed to discharge or change the colour, *and it does change it.* Force must be employed to change a motion, *and it does change it.* The impropriety, both of thought and language, is *plain* in the one case, and it is no less *real* in the other. Both of the terms *inherent force* and *inertia* may be used with safety for abbreviating language, if we be careful to employ them only for expressing *either the simple fact of persevering in the former state*, or *the necessity of employing a certain determinate force in order to change that state, and if we avoid all thought of resistance.*

Deviations from uniform rectilineal motion are the only indications of force.

36. From the whole of this discussion we learn that the deviations from uniform motions are the indications of the existence and agency of mechanical forces, and that they are the only indications. The indication is very simple—mere change of place; it can therefore indicate nothing but what is very simple, the something competent to the production of the very motion that we observe; and when two changes of motion are precisely similar, they indicate the same thing. Suppose a mariner's compass on the table, and that by a small tap with my finger I cause the needle to turn off from its quiescent position ten degrees. I can do the same thing by bringing a magnet near it, or by bringing an electrified body near it, or by the unbending of a fine spring pressing it aside, or by a puff of wind, or by several other methods. In all these cases the indication is the same; therefore the thing indicated is the same, namely, a certain intensity and direction of a moving power. How it operates, or in what manner it exists and exerts itself in these instances, outwardly so different, is not under consideration at present. Impulsiveness, intensity, and direction, are all the circumstances of resemblance by which the affections of matter are to be characterized; and it is to the discovery and determination of these alone that our attention is now to be directed. We are directed in this research by the

SECOND LAW OF MOTION.

Every change of motion is proportional to the force impressed, and is made in the direction of that force.

37. This law also may almost be considered as an identical proposition; for it is equivalent to saying that the changing force is to be measured by the change which it produces, and that the direction of this force is the direction of the change. Of this there can be no doubt, when we consider the force in no other sense than that of the cause of motion, paying no attention to the form or manner of its exertion. Thus, when a pellet of tow is shot from a pop-gun by the expansion of the air compressed by the rammer, or where it is shot from a toy pistol by the unbending of the coiled wire, or when it is nicked away by the thumb like a marble—if, in all these cases, it moves off in the same direction, and with the same velocity, we cannot consider or think of the force, or at least of its exertion, as any how different. Nay, when it is driven forward by the instantaneous percussion of a smart stroke, although the manner of producing this effect (if possible) is essentially different from what is conceived in the other cases, we must still think that the propelling force, considered as a propelling force, is one and the same. In short, this law of motion, as thus expressed by Sir Isaac Newton, is equivalent to saying, "that we take the changes of motion as the measures of the changing forces, and the direction of the change for the indication of the direction of the forces:" for no reflecting person can pretend to say that it is a deduction from the acknowledged principle, that effects are proportional to their causes. We do not affirm this law from having observed the proportion of the forces and the proportion of the changes, and that these proportions are the same; and from having observed that this has obtained through the whole extent of our study of nature. This would indeed establish it as a physical law, an universal fact; and it is, in fact, so established. But this does not establish it as a law of motion, according to our definition of that term; as a law of human thought, the result of the relations of our ideas, as an intuitive truth. The injudicious attempts of philosophers to prove it as a matter of observation, have occasioned the only dispute that has arisen in mechanical philosophy. It is well known that a bullet moving with double velocity penetrates four times as far. Many other similar facts corroborate this: and the philosophers observe, that four times the force has been expended to generate this double velocity in the bullet; it requires four times as much powder. In all the examples of this kind it would seem that the ratio of the forces employed has been very accurately ascertained; yet this is the invariable result. Philosophers, therefore, have concluded that moving forces are not proportional to the velocities which they produce, but to the squares of those velocities. It is a strong confirmation to see that the bodies in motion seem to possess forces in this very proportion, and produce effects in this proportion; penetrating four times as deep when the velocity is only twice as great, &c.

But if this be a just estimation, we cannot reconcile it to the concession of the same philosophers, who grant that the velocity is proportional to the force impressed, in the cases where we have no previous observation of the ratio of the forces, and of its equality to the ratio of the velocities. This is the case with gravity, which these

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philosophers always measure by its accelerating power, or the velocity which it generates in a given time. And this cannot be refused by them; for cases occur where the force can be measured in the most natural manner by the actual pressure which it exerts. Gravity is thus measured by the pressure which a stone exerts on its supports. A weight which at Quito will pull out the rod of a spring steelyard to the mark 312, will pull it to 313 at Spitzbergen; and it is a fact, that a body will fall 313 inches at Spitzbergen in the same time that it falls 312 at Quito. Gravitation is the cause both of the pressure and the fall, and it is a matter of unexcepted observation that they have always the same ratio. The philosophers who have so strenuously maintained the other measure of forces are among the most eminent of those who have examined the motions produced by gravity, magnetism, electricity, &c.; and they never think of measuring those forces any other way than by the velocity. It is in this way that the whole of the celestial phenomena are explained in perfect uniformity with observation, and that the Newtonian philosophy is considered as a demonstrative science.

There must, therefore, be some defect in the principle on which the other measurement of forces is built, or in the method of applying it. Pressure is undoubtedly the immediate and natural measure of force; yet we know that four springs, or a bow four times as strong, give only a double velocity to an arrow.

The truth of our law rests on this only, that we assume the changes of motion as the measure of the changing forces, or at least as the measures of their exertions in producing motion. In fact, they are the measures only of a certain circumstance, in which the actions of very different natural powers may resemble each other, namely, the competency to produce motion. They do not, perhaps, measure their competency to produce heat, or even to bend springs. We can surely consider this apart from all other circumstances, and it is worthy of separate consideration. Let us see what can be, and what ought to be, deduced from this way of treating the subject.

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38. The motion of a body may certainly remain unchanged. If the direction and velocity remain the same, we perceive no circumstance in which its condition with respect to motion differs. Its change of place or situation can make no difference; for this is implied in the very circumstance of the bodies being in motion.

But if either the velocity or direction change, then surely is its mechanical condition no longer the same; a force has acted on it, either intrinsic or from without, either accelerating, or retarding, or deflecting it. Supposing the direction to remain the same, its difference of condition can consist in nothing but its difference of velocity. This is the only circumstance in which its condition can differ, as it passes through two different points of its rectilineal path. It is this determination by which the body will describe a certain determinate space uniformly in a given time, which defines its condition as a moving body; the changes of this determination are the measures of their own causes, and to those causes we have given the name *force.* Those causes may reside in other bodies, which may have other properties, characterized and measured by other effects. Pressure may be one of those properties, and may have its own measures; these may or may not have the same proportion with that property which is the cause of a change of velocity; and therefore changes of velocity may not be a measure of pressure. This is a question of fact, and requires observation and experience; but, in the mean time, velocity, and the change of velocity, is the measure of moving force and of changing force. When, therefore, the change of velocity is the same whatever the previous velocity may be, the changing force must be considered as the same. Therefore, finally, if the previous velocity is nothing, and consequently the change on that body is the very velocity or motion that it acquires, we must say, that the force which produces a certain change in the velocity of a moving body is the same with the force which would impart to a body at rest a velocity equal to this change or difference of velocity produced on the body already in motion.

Second
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Motion.

39. This manner of estimating force is in perfect conformity to our most familiar notions on these subjects. We conceive the weight or downward pressure of a body as the cause of its motion downwards; and we conceive it as belonging to the body at all times, and in all places, whether falling, or rising upwards, or describing a parabola, or lying on a table; and, accordingly, we observe, that in every state of motion it receives equal changes of velocity in the same or an equal time, and all in the direction of its pressure.

40. All that we have now said of a change of velocity might be repeated of a change of direction. It is surely possible that the same change of direction may be made on any two motions. Let one of the motions be considered as growing continually slower, and terminating in rest. In every instant of this motion it is possible to make one and the same change on it. The same change may therefore be made at the very instant that the motion is at an end. In this case the change is the very motion which the body acquires from the changing force. Therefore, in this case also, we must say that a change of motion is itself a motion, and that it is the motion which the force would produce in a body that was previously at rest.

How ascertained and measured.

41. The result of these observations is evidently this, that we must ascertain, in every instance, what is the change of motion, and mark it by characters that are conspicuous and distinguishing; and this mark and measure of change must be a motion. Then we must say, that the changing force is that which would produce this motion in a body previously at rest. We must see how this is manifest as a motion in the difference between the former motion and the new motion; and, on the other hand, we must see how the motion produceable in a quiescent body may be so combined with a motion already existing as to exhibit a new motion, in which the agency of the changing force may appear.

Suppose a ship at anchor in a stream, while one man walks forward on the quarter deck at the rate of two miles per hour, another walks from stem to stern at the same rate, a third walks athwart ship, and a fourth stands still. Let the ship be supposed to cut or part her cable, and float down the stream at the rate of three miles per hour. We cannot conceive any difference in the change made on each man's motion in absolute space; but their motions are now exceedingly different from what they were: the first man, whom we may suppose to have been walking westward, is now moving eastward one mile per hour; the second is moving eastward four miles per hour, and the third is moving in an oblique direction, about three points north or south of due east. All have suffered the same change of condition with the man who had been standing still. He has now got a motion eastward three miles per hour. In this instance, we see very well the circumstance of sameness that obtains in the change of these four conditions. It is the motion of the ship which is blended with the other motions. But this circumstance is equally present whenever the same previous motions are changed into the same new motions. We must learn to expiscate this; which we shall do by considering the manner in which the motion of the ship is blended with each of the men's motions.

Second Law of Motion.

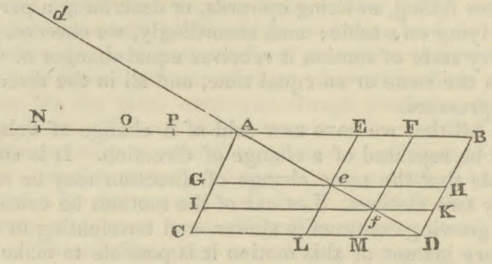
Composition of motion.

42. This kind of combination has been called the *composition of motion;* because, in every point of the motion really pursued, the two motions are to be found.

The fundamental theorem on this subject is this: Two uniform motions in the sides of a parallelogram compose an uniform motion in the diagonal.

Suppose that a point A (fig. 1) describes AB uniformly in some given time, while the line AB is carried uniformly along AC in the same time, keeping always parallel to its first position AB. The point A, by the combination of these motions, will describe AD, the diagonal of the parallelogram ABDC, uniformly in the same time.

Fig. 1.



For it is plain that the velocities in AB and AC are proportional to AB and AC, because they are uniformly described in the same time. When the point has got to E, the middle of AB, the line AB has got into the situation GH, half way between AB and CD, and the point E is in the place *e*, the middle of GH. Draw E*e*L parallel to AC. It is plain that the parallelograms ABDC and AE*e*G are similar; because AE and AG are the halves of AB and AC, and the angle at A is common to both. Therefore, by a proposition in the elements, they are about the same diagonal, and the point *e* is in the diagonal of AD. In like manner, it may be shown, that when A has described AF, three fourths of AB, the line AB will be in the situation IK; so that AI is three fourths of AC, and the point *f*, in which A is now found, is in the diagonal AD. It will be the same in whatever point of AB the describing point A be supposed to be found. The line AB will be on a similar point of AC, and the describing point will be in the diagonal AD.

Moreover, the motion in AD is uniform; for A*e* is described in the time of describing AE; that is, in half the time of describing AB, or in half the time of describing AD. In like manner, A*f* is described in three fourths of the time of describing AD, &c. &c.

Lastly, the velocity in the diagonal AD is to the velocity in either of the sides as AD is to that side. This is evident, because they are uniformly described in the same time.

This is justly called *a composition of the motions* AB *and* AC, as will appear by considering it in the following manner: Let the lines AB, AC be conceived as two material lines like wires. Let AB move uniformly from the situation AB into the situation CD, while AC moves uniformly into the situation BD. It is plain that their intersection will always be found on AD. The point *e*, for example, is a point common to both lines. Considered as a point of EL, it is then moving in the direction *e*H or AB; and considered as a point of GH, it is moving in the direction *e*L. Both of these motions are therefore blended in the motion of the intersection along AD. We can conceive a small ring at *e* embracing loosely both of the wires. This material ring will move in the diagonal, and *will really partake* of both motions.

Thus we see how the motion of the ship is actually blended with the motions of the three men; and the circumstance of sameness which is to be found in the four changes of motion is this motion of the ship, or of the man who was standing still. By composition with each of the three former motions, it produces each of the three new motions. Now, when each of two primitive motions is the same, and each of the new motions is the same, the change is surely the same. If one of the changes has been brought about by the actual composition of motions, we know precisely what that change is; and this informs us what the other is, in whatever way it was produced.

Seco Law Mot

Hence we infer that,

Its ma and m sure.

43. *When a motion is any how changed, the change is that motion which, when compounded with the former motion, will produce the new motion.* Now, because we assume the change as the measure and characteristic of the changing force, we must do so in the present instance; and we must say,

Chang force.

44. *That the changing force is that which will produce in a quiescent body the motion which, by composition with the former motion of a body, will produce the new motion.*

And, on the other hand,

Its eff

When the motion of a body is changed by the action of any force, the new motion is that which is compounded of the former motion, and of the motion which the force would produce in a quiescent body.

Deflec force.

When a force changes the direction of a motion, we see that its direction is transverse in some angle BAC; because a diagonal AD always supposes two sides. As we have distinguished any change of direction by the term *deflection,* we may call the transverse force a *deflecting force.*

In this way of estimating a change of motion, all the characters of both motions are preserved, and it expresses every circumstance of the change; the mere change of direction, or the angle BAD, is not enough, because the same force will make different angles of deflection, according to the velocity of the former motion, or according to its direction. But in this estimation the full effect of the deflecting force is seen; it is seen *as a motion;* for when half of the time is elapsed, the body is at *e* instead of E; when three fourths are elapsed it is at *f* instead of F; and at the end of the time it is at D instead of B. In short, the body has moved uniformly away from the points at which it would have arrived independent of the change; and this motion has been in the same direction, and at the same rate, as if it had moved from A to C by the changing force alone. Each force has produced its full effect; for when the body is at D, it is as far from AC as if the force AC had not acted on it; and it is as far from AB as it would have been by the action of AC alone.

For all these reasons, therefore, it is evident, that if we are to abide by our measure and character of force as a mere producer of motion, we have selected the proper characteristic and measure of a changing force; and our descriptions, in conformity to this selection, must be agreeable to the phenomena of nature, and retain the accuracy of geometrical procedure; because, on the other hand, the results which we deduce from the supposed influence of those forces are formed in the same mould. It is not even requisite that the real exertions of the natural forces, such as pressure of various kinds, &c. shall follow these rules; for their deviations will be considered as new forces, although they are only indications of the differences of the real forces from our hypothesis. We have obtained the precious advantage of mathematical investigation, by which we can examine the law of exertion which characterizes every force in nature.

45. On these principles we establish the following fundamental elementary proposition, of continual and indispensable use in all mechanical inquiries.

S ond L v of M ion.

If a body or material particle be subjected at the same time to the action of two moving forces, each of which would separately cause it to describe the side of a parallelogram uniformly in a given time, the body will describe the diagonal uniformly in the same time.

Fu a- me al the em.

For the body, whose motion AB was changed into AD, had gotten its motion by the action of some force. It was moving along NAB, and when it reached the point A, the force AC acted on it. The primitive motion is the same, or the body is in the same condition in every instant of the primitive motion. It may have acquired this motion when it was in N, or when at O, or any other point of NA. In all these cases, if AC act on it when it is in A, it will always describe AD; therefore it will describe AD when it acquires the primitive motion also in A; that is, if the two forces act on it at one and the same instant. The demonstration may be neatly expressed thus: The change induced by each force on the motion produced by the other is the motion which it would produce in the body if previously at rest. Therefore the motion resulting from joint action is the motion which is compounded of these two motions, or it is a motion in the diagonal of the parallelogram, of which these motions are the sides.

Co posi- tio f for .

This is called the *composition of forces.* The forces which produce the motions along the sides of the parallelogram are called the *simple forces,* or the *constituent forces;* and the force which would alone produce the motion along the diagonal is called the *compound force,* the *resulting force,* the *equivalent force.*

46. On the other hand, the force which produces a motion along any line whatever may be conceived as resulting from the combined action of two or more forces. We may *know* or *observe* it to be so; as when we see a lighter dragged along a canal by two horses, one on each side. Each pulls the boat directly toward himself in the direction of the track-rope; the boat cannot go both ways, and its real motion, whatever it is, results from this combined action. This might be produced by a single force; for example, if the lighter be dragged along the canal by a rope from another lighter which precedes it, being dragged by one horse, aided by the helm of the foremost lighter. Here the real force is not the resulting, or the compound, but the equivalent force.

R lution of ces.

This view of a motion mechanically produced is called the *resolution of forces.* The force in the diagonal is said to be *resolved* into the two forces, having the directions and velocities represented by the sides. This practice is of the most extensive and multifarious use in all mechanical disquisitions. It may frequently be exceedingly difficult to manage the complication of the many real forces which concur in producing a phenomenon; and by substituting others, whose combined effects are equivalent, our investigation may be much expedited. But more of this afterwards.

We must carefully remember, that when the motion AD is once begun, all composition is at an end, and the motion is a simple motion. The two determinations, by one of which the body would describe AB, and by the other of which it would describe AC, no longer *co-exist* in the body. This was the case only *in the instant,* in the very act of changing the motion AB into the motion BD; yet is the motion AD equivalent to a motion which is produced by the *actual composition* of two motions AB and AC; in which case the two motions co-exist in every point of AD.

U l de- m tra- tio ncon- clu e.

47. Accordingly this is the way in which the composition of forces is usually illustrated, and thought to be demonstrated. A man is supposed (for instance) to walk uniformly from A to C on a sheet of ice, while the ice is carried uniformly along AB by the stream. The man's real motion is undoubtedly along AD; but this is by no means a demonstration that the instantaneous or short-lived action of two forces would produce that motion; the man must continue to exert force in order to walk; and the ice is dragged along by the stream. Some indeed express this proof in another way, saying, let a body describe AB, while the space in which this motion is performed is carried along AC. The ice may be carried along, and may, by friction or otherwise, drag the man along with it; but a space cannot be removed from one place to another, nor, if it could, would it take the man with it. Should a ship start suddenly forward while a man is walking across the deck, he would be left behind, and fall toward the stern. We must *suppose* a transverse force, and we must *suppose* the composition of this force without proof. This is no demonstration.

Second Law of Motion.

We apprehend, that the demonstration given above of this fundamental proposition is unexceptionable, when the terms force and deflection are used in the abstract sense which we have affixed to them. The only circumstance in it which can be the subject of discussion is, whether we have selected the proper measure and characteristic of a change of motion. We never met with any objection to it.

Objections to the demonstration of No. 45. It will not apply to pressures.

48. But some have still maintained that it does not evidently appear from these principles, that the motion which results from the joint action of two natural powers, whose known and measurable intensities have the same proportions with AB and BC, and which also exert themselves in those directions, will produce a motion having the direction and proportion of AD. They will not, if the velocities produced by these forces are not in the proportion of those intensities, but in the subduplicate ratio of them. Nay, they say that it is not so. If a body be impelled along AC by one spring, and along AB by two springs equally strong, it will not describe the diagonal of a parallelogram, of which the side AB is double the side AC. They add, that an indefinite number of examples can be given where a body *does not* describe the diagonal of the parallelogram by the joint action of two forces, which separately would cause it to describe the sides. And lastly, they say that at any rate it does not appear evident to the mind, that two *incitements* to motion, having the directions and the same proportion of intensity with that of the sides of a parallelogram, actually generate a third, which is the immediate cause of the motion in the diagonal. An equivalent force is not the same with a resulting force.

49. Yet we see numberless cases of the composition of incitements to motion, and they seem as determinate and as susceptible of being combined by composition, as the things called moving forces, which are measured by the velocities. We see them actually so combined in a thousand instances, as in the example already given of a lighter dragged by two horses pulling in different directions. Experiment even shows, that this composition follows precisely the same rule as the composition of the forces which are measured by the velocities; for if the point A (fig. 1) be pulled by a thread or pressed by a spring in the direction AB, and by another in the direction AC, and if the pressures are proportional to AB and AC, then it will be withheld from moving, if it be pulled or pressed by a third force, acting in the direction A*d*, opposite to AD, the pressure being also proportional to AD. This force acting in the direction A*d*, would certainly withstand an equal force acting in the direction AD; therefore we must conclude that the two pressures AB and AC really generate a force AD. This uniform agreement shows that the composition is deducible from fixed principles; but it does not appear that it can be held as demonstrated by the arguments employed in the case of motions. A demonstration of the composition of pressures is farther

Second Law of Motion.

wanted, in order to render mechanics a demonstrative science.

This composition is of more difficult investigation.

Accordingly, philosophers of the first eminence have turned their attention to this problem. It is by no means easy; being so nearly allied to first principles, that it must be difficult to find axioms of greater simplicity by which it may be proved.

Mechanicians generally contented themselves with the solution given by Aristotle; but this is merely a composition of motions; indeed he does not give it for any thing else, and calls it *συνθεσις των φυ ᾳν.* The first writer who appears to have considered it as different from the mere composition of motions, was the celebrated Dutch engineer Stevinus, in his work *on Sluices;* but his solution is obscure. It was sufficient, however, to convince Daniel Bernoulli of the necessity and the difficulty of the problem. He has given the first complete demonstration of it in the first volume of the commentaries of the Imperial Academy of Sciences at St Petersburg. It is extremely ingenious; but it is tedious and intricate, requiring a series of fifteen propositions to demonstrate that two pressures, having the directions and magnitudes of the sides of any parallelogram, compose a third, which has the direction and magnitude of its diagonal. His first proposition is, that *two equal pressures, acting at right angles, compose a third, in the direction of the diagonal of a square, and having to either of the other two the proportion of the diagonal of a square to its sides.*

M. d'Alembert has greatly simplified and improved this demonstration, by beginning with a case that is self-evident; namely, *if three equal forces are inclined to each other in equal angles of 120°, any one of them will balance the combined action of the other two.* Surely; for neither of them can prevail. Therefore *two* equal forces, inclined in an angle of 120°, produce a third, which has the direction and proportion of the diagonal of the rhombus; for this is equal and opposite to one of the three above mentioned. He then demonstrates the same thing of two equal forces inclined in *any* angle; and by a series of eight propositions more, demonstrates the general theorem. This dissertation is in the Memoirs of the Academy at Paris for 1769. He improves it still farther in a subsequent memoir.

Mr Riccati and Mr Fonsenex, in the Commentaries of me Academy of Turin, have given analytical demonstrations, which are also very ingenious and concise, but require acquaintance with the higher mathematics. There is another very ingenious demonstration in the *Journal des Sçavans* for June 1764, but too obscure for an elementary proposition. It is somewhat simplified by Belidor in his *Ingenieur François.* Frisius, in his *Cosmographia,* has given one, which is perhaps the best of all those that are easily comprehended without acquaintance with the higher mathematics; but we imagine that, although no one can doubt of the conclusion, it has not that intuitive evidence for every step of the process that seems necessary.

Composition of pressures.

50. We here offer another, composed by blending together the methods of Bernoulli and D'Alembert; and we imagine that no objection can be made to any step of it. We limit it entirely to pressures, and do not at all consider nor employ the motions which they may be supposed to produce.

(A.) If two equal and opposite pressures or incitements to motion act at once on a material particle, it suffers no change of motion; for if it yields in either direction by their joint action, one of the pressures prevails, and they are not equal.

Equal and opposite pressures are said to *balance* each other; and such as balance must be esteemed equal and opposite.

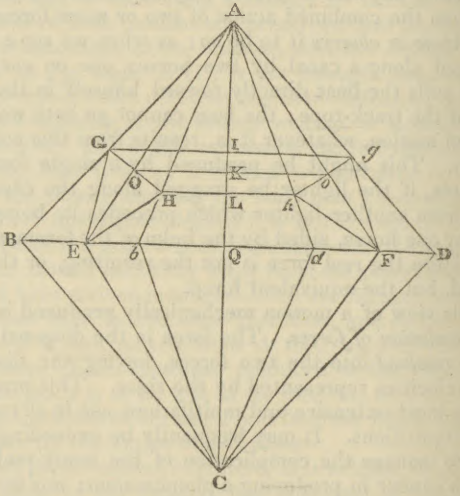
(B.) If a and b are two magnitudes of the same kind, proportional to the intensities of two pressures which act in the same direction, then the magnitude $a+b$ will measure the intensity of the pressure, which is equivalent, and may be called equal to the combined effort of the other two; for when we try to form a notion of pressure as a measurable magnitude, distinct from motion or any other effect of it, we find nothing that we can measure it by but another pressure. Nor have we any notion of a double or triple pressure different from a pressure that is equivalent to the joint effort of two or three equal pressures. A pressure a is accounted triple of a pressure b, if it balances three pressures, each equal to b, acting together. Therefore, in all proportions which can be expressed by numbers, we must acknowledge the legitimacy of this measurement; and it would surely be affectation to omit those which the mathematicians call *incommensurable.*

In like manner, the magnitude $a-b$ must be acknowledged to measure that pressure which arises from the joint action of two pressures a and b acting in opposite directions, of which a is the greatest.

(C.) Let ABCD and AbCd (fig. 2) be two rhombuses, which have the common diagonal AC. Let the angles BAb, DAd, be bisected by the straight lines AE and AF.

If there be drawn from the points E and F the lines EG, EH, Fg, Fh, making equal angles on each side of EA and FA, and if Gg, Hh be drawn, cutting the diagonal AC in I and L: then AI + AL will be greater or less than AQ, the half of AC, according as the angles GEH, gFh, are greater or less than GAH, gAh.

Fig. 2.



Draw GH, gh, cutting AE, AF, in O and o, and draw Oo, cutting AC in K.

Because the angles AEG and EAG are respectively equal to AEH and EAH, and AE is common to both triangles, the sides AG, GE, are respectively equal to AH, HE, and GH is perpendicular to AE, and is bisected in O; for the same reasons gh is bisected in o. Therefore the lines Gg, Oo, Hh, are parallel, and IL is bisected in K. Therefore AI + AL is equal to twice AK. Moreover, if the angle GEH be greater than GAH, AO is greater than EO, and AK is greater than KQ. Therefore AI + AL is greater than AQ; and if the angle GEH be less than GAH, AI + AL is less than AQ.

(D.) Two equal pressures, acting in the directions AB and AC (fig. 3), at right angles to each other, compose a pressure in the direction AD, which bisects the right angle; and its intensity is to the intensity of each of the constituent pressures as the diagonal of a square to one of the sides.

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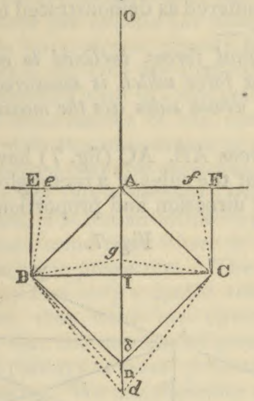
Fig. 3.



It is evident, that the direction of the pressure, generated by their joint action, will bisect the angle formed by their directions; because no reason can be assigned for the direction inclining more to one side than to the other.

In the next place, since a force in the direction AD does, in fact, arise from the joint action of the equal pressures AB and AC, the pressure AB may be conceived as arising from the joint action of two equal forces similarly inclined and proportioned to it. Draw EAF perpendicular to AD. One of these forces must be directed along AD, and the other along AE. In like manner, the pressure AC may arise from the joint action of a pressure in the direction AD, and an equal pressure in the direction AF. It is also plain that the pressures in the directions AE and AF, and the two pressures in the direction AD, must be all equal. And also, any one of them must have the same proportion to AB or to AC, that AB or AC has to the force in the direction AD, arising from their joint action.

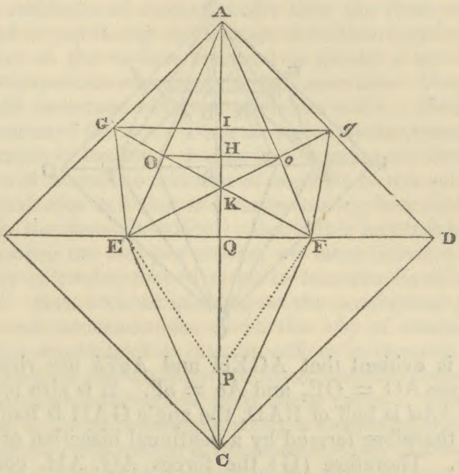
Therefore, if it be said that AD does not measure the pressure arising from the joint action of AB and AC, let A*d*, greater than AD, be its just measure, and make A*d* : AB = AB : A*g* = AB : A*e*. Then A*g* and A*e* have the same inclination and proportion to AB that AB and AC have to A*d*. We determine, in like manner, two forces A*f* and A*g* as constituents of AC.

Now A*d* is equivalent to AB and AC, and AB is equivalent to A*e* and A*g*; and AC is equivalent to A*f* and A*g*. Therefore A*d* is equivalent to A*e*, A*f*, A*g*, and A*g*. But (A) A*e* and A*f* balance each other, or annihilate each other's effect; and there remain only the two forces or pressures A*g*, A*g*. Therefore (B) their measure is a magnitude equal to twice A*g*. But if A*d* be greater than the diagonal AD of the square, whose sides are AB and AC; then A*g* must be less than AI, the side of the square whose diagonal is AB. But twice A*g* is less than AD, and much less than A*d*. Therefore the measure of the equivalent of AB and AC cannot be a line A*d*, greater than AD. In like manner, it cannot be a line Aδ that is less than AD. Therefore it must be equal to AD, and the proposition is demonstrated.

(E.) *Cor.* Two equal forces, AB, AC, acting at right angles, will be balanced by a force AO, equal and opposite to AD, the diagonal of the square whose sides are AB and AC; for AO would balance AD, which is the equivalent of AB and AC.

(F.) Let AECF (fig. 4), be a rhombus, the acute angle of which, EAF, is half of a right angle. Two equal pressures, which have the directions and measures AE, AF, compose a pressure having the direction and measure AC, which is the diagonal of the rhombus.

Fig. 4.



It is evident, in the first place, that the compound force has the direction AC, which bisects the angle EAF. If AC be not its just measure, let it be AP less than AC. Let ABCD be a square described on the same diagonal, and make AP : AQ = AE : AO, = AF : A*o*. Draw KOG, K*og* perpendicular to AE, AF; draw GI*g*, OH*o*, EG, EK, F*g*, FK, PF, and PE.

The angles CAB and FAE are equal, each being half of a right angle. Also the figures AEPF and AGEK are similar; because AP : AQ = AE : AO. Therefore FA : AP = KA : AE, and EA : AP = GA : AE. Therefore, in the same manner that the forces AE, AF are affirmed to compose AP, the forces AG and AK may compose the force AE, and the forces A*g* and AK may compose the force AF. Therefore (B) the force AP is equivalent to the four forces AG, AK, A*g*, AK. But (D) AG and A*g* are the sides of a square, whose diagonal is equal to twice AI; and the two forces AK, AK are equal to, or are measured by, twice AK. Therefore the four forces AG, AK, A*g*, AK, are equivalent to 2 AI + 2 AK = 4 AH.

But because AP was supposed less than AC, the angle FPE is greater than FAE, and GEK is greater than GAK, AO is greater than OE, and AH is greater than HQ, and 2AH is greater than AQ; and therefore 4AH is greater than AC, and much greater than AP. Therefore AP is not the just measure of the force composed of AE and AF.

In like manner it is shown that AE and AF do not compose a force whose measure is greater than AC. It is therefore equal to AC; and the proposition is demonstrated.

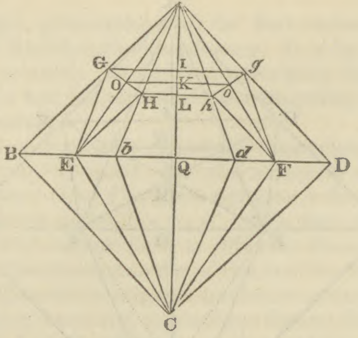
(G.) By the same process it may be demonstrated, that if BAD be half a right angle, and EAF be the fourth of a right angle, two forces AE, AF will compose a force measured by AC. And the process may be repeated for a rhombus, whose acute angle is $\frac{1}{8}$th, $\frac{1}{10}$th, &c. of a right angle; that is, any portion of a right angle that is produced by continual bisection. Two forces, forming the sides of such a rhombus, compose a force measured by the diagonal.

(H.) Let ABCD, A*b* C*d*, (fig. 5), be two rhombuses, formed by two consecutive bisections of a right angle. Let AECF be another rhombus, whose sides AE and AF bisect the angles BA*b* and DA*d*.

The two forces AE, AF, compose a force AC.

Bisect AE and AF in O and *o*. Draw the perpendiculars GOH, *goh*, and the lines GI*g*, OK*o*, HL*h*, and the lines EG, EH, F*g*, F*h*.

Fig. 5.



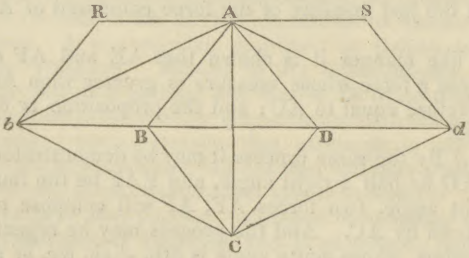
It is evident that $AGEH$ and $AgFh$ are rhombuses; because $AO = OE$, and $Ao = oF$. It is also plain, that since bAd is half of BAD, the angle GAH is half of bAd. It is therefore formed by a continual bisection of a right angle. Therefore (G) the forces AG, AH, compose a force AE; and Ag, Ah, compose the force AF. Therefore the forces AG, AH, Ag, Ah, acting together, are equivalent to the forces AE, AF, acting together. But AG, Ag compose a force $= 2\,AI$; and the forces AH, Ah compose a force $= 2\,AL$. Therefore the four forces acting together are equivalent to $2\,AI + 2\,AL$, or to $4\,AK$. But because AO is $\frac{1}{2}\,AE$, and the lines Gg, Oo, Hh, are evidently parallel, $4\,AK$ is equal to $2\,AQ$, or to AC; and the proposition is demonstrated.

(I.) *Cor.* Let us now suppose that by continual bisection of a right angle we have obtained a very small angle a of a rhombus; and let us name the rhombus by the multiple of a, which forms its acute angle.

The proposition (G) is true of a, $2a$, $4a$, &c. The proposition (H) is true of $3a$. In like manner, because (G) is true of $4a$ and $8a$, proposition (H) is true of $6a$; and because it is true of $4a$, $6a$, and $8a$, it is true of $5a$ and $7a$. And so on continually till we have demonstrated it of every multiple of a that is less than a right angle.

(K.) Let RAS (fig. 6) be perpendicular to AC, and let $ABCD$ be a rhombus, whose acute angle BAD is some multiple of $2a$ that is less than a right angle. Let Ab, Cd be another rhombus, whose sides Ab, Ad bisect the angles RAB, SAD. Then the forces Ab, Ad compose a force AC.

Fig. 6.



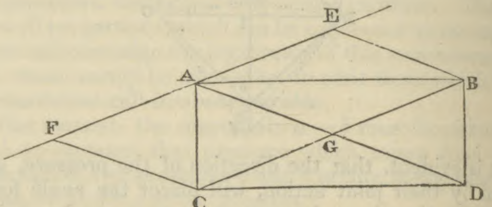
Draw bR, dS parallel to BA, DA. It is evident that $ARbB$ and $ASdD$ are rhombuses, whose acute angles are multiples of a, that are each less than a right angle. Therefore (I) the forces AR and AB compose the force Ab and AS, AD compose Ad; but AR and AS annihilate each other's effect, and there remains only the forces AB, AD. Therefore Ab and Ad are equivalent to AB and AD, which compose the force AC; and the proposition is demonstrated.

(L.) *Cor.* Thus is the corollary of last proposition extended to every rhombus, whose angle at A is some multiple of a less than two right angles. And since a may be taken less than any angle that can be named, the proposition may be considered as demonstrated of every rhombus; and we may say,—

(M.) *Two equal forces, inclined to each other in any angle, compose a force which is measured by the diagonal of the rhombus, whose sides are the measures of the constituent forces.*

(N.) Two forces AB, AC (fig. 7) having the direction and proportion of the sides of a rectangle, compose a force AD, having the direction and proportion of the diagonal.

Fig. 7.

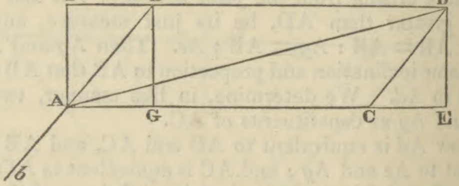


Draw the other diagonal CB, and draw EAF parallel to it: draw BE, CF parallel to DA.

$AEBG$ is a rhombus; and therefore the forces AE and AG compose the force AB. $AFCG$ is also a rhombus, and the force AC is equivalent to AF and AG. Therefore the forces AB and AC, acting together, are equivalent to the forces AE, AF, AG, and AG acting together, or to AE, AF, and AD acting together; but AE and AF annihilate each other's action, being opposite and equal (for each is equal to the half of BC). Therefore AB and AC acting together are equivalent to AD, or compose the force AD.

(O.) Two forces, which have the direction and proportions of AB, AC (fig. 8) the sides of any parallelogram, compose a force having the direction and proportion of the diagonal AD.

Fig. 8.



Draw AF perpendicular to BD, and BG and DE perpendicular to AC.

Then $AFBG$ is a rectangle, as is also $AFDE$; and AG is equal to CE. Therefore (N) AB is equivalent to AF and AG. Therefore AB and AC acting together, are equivalent to AF, AG, and AC acting together; that is, to AF and AE acting together; that is (N) to AD; or the forces AB and AC compose the force AD.

51. Hence arises the most general proposition.

If a material particle be urged at once by two pressures or incitements to motion, whose intensities are proportional to the sides of any parallelogram, and which act in the directions of those sides, it is affected in the same manner as if it were acted on by a single force, whose intensity is measured by the diagonal of the parallelogram, and which acts in its direction: Or, two pressures, having the direction and proportion of the sides of a parallelogram, generate a pressure having the direction and proportion of the diagonal.

52. Thus have we endeavoured to demonstrate from abstract principles the perfect similarity of the composition of pressures, and the composition of forces measured by the motions which they produce. We cannot help being of the opinion that a separate demonstration is indispen-

eeng iffence f th om- ositns f mon nd pres- ure sap- ear hen arely xamed.

sably necessary. What may be fairly deduced from the one case cannot always be applied to the other. No composition of pressures can explain the change produced by a deflecting force on a motion already existing; for the changing pressure is the only one that exists, and there is none to be compounded with it. And, on the other hand, our notions and observations of the composition of motions will not explain the composition of pressures, unless we take it for granted that the pressures are proportional to the velocities; but this is perhaps a gratuitous assumption. At any rate, it is not an intuitive proposition; and we have mentioned some facts where it seems that they do not follow the same proportion. The pressure of four equal springs produces only a double velocity. It would appear, therefore, that there are circumstances which oblige us to say, that the *exertion* of pressure, as a cause of motion, is not (always at least) proportional to the real measurable pressure. We are therefore anxious to discover in what the difference consists; and in the mean time must allow, that the pressure exerted on a body at rest is different from its exertion in producing motion. We cannot indeed state any immediate comparison between pressure and motion, nor have we any clear conception of the connection between them. It is only by our own sensations of touch that we have any notion of pressure, and it is experience that teaches us that it always accompanies every cause of motion. We can, however, observe the proportions of pressures, and compare them with the proportions of motion. We very often observe them different; and therefore it was indispensably necessary to investigate the laws of combined pressure as we did the laws of combined motion in consequence of pressure. Yet we should err if we hastily asserted that pressures are not proportional to the motions which they produce; all that we are entitled to call in doubt is, whether the pressures in their exertion, while they actually produce motion, or changes of motion, continue to be the same as when they do not produce motion, being withstood or balanced by opposite pressures. Considered as causes of motion, we ought to think that they do not vary while they produce motion, and that the actual pressure, while it produces a double motion, is really double, although it may be quadruple when the body exerting it is made to act on a body that it cannot move. We are confirmed in this opinion by observing, that other facts show us, that even while producing motion, the pressure which we call quadruple, because we have measured it by four equal pressures balancing it, is really quadruple, considered as the cause of motion, and produces a quadruple motion. A bow which requires four times the force to draw it to any given extent, will communicate the same velocity to a bundle of four arrows that a bow four times more easily drawn communicates to one arrow, and will therefore produce a quadruple motion. Yet it will only produce a double velocity in the arrow that acquired a simple velocity from a bow having one fourth of the strength.

These discrepancies should excite the endeavours of mechanicians to investigate the laws observed in the action of pressures producing motion. Had this been done with care and with candour, we should not have had the great difference of opinion which still divides philosophers about the measures of moving forces. But a spirit of party, which had arisen from other causes, gave importance to what was at first only a difference of expression, and made the partizans of Mr Leibnitz avail themselves of the figurative language which has done so much harm in all the departments of philosophy. Notwithstanding all our caution, it is hardly possible to avoid metaphorical conceptions when we employ the language of metaphor. The abettors of the Leibnitzian measure of moving forces, or perhaps, to speak more properly, the abettors of the Leibnitzian measure of that force which is supposed to preserve bodies in their condition of motion, insist that the force which is exerted in producing any change of motion is greater in proportion as the motion changed is greater; and they give a very specious argument for their assertion. They appeal to the exertions which we ourselves make. Here we are conscious of the fact. Then they give similar examples of the action of bodies. A clay ball, moving six feet per second, will make the addition of one foot to the velocity of an equal clay ball that is already moving four feet per second in the same direction. But if this last ball be already moving ten feet per second, we must follow it with a velocity of twelve feet in order to increase its velocity one foot. But, without insisting on the numberless paralogisms and inconsistencies which this way of conceiving the matter would lead us into, it suffices to observe, that the phenomena give us abundant assurance that there has been the same exertion in both these cases. This acceleration is always accompanied by a compression of the balls, and the compression is the same in both. This compression is a very good measure of the force employed to produce it; and, in the present case, we need not even trouble ourselves with any rule for its measurement: for surely, when the compression is not different, but the same, the force exerted is the same. This is farther confirmed by observing, that it requires the same force to make the same pit, or to give the same motion, to a piece of clay lying on the table of a ship's cabin, whether the ship be sailing two miles or ten miles per hour.

Thus we see that there are strong reasons for believing, that the exertions of pressure in producing motion, or that the pressures *actually exerted*, are proportional to the changes of motion observed, and that they coincide in this respect with our abstract conceptions of moving forces.

But we have still better arguments. None of the Leibnitzians think of denying the equal exertions of gravity, or of any of those powers which they call *solicitations or accelerating forces*. They all admit that gravity, or any constant accelerating force, produces equal increments of velocity in equal times, and that a double gravity will produce a double increment in an equal time, and an equal increment in half of the time: and that a quadruple gravity will produce a double velocity in half the time. All these things are granted by them, and their writings are full of reasonings from this principle. Now, from the fact, acknowledged by the Leibnitzians, that the quadruple force of a bow gives a double velocity to the arrow, in every instant of its action, it indisputably follows, that it has acted on it only for half the time of the action of the four times weaker bow, which gives the arrow only half the velocity; and thus has the discrepancy between the effects of pressures and of our abstract moving forces entirely disappeared. For this circumstance of the difference in the time of acting will be found, on strict examination, in all the cases of the change of motion by pressures which we measure by their effects on a body at rest. When this and the appreciable changes of actual pressure, during the time of producing the motion, are taken into consideration, all difference vanishes, and the composition of pressures is in perfect harmony with the composition of motions, or of abstract moving forces. Dynamics is thus made a demonstrative science, and affords the opportunity of investigating, by observation and experiment, the nature of those mechanical powers which reside in bodies, and which appear to us under the form of pressure, inducing us to consider pressure as a cause of motion.

In this, however, we are rather inaccurate. Pressure is one of the sensible effects of that property which is also

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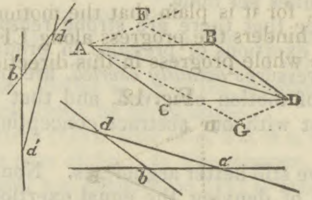
the cause of motion. It is not the pressure of a piece of lead, but its heaviness, that is the reason that it gives motion to a kitchen jack. Pressure is merely a generic name, borrowed from a similar instance, and given to moving forces, which have the same nature, but different names that serve to mark their connection with certain substances, in which they may be supposed to reside. Natural philosophy is almost entirely employed in examining the nature of these various pressures or accelerative forces; and the general doctrines of dynamics, by ascertaining what is common to them all, enable us to mark with precision what is characteristic of each.

General corollaries.

53. We have now advanced very far in this investigation; for we have obtained the criterion by which we learn the direction and the magnitude of every changing force; and, on the other hand, we see how to state what will be the effect of the exertion of any force that is known or suspected to act. All this we learn by the composition of forces; and the greatest part of mechanical disquisition consists in the application of this doctrine. For such reasons it merits minute consideration; and therefore we must point out some general conclusions from the properties of figure, which will greatly facilitate the use of the parallelogram of forces.

54. *First*, The constituent and the resulting forces, or the simple and compound forces, act in the same plane; for the sides and diagonal of a parallelogram are in one plane.

Fig. 9.



55. *Second*, The simple and the compound forces are proportional to the sides of any triangle which are parallel to their directions. For if any three lines, *ab*, *bd*, *ad*, be drawn parallel to AB, AC, and AD (fig. 9), they will form a triangle similar to the triangle ABD. For the same reasons they are proportional to the sides of a triangle *a′b′d*, which are respectively perpendicular to their directions.

56. *Third*, Therefore each is proportional to the sine of the opposite angle of this triangle; for the sides of any triangle are proportional to the sines of the opposite angles.

57. *Fourth*, Each is proportional to the sine of the angle contained by the directions of the other two; for AD is to AB as the sine of the angle ABD to the sine of the angle ADB. Now the sine of ABD is the same with the sine of BAC contained between the directions AB and AC, and the sine of ADB is the same with the sine of CAD; also AB is to AC, or BD, as the sine of ADB (or CAD) to the sine of BAD.

Some special uses of the parallelogram of forces.

58. We now proceed to the application of this fundamental proposition. And we observe, in the first place, that since AD may be the diagonal of an indefinite number of parallelograms, the motion or the pressure AD may result from the joint action of many pairs of forces. It may be produced by forces which would separately produce the motions AF and AG. This generally gives us the means of discovering the forces which concur in its production. If one of them, AB, is known in direction and intensity, the direction AC, parallel to BD, and the intensity, are discovered. Sometimes we know the directions of both. Then, by drawing the parallelogram or triangle, we learn their proportions. The force which deflects any motion AB into a motion AD, is had by simply drawing a line from the point B (to which the body would have moved from A in the time of really moving from A to D) to the point D. The deflecting force is such as would have caused the body move from B to D in the same time. And, in the same manner, we get the compound motion AD, which arises from any two simple motions AB and AC, by supposing both of the motions to be accomplished in succession. The final place of the body is the same, whether it moves along AD or along AB and BD in succession.

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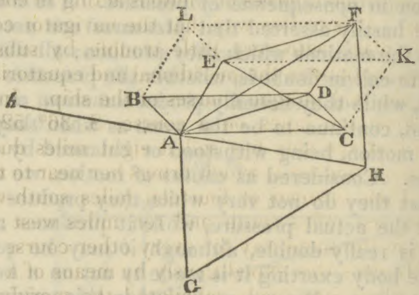
59. This theorem is not limited to the composition of two motions or two forces only; for since the combined action of two forces puts the body into the same state as if their equivalent alone had acted on it, we may suppose this to have been the case, and then the action of a third force will produce a change on this equivalent motion. The resulting motion will be the same as if only this third force and the equivalent of the other two had acted on the body. Thus, in fig. 10, the three forces AB, AC, AE, may act at once on a particle of matter. Complete the parallelogram ABDC; the diagonal AD is the force which is generated by AB and AC. Complete the parallelogram AEFD; the diagonal AF is the force resulting from the combined action of the forces AB, AC, and AE. In like manner, completing the parallelogram AGHF, the diagonal AH is the force resulting from the combined action of AB, AC, AE, and AG, and so on of any number of forces.

Equi lent many ces.

Fig. 10.



This resulting force and the resulting motion may be much more expeditiously determined, in any degree of composition, by drawing lines in the proportion and direction of the forces in succession, each from the end of the preceding. Thus, draw AB, BD, DF, FH, and join AH; AH is the resulting force. The demonstration is evident.

60. It is to be noticed here, that in the composition of more than two forces, we are not limited to one plane. The force AD is in the same plane with AB and AC; but AE may be elevated above this plane, and AG may lie below it. AF is in the plane of AD and AE, and AH is in the plane of AF and AG.

Complete the parallelograms ABLE, ACKE, ELFK. It is evident that ABLFKCD is a parallelopiped, and that AF is one of its diagonals. Hence we derive a more general theorem of great use.

Three forces having the proportion and direction of the three sides of a parallelopiped, compose a force having the proportion and direction of the diagonal.

One f may b lance acting gether

61. Any number of forces acting together on one particle of matter are balanced by a force that is equal and opposite to their resulting force; for this force would balance their resulting force which is equivalent to them in action. When this is duly considered, we perceive that each force is then in equilibrio with the equivalent of all

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the others; for a force can balance only what is equal and opposite to it. It appears very readily by the geometrical construction. If, instead of the circuit A, B, D, F, H, we take B, D, F, H, A, we have BA for the equivalent of the forces AC, AE, AG; but AB is equal and opposite to BA. Therefore the force AB is in equilibrio with the equivalent of all the others.

62. When any number of forces act on one particle of matter, and are in equilibrio, if they be considered as acting in parcels, the equivalents of these parcels are in equilibrio; for let the forces AB, AC, AE, AG, A*h*, be in equilibrio, and let them be considered in the two parcels AB, AC, and AE, AG, A*h*, then AD is the equivalent of AB, BD (or AC), and DA is the equivalent of DF, FH, HA (or A*h*): now AD and DA balance each other. This corollary enables us to simplify many intricate complications of force; it also enables us to draw accurate conclusions from very imperfect observations. In most of our practical discussions we know, or at least we attend to, a part only of the forces which are acting on a material particle; and in such cases we reason as if we saw the whole: yet is our mathematical reasoning good with respect to the equivalent of all the parcels which we are contemplating, and the equivalents of the smaller parcels of which it consists; and the neglected force, or parcel of forces, induces no error on our conclusions.

Ex li-tio me-tho for obt ing the sult-ing otion in pli-cat cases.

63. In the spontaneous phenomena of nature, the investigation and discovery of our ultimate object of search is frequently very difficult, on account of the multiplicity of directions and intensities of the operating forces or motions. We may generally facilitate the process, by substituting equivalent forces or motions acting in convenient directions. It is in this way that the navigator computes the ship's place with very little trouble, by substituting equivalent motions in the meridional and equatorial directions for the real oblique courses of the ship. Instead of setting down ten miles on a course, S. 36° 52′ W. he supposes that the ship has sailed eight miles due south, and six miles due west, which brings her near to the same place. Then, instead of fourteen miles south-west, he sets down ten miles south and ten miles west; and he proceeds in the same way for every other course and distance. He does this expeditiously by means of a traverse table, in which are ready calculated the meridional and equatorial sides of right-angled triangles, corresponding to every course and distance. Having done this for the course of a whole day, he adds all the southings into one sum, and all the westings into another; he considers these as forming the sides of a right-angled triangle; he looks for them, paired together, in his traverse table, and then notices what angle and what distance corresponds to this pair. This gives him the position and magnitude of the straight line joining the beginning and end of his day's work.

The miner proceeds in the same way when he takes the plan of subterraneous workings, measuring, as he goes along, and noticing the bearing of each line by the compass, and setting down, from his traverse table, the northing or southing, and the easting or westing, for each oblique line: but there is another circumstance which he must attend to, namely, the slope of the various drifts, galleries, and other workings. This he does by noting the rise or the dip of each sloping line. He adds all these into two sums, and taking the risings from the dips, he obtains the whole dip. Thus he learns how far the workings proceed to the north, how far to the east, and how far to the dip.

The reflecting reader will perceive that the line joining the two extremities of this progression will form the diagonal of a rectangular parallelopiped; one of whose sides lies north and south, the other lies east and west, and the third is right up and down.

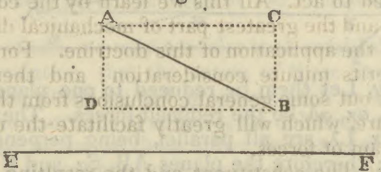
Second Law of Motion.

The mechanician proceeds in the very same way in the investigation of the very complicated phenomena which frequently engage his attention. He considers every motion as compounded of three motions in some convenient directions, at right angles to each other. He also considers every force as resulting from the joint action of three forces, at right angles to each other, and takes the sum or difference of these in the same or opposite directions. From this process he obtains the three sides of a parallelopiped, and from these computes the position and magnitude of the diagonal. This is the motion or force resulting from the composition of all the partial ones.

Forces may be estimated by, or reduced to,

This procedure is called the *estimation* or *reduction* of motions and forces.

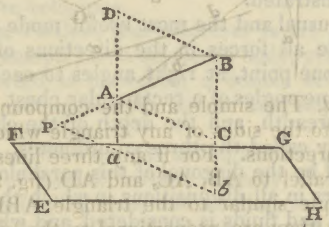
Fig. 11.



a given direction,

64. A motion or force AB (fig. 11) is said to be *estimated* in the direction EF, or to be *reduced* to this direction when it is conceived as compounded of the motions or forces AC, AD, one of which, AC, is parallel to EF, and the other, AD, is perpendicular to it. This expression is abundantly significant; for it is plain that the motion AD neither promotes nor hinders the progress along EF, and that AC expresses the whole progress in this direction.

Fig. 12.



or a given plane.

65. In like manner, a force AB (fig. 12) is said to be *estimated in*, or *reduced to*, a given plane EFG when it is conceived as resulting from the joint action of two forces AC, AD, one of which is parallel to a line *ab* drawn in that plane, and the other AD is perpendicular to it. The position of the line *ab* is determined by letting fall B*b* perpendicular to the plane, and drawing *b*P to the point P, in which BA meets the plane; then A*a* being drawn parallel to B*b*, will cut off *ba*, which is the reduction of the motion AB to the plane. Drawing AC parallel to *ab*, and completing the parallelogram ACBD, it is evident that the motion AB is equivalent to AD and AC, which is parallel to *ab*, and the three forces AB, AC, AD, are, as they should be, in one plane perpendicular to the plane EG.

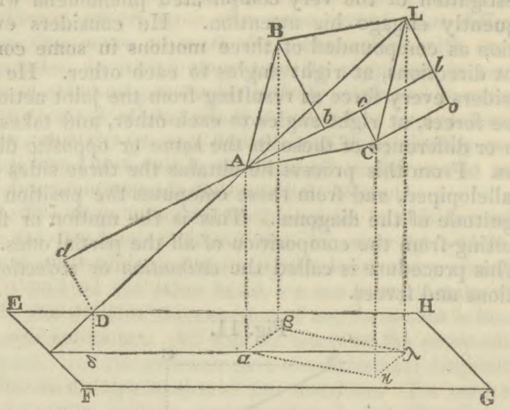
Equilibrium of forces so estimated or reduced.

66. If three forces AB, AC, AD (fig. 13) are in equilibrio, and are reduced to any one direction *d*A*l*, or to one plane EFGH, the reduced forces are also in equilibrio.

First, let them be reduced to one direction *dl* by drawing the perpendiculars B*b*, C*c*, D*d*; make AL equal to AD, and join BL, CL, and draw the perpendiculars L*l*, C*c*; then, because the forces AB, AC, AD, are in equilibrio, ABLC must be a parallelogram, and AL is the force equivalent to AB and AC combined; then, because the lines D*d*, B*b*, C*c*, L*l*, are parallel, *d*A is equal to A*l*, and A*b* to C*o*, or to *cl*; therefore A*l* is equal to the sum of A*b* and A*c*, which are the reductions of AB and AC;

therefore dA is equal to the same sum, and in equilibrio with them.

Fig. 13.



Secondly, Let them be reduced to one plane, EFGH, and let $\alpha\beta$, $\alpha\varkappa$, $\alpha\delta$, be the reduced forces. The lines Dδ, Aα, Bβ, C$\varkappa$, Lλ, are all parallel, being perpendicular to the plane; therefore the planes AB, $\beta\alpha$, and CL, $\lambda\varkappa$, are parallel, and $\alpha\beta$, $\varkappa\lambda$, are parallel. For similar reasons, $\beta\lambda$, $\alpha\varkappa$, are parallel; therefore $\alpha\beta\lambda\varkappa$ is a parallelogram. Also, because the lines Dδ, Aα, Lλ, are parallel, and DA is equal to AL; therefore $\delta\alpha$ is equal to $\alpha\lambda$. But because $\alpha\beta\lambda\varkappa$ is a parallelogram, the forces $\alpha\beta$, $\alpha\varkappa$, are equivalent to $\alpha\lambda$; and $\alpha\delta$ is equal and opposite to $\alpha\lambda$, and will balance it; and therefore will balance $\alpha\beta$ and $\alpha\varkappa$, which are the reductions of AB and AC to the plane EFGH, while $\alpha\delta$ is the reduction of AD; therefore the proposition is demonstrated.

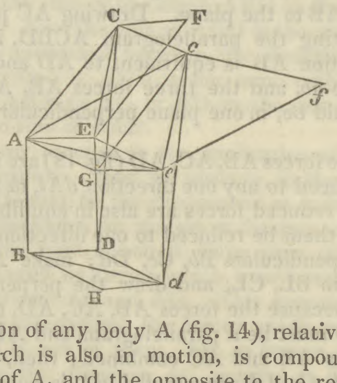
The most useful mode of reduction is to their co-ordinates.

The most usual and the most useful mode of reduction is to estimate all forces in the directions of three lines drawn from one point, at right angles to each other, like the three plane angles of a rectangular chest, forming the length, the breadth, and the depth of the chest. These are commonly called the three co-ordinates. The resulting force will be the diagonal of this parallelopiped. This process occurs in all disquisitions in which the mutual action of solids and fluids is considered, and when the oscillation or rotation of detached free bodies is the subject of discussion.

Relative motions of bodies not affected by any extraneous equal and parallel force.

67. The only other general theorem that remains to be deduced from this law of motion is, that if a number of bodies are moving in any manner whatever, and an equal force act on every particle of matter in the same or parallel directions, their relative motions will suffer no change; for the motion of any body A (fig. 14), relative to another body B, which is also in motion, is compounded of the real motion of A, and the opposite to the real motion of B; for let A move uniformly from A to C, while B describes BD uniformly; draw AB, also draw AE equal and parallel to BD; join EC, DC, ED. The motion of A, relative to B, consists in its change of position and distance. Had A described AE, while B described BD, there would have been no change of relative place or distance; but A is now at C, and DC is its new direction and distance. The relative or apparent motion of A therefore is EC. Complete the parallelogram ACFE; it is plain that the motion EC is compounded of EF, which is equal and parallel to AC, the real motion of A, and of EA, the equal and opposite to BD, the real motion of B.

Fig. 14.



Now let the motions of A and B sustain the same change; let the equal and parallel motions AG, BH, be compounded with the motions AC and BD; or let forces act at once on A and B, in the parallel directions AG, BH, and with equal intensities; in either supposition, the resulting motions will be Ac, Bd, the diagonals of the parallelograms AGcC and BHdD. Construct the figure as before, and we see that the relative motion is now ec, and that it is the same with EC both in respect of magnitude and position.

Here we still see the constant analogy between the composition of motions and the composition of forces. In the first case, the relative motions of things are not changed, whatever common motion be compounded with them all; or, as it is usually but inaccurately expressed, although the space in which they move be carried along with any motion whatever. In the second case, the relative motions and actions are not changed by any external force, however great, when equally exerted on every particle in parallel directions.

Thus it is that the evolutions of a fleet in a uniform current are the same, and produced by the same means, as in still water. Thus it is that we walk about on the surface of this globe in the same manner as if it neither revolved round the sun, nor turned round its axis. Thus it is that the same strength of a bow will communicate a certain velocity to an arrow, whether it is shot east, or west, or north, or south. Thus it is that the mutual actions of sublunary bodies are the same, in whatever directions they are exerted, and notwithstanding the very great changes in their velocities by reason of the earth's rotation and orbital revolution. The real velocity of a body on the earth's equator is about 3000 feet per second greater at midnight than at mid-day. For at midnight the motion of rotation nearly conspires with the orbital motion, and at mid-day it nearly opposes it. The difference between the velocities at the beginning of January and the beginning of July is vastly greater. And at other times of the day, and other seasons of the year, both motions of the earth are transversely compounded with the easterly or westerly motion of an arrow or cannon bullet; yet we can observe no change in the effects of the mutual actions of bodies.

68. This is an important observation, because it proves that forces are to be measured by no other scale than by the motions which they produce. We have had repeated occasions to mention the very different estimation of moving forces by Mr Leibnitz; and have shown how, by a very partial consideration of the action of those natural powers called *pressures*, he has attempted to prove that moving forces are proportional to the squares of the velocities; and we showed briefly in what manner a right consideration of what passes when motion is produced by measurable pressures, proves that the forces really exerted are as the velocities produced. But the most copious proof is had from the present observation, that, in fact, the mutual actions of bodies depend on their relative motions alone.

69. The Leibnitzian measure of moving force is altogether incompatible with the universal fact now mentioned,

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viz. that the relative motions of bodies, resulting from their mutual actions, are not affected by any common motion, or the action of any equal and parallel force on both bodies; for this universal fact imports, that when two bodies are moving with equal velocities in the same direction, a force applied to one of them, so as to increase its velocity, gives it the same motion relative to the other, as if both bodies had been at rest. Here it is plain that the space described by the body in consequence of the primitive force, and of the force now added, is the sum of the spaces which each of them would generate in a body at rest. Therefore the forces are proportional to the velocities or changes of motion which they produce, and not to the squares of those velocities. This measure of forces, or the position that a force makes the same change on any velocity whatever, and the independence of the relative motions on any motion that is the same on all the bodies of a system, are counterparts of each other. Since this independence is a matter of observation in all terrestrial bodies, we are entitled to say that the powers which the Author of nature has imparted to natural bodies are no way different from what are competent to matter once called into existence. And it also follows from this, that we must always remain ignorant of the absolute motions of bodies. The fact that it has required the unremitted study of ages to discover even the relative motions of our solar system, is an argument to prove that the influence of this mechanical principle extends far beyond the limits of this sublunary world; nor has any phenomenon yet been exhibited which should lead us to imagine that it is not universal.

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When we have made use of these arguments with some zealous partizans of Mr Leibnitz's doctrine, they have answered, that if indeed this independence of the relative motions of terrestrial bodies were observed to obtain exactly, it would be a conclusive argument. But the motion with which all is carried along is so great in comparison with the motions which we can produce in our experiments, that the small additions or diminutions that we can make to the velocity of this common motion must observe very nearly the proportions of the additions or diminutions of their squares. The differences of the squares of 2, 3, and 4, are very unequal; but the differences of the squares of 9, 10, 11, are much nearer to the ratio of equality; and the differences of the squares of 1000001, 1000002, 1000003, do not sensibly deviate from this ratio. But it is not fact that we cannot produce motions which have a very sensible proportion to the common motion. The motion of a cannon ball discharged with one third of its weight of powder, is nearly equal to that of the rotation of the earth's equator. When, therefore, we discharge the ball eastward, we double its motion; when to the westward, we destroy it. Therefore, according to Leibnitz, the action in the first case is three times the action in the second. In the first case it changes the square of the velocity (which we may call 1) from 1 to 4; and, in the second, it changes it from 1 to 0. But, say the Leibnitzians, the velocity of rotation is but $\frac{1}{63}$ of the orbital velocity of the earth, and our observations of the velocities of cannon bullets are not sufficiently exact to ensure us against an error of $\frac{1}{31\frac{1}{2}}$. But the latter observations on the peculiar motions of the fixed stars concur in showing, that the sun, with his attending planets, are carried along with a very great motion, which, in all probability, has a sensible ratio to the orbital motion of the earth. This must make a prodigious change on the earth's absolute motion, according as her orbital motion conspires with, opposes, or crosses, this other motion; the earth may even be at absolute rest in some points of its orbit. Thus will the composition with the motions produced in our experiments be so varied that cases *must* occur when the difference of the results of the two measures of force will be very sensible.

Second
Law of
Motion.

But, further, they have not attended to the agreement of our experiments when the discharges of cannon are made in a direction transverse to that of the common motion. Here the immensity of the common motion, and the minuteness of our experimental velocities, can have no effect in diminishing the difference of the results of the two doctrines. This will appear distinctly to every reader who is much conversant in disquisitions of this kind; and it is in these more moderate motions that the complete independence of the relative motions on the common motions most accurately appears. Pendulum clocks and watches have been often executed which do not deviate from perfect equability of motion one part in 86,400. This could not be obtained in all directions of the oscillations, if the forces deviated from the ratio of the velocities one part in 86,400.

Perfect
agreement
of the abstract notion of
force with
all our accurate observations
of the exertions of
natural
powers.

On the whole, we may consider it as established on the surest foundation, that the action of those powers of natural bodies which we call *pressures*, such as the force of springs, the exertions of animals, the cohesion of bodies, as well as the action of those other incitements to motion which we call *attractions* and *repulsions*, such as gravitation, magnetism, and electricity, is proportional to the change of velocity produced by it. And we must observe here, that this is not a mere mode of conception, the result of the laws of human thought, which cannot conceive a natural power as the cause of motion otherwise than by its producing motion, and which cannot conceive any degree of *moving* power different from the degree of the motion. This is the abstract doctrine, and is true whether the pressures are proportional to the velocities or to the squares of the velocities.

But we see further, that whatever is the pressure of a spring (for example) on a quiescent body, yet the pressure actually exerted in producing a double velocity is only double, and not quadruple, as our first imperfect observations make us imagine.

Newton's
third law
of motion
is founded
on experience alone,
and is not
a necessary
truth.

70. Sir Isaac Newton has added another proposition to the number of laws of motion; namely, that *every action is accompanied by an equal and contrary re-action*. But in affirming this to be a law of nature, he only means that it is a universal fact: and he makes this affirmation on the authority of what he conceives to be a law of human thought; namely, that those qualities which we find in all bodies on which we can make experiments and observations, are to be considered as universal qualities of body. But we have limited the term *law of motion* to those consequences that necessarily flow from our notions of motion, of the causes of its production and changes. Now this third Newtonian proposition is not such a result. A magnet is said to act on a piece of iron, when, and only when, the vicinity of the magnet is observed to be accompanied by certain motions of the iron. But it by no means follows from this observation, that the presence of the iron shall be accompanied by any motion, or any change of state whatever of the magnet, or any appearance that can suggest the notion that the iron acts on the magnet. When this was observed, it was accounted a discovery. Newton *discovered* that the sun acts on the planets, and that the earth acts on the moon; and Kepler *discovered* that the moon re-acts on the earth. Newton had observed that the iron re-acts on the magnet; that the actions of electrified bodies were mutual; and that every action of sublunary bodies was, in fact, accompanied by an equal and contrary re-action. On the authority of his rule of philosophizing, he affirmed that the planets re-act on the sun, and that the sun is not at rest, but is continually agi-

tated by a small motion round the general centre of gravitation. He pointed out several consequences of this re-action. Astronomers examined the celestial motions more narrowly, and found that those consequences do really obtain, and disturb all the planetary motions. It is now found that this reciprocity of action obtains throughout the solar system with the utmost precision, and that the third Newtonian proposition is really a law of nature, although it is not a law of human thought. It is a discovery. The contrary involves no absurdity or contradiction. It would indeed be contrary to experience; but things might have been otherwise. It is conceivable and possible that a ball A shall strike another equal ball B, and carry it along with it, without any diminution of its velocity. The fact that the velocity of A is reduced to one half, is the indication of a force residing in B, which force changes the motion of A; and the intensity of this force is learned from the change which it produces. This is found to be equal to the change produced by A on B. And thus the re-action of B is *discovered* to be equal to the action of A.

It is highly probable that this universality and equality of re-action to action is the consequence of some general principle, which we may in time discover; meanwhile we are entitled to suppose it universal, and to reason from this topic in our disquisitions about the actions of bodies on each other.

Maupertuis, Leibnitz, and other philosophers, have entertained very inadequate opinions concerning the foundation of the laws of motion.

Although the celebrated philosophers of Europe have at last agreed in the reception of the two propositions so largely discussed by us as the laws of motion, they have differed exceedingly in their opinion about their origin and validity. Some asserted that they are entirely matters of experience, while others affirmed them to be necessary truths. The Royal Academy of Berlin made this question the subject of their prize dissertation in the year 1744. Mr Maupertuis, president of the academy, published a dissertation, in which he endeavoured to prove that they are necessary truths, only because *they are such as make the quantity of action the least possible*, an economy which is worthy of infinite wisdom, and therefore certainly directs the choice of the Author of nature. On this account alone are they necessary truths.

But this is not the way to consider a question of this kind. We know too little about infinite wisdom to be able to say, with Messrs Leibnitz and Maupertuis, that the Deity should or should not impress on bodies laws different from those which are essential to matter; and we are not to inquire whether God could or could not do this. We know from our own experience, that matter, when subjected to the action of intelligence, may be moved in a way extremely different from what it would follow if left to itself, and that its motions may either be regulated by fixed but contingent law, or may be without any constancy whatever, and vary in every instance. When we suppose the existence of matter and motion, a variety of truths are involved in the supposition, in the same manner as all the theorems in the third book of Euclid's *Elements* are involved in the conception of a circle and a straight line. Our first employment should be to evolve those truths. We can do this in no way but by first noticing the relations of the ideas that we have of the different objects of contemplation, and then following the laws of human thought in our judgments concerning those relations. This process of the mind is expressed in the train of a geometrical demonstration. The different parts or argumentations of this train are not the causes of our conclusions, but the means by which we form our judgment; not the reasons of the truth of our ultimate conclusion, but the steps by which we arrive at the knowledge of it. The young geometer generally thinks otherwise. But that this is the matter of fact, is plain from this, that more than one demonstration, and often very different, can be given of the same theorem. We must proceed in the same manner in the present question; and the first general truths which we find involved in the notions of matter, motion, and force, must be received as *necessary* truths. The steps by which we arrive at the discovery are the laws of human thought; and the expression of the discovery, involving both the truth itself, and the manner of conceiving it, is a necessary law of motion. There may be other facts, perhaps as general as any of those necessary laws, but which do not necessarily result from the relations of our notions of motion and of force. These are discovered by observation only, and they serve to characterize the forces which nature presents to our view. These facts are *contingent* laws of motion.

We apprehend that this method has been followed in treating this article. The first proposition, termed *a law of motion*, is only a more convenient way of expressing our contemplation of a motion in body as an effect of the general cause which we term *force*. The second proposition does nothing but express more distinctly the relation between this cause and its effect; it expresses what we mean by the magnitude and the kind of the cause. The proposition, stating the composition of forces, is but another form of the same law, better suited to the ordinary procedure in geometrical disquisitions.

These propositions might have completed the doctrines of dynamics; but it appears that, in order to the production of a material universe which should accomplish the purposes of the Creator, it was necessary that there be certain characteristic differences between the forces inherent in the various collections of matter which compose this universe. The facts or physical laws (for the above-mentioned laws are metaphysical) of motion may be different from those which would have been observed had matter been left entirely to itself. This difference may have introduced other laws of motion as necessarily resulting from the nature of the forces. We have occasionally mentioned some instances where this appears to obtain, but gave good reasons for affirming that a due examination of all circumstances which may be observed in the production or variation of motion by those forces, has demonstrated, that there are no such deviations from the two laws of motion already determined, but that all the mechanical powers of bodies, when considered merely as causes of motion, act agreeably to the same laws. Careful examination was, however, said to be necessary.

This examination must consist in distinctly noticing the circumstances that occur in the production of motion by any force whatever. It is by no means enough to state simply the intensity of the force and the direction of its exertion. If a force continue to act, it continues to vary the motion already produced. Should the force change its intensity or direction while it is acting, these circumstances must induce still farther changes in the motion; and it is not till all action has ceased that the motion is brought to its ostensible state, in which it is the object of our attention and our future discussions. Instances of the effects of such continued and such varied actions are to be seen in most of the phenomena of nature or art. The communication of motion by impulse is perhaps the only instance (very frequent indeed) that can be produced where this is not necessary; nay, we shall perhaps find reason to conclude that this instance is not an exception, and that even the communication of motion from one billiard ball to another is brought about by an action continued for some time, and greatly varied during that time. Much preparation is therefore necessary before we can apply the general laws of motion to the solution of most of the questions which come before us in the course even of our elementary disquisitions. We must lay down some general propositions which determine the results of the continued, and perhaps varied, actions of moving forces; and we must mark the different effects of the simple continuation of action, and also those of the variations in this continued action, both in respect of intensity and direction. The effect of a mere continuance of action must be an acceleration of the motion, or a retardation of it if the force continue to act in the opposite direction. The effect of the continued action of a transverse force must be a continual deflection, that is, a curvilineal motion. These must therefore now occupy our attention in their order.

OF ACCELERATED AND RETARDED MOTIONS.

Circumstantial exposition of our conception of the condition of a body in respect to motion.

71. All men can perceive that a stone dropped from the hand, or sliding down an uniform slope, has its motion continually accelerated, and that the motion of an arrow rising perpendicularly through the air is continually retarded; and they feel no difficulty in conceiving these changes of motion as the effects of the continual operation of their weight or heaviness. The falling stone is in a different condition in respect of motion in the beginning and end of its fall. In what respect do these states of the body differ? Only in respect to what we call its *velocity*. This is an affection of motion; it is an expression of the relation between the two notions or ideas which concur to form the idea of motion, namely, the space and the time. These are all the circumstances that we observe in a motion. Time elapses, and during its currency a space is described. The term *velocity* expresses the magnitude of the space, which corresponds to some unit of time. Thus the rate of a ship's motion is determined when we say that it is nine miles in an hour, or nine miles per hour. We sometimes say (but awkwardly) "the motion is at the rate or with the velocity of a mile in three days." It is most conveniently expressed by a number of some given units of length, which completely make up the line described during this unit of time. But the mechanicians express it in a way more general by a fraction, of which the numerator is a number of inches, feet, yards, fathoms, or miles, and the denominator is the number of seconds, minutes, or hours employed in moving along this line. This is a very proper expression; for when we speak of any velocity, and continue to reason from it, we conceive ourselves to speak of something that remains the same, in the different occasions of using the term. Now if the velocity be constant, it is indifferent how long the line may be, because the time of its description will be lengthened in the same proportion. Thus if 48 feet be described in 12 seconds, 36 feet will be described in 9 seconds, 16 feet will be described in 4 seconds, &c. Now $\frac{48}{12}$, $\frac{36}{9}$, and $\frac{16}{4}$, are fractions of equal value, being equal to $\frac{4}{1}$, or 4, that is, to the velocity of 4 feet per second. The value of this fraction, or the quotient of the number of the units of length, divided by the number of units of time, is the number of those units of length described uniformly in one unit of time.

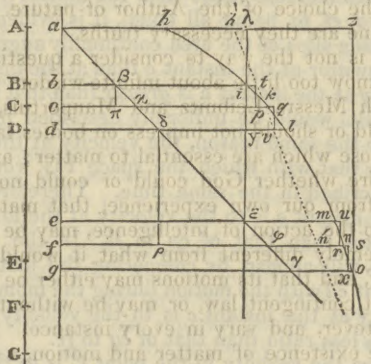
Magnitude of a velocity which we have no actual measure.

But how shall we determine the velocity in any instant or in any point of a motion that is continually changing? Suppose that a body has fallen 144 feet, and that we would ascertain its velocity in that point of its fall, or the velocity which it has in passing through that point. In the next second the body falls 112 feet farther. This cannot be the measure of the velocity at the beginning of the fourth or the end of the third second. It is too great. The fall during the preceding second was 80 feet. This is too small. The mean of these two, or $\frac{80+112}{2}, = \frac{192}{2} = 96$, is probably more exact. Due attention to the nature of this motion shows us that 96 is the proper measure, or that the motion at that instant is at the rate of 96 feet per second. But it is peculiar to this kind of motion that the half sum of the spaces described in two succeeding equal moments is the measure of the velocity in the middle instant. Therefore this method will not generally give an accurate measure. Yet it is indispensably necessary to obtain some accurate measure; for it is in this particular alone that the state of the body differs from its similar state in another instant. The difference of place makes no distinction; for if a body continue its motion unchanged, its condition in every different instant of time, or point of space, is unchanged, or the same. The change of place is not a change of motion, but is involved in the very conception of the continuation of the motion. The change of condition consists, therefore, in the change of velocity: therefore the change of velocity is the only indication and the only measure of the action (perhaps accumulated) of the changing force. It is therefore the chief object of our search; and accurate measures of velocity are absolutely necessary.

Momentary proportion of velocities that are continually changing.

72. When the velocity changes continually, there can be no *actual* measure of it. In what then does the magnitude of a velocity consist, when there is no actual measure of it? It is a certain undescribable *determination*, by which, if not changed, a certain space *would* be uniformly described in a given unit of time. Thus we know, that if, when a stone has fallen sixteen feet, its motion be directed along a horizontal plane, without diminution, it will move on for ever at the rate of thirty-two feet per second. The space which would be thus described is not the velocity, but the measure of the velocity. But the proportions of those spaces, being the proportions of those measures, are the proportions of the velocities themselves. We may discover these proportions in the following manner:

Fig. 15.



Fundamental requisite in all mechanical disquisitions.

Let ACG (fig. 15) be a line described by a body with a motion any how continually but gradually varied; and let it be required to determine the proportion of the velocity in any point C to the velocity in any other point F.

Axiom.—If A be to B in a ratio that is greater than any ratio less than that of C to D, but less than any ratio greater than that of C to D, then A is to B as C to D.

Take the straight line *acg* to represent the time of the body's motion along ACG, so that the points *a*, *c*, *f*, *g*, may represent the instants of time in which the body passes through the points A, C, F, G; and the portions *ac*, *cf*, *fg*, of the line *ag*, may represent the times employed in describing the portions AC, CF, FG; and therefore *ac* is to *af* as the time of describing AC to the time of describing AF.

Of Accelerated and Retarded Motions.

Moreover, let *hkno* be a line so related to the straight line *acfg*, by the perpendicular ordinates *ah*, *ck*, *fn*, *go*, that the areas *ackh*, *afnh*, *agoh*, may be proportional to the portions AC, AF, AG, of the line described by the moving body; and let this relation be true with respect to every point B, D, E, &c. and the corresponding points *b*, *d*, *e*, &c.

Then it is affirmed that *the velocity in the point* C *is to the velocity in the point* F *as ck is to fn.*

Let the equal lines *bc*, *cd*, *ef*, *fg*, represent equal moments of time, and let B, D, E, G, be the points through which the body is passing at the instants *b*, *d*, *e*, *g*. Then the areas *bikc*, *ckld*, *emnf*, *fnog*, will represent, and be proportional to, the spaces BC, CD, EF, FG, which are described during the moments *bc*, *cd*, *ef*, *fg*.

Draw *tp* parallel to *ag*, so as to make the rectangle *btpc* equal to the trapezium *bikc;* and draw the lines *qv*, *ur*, *sx*, in the same manner, so that each rectangle may be equal to its corresponding trapezium.

If the motions had been uniform during the moments *bc* and *fg*, that is, if the spaces BC and FG had been uniformly described, then the velocity in the point C would have been to the velocity in the point F as *cp* to *fs;* for since the rectangles *btpc* and *fsxg* are respectively equal to the trapeziums *bikc* and *fnog*, and since *bikc* is to *fnog* as BC is to FG, the rectangle *btpc* is to the rectangle *fsxg* as BC to FG. But because these two rectangles have equal altitudes *bc* and *fg*, they are to each other in the proportion of their bases *cp* and *gx*, or *cp* and *fs*. Therefore BC is to FG as *cp* to *fs*. But if BC and FG are uniformly described in equal times, they are proportional to the velocities of those uniform motions. Therefore *cp* is to *fs* as the velocity with which BC is uniformly described to the velocity with which FG is uniformly described in an equal time.

But the motion expressed by the figure is not uniform, because the line *hlo* recedes from the axis *ag*, and the areas, cut off by the parallel ordinates, increase in a greater proportion than the corresponding parts of the axis; that is, the spaces increase faster than the times; for the moments *bc*, *cd*, *ef*, *fg*, being all equal, it is evident that the corresponding slips of the area continually augment. The motion is swifter at the instant *c* than at the instant *b*, and the velocity at the instant *c* is *greater* than that with which the space BC would be uniformly described in the same time. For the same reason, the velocity at the instant *f* is *less* than that with which the space FG would be uniformly described in the same time. Therefore the velocity at the instant *c* is to the velocity at the instant *f* in a greater ratio than that of *cp* to *fs*. In the very same manner, it will appear, by comparing the motion during the moment *cd* with the motion during the moment *ef*, that the velocity at the instant *c* is to the velocity at the instant *f* in a less ratio than that of *cq* to *fr*.

Therefore the velocity in the point C is to the velocity in the point F in a greater ratio than that of *cp* to *fs*, but in a less ratio than that of *cq* to *fr*.

But by continually diminishing the equal moments *bc*, *cd*, *ef*, *fg*, it is evident that *cp* and *cq* continually approach to equality with *ck*, and *fr* and *fs* continually approach to equality with *fn;* that when *cp* is less than *ck*, *fs* is greater than *fn*, and when *cq* is greater than *ck*, *fr* is less than *fn*.

Therefore the velocity in the point C is to the velocity in the point F in a ratio that is greater than the ratio of *any* line less than *ck* to *any* line greater than *fn*, but which is less than the ratio of any line greater than *ck* to any line less than *fn*. Therefore the ratio of the velocity in C to the velocity in F is greater than any ratio that is less than that of *ck* to *fn;* but it is less than any ratio that is greater than that of *ck* to *fn*. Therefore the velocity in the point C is to the velocity in the point F as *ck* to *fn*.

This important theorem may be expressed in more general terms as follows:

If the abscissa ag of a line hko represent the time of any motion, and if the areas bounded by parallel ordinates be proportional to the spaces described, the ordinates are proportional to the velocities.

Remark.—The propriety or aptitude of expressing the time by the portions of the axis *acg* will perhaps appear more clearly in the following manner:

Let *acg* be any straight line, and let *h'kv* be another line straight or curved. Let the straight line *ahz*, perpendicular to *ag*, be carried uniformly down along this line, keeping always perpendicular to it, and therefore always parallel to its first position *ahz*. In its various situations *ckz*, *emz*, &c. it will cut off areas *ackh*, *aemh*, &c. bounded by the axis, by the ordinates *ah* and *ck*, or by the ordinates *ah* and *em*, &c. and by the line *hkg*. By this motion the moveable ordinate is said, in the language of modern geometry, to *generate* the areas *ackh*, *acmh*, &c. At the same time, let a point A move along the line ACG, setting out from A at the instant when the line *az* sets out from *a;* and let the motion of the point A be so regulated that the spaces AB, AC, AD, &c. generated by this motion may increase at the same rate with the areas *abih*, *ackh*, *adlh*, &c. or such that we shall have AB to AC as *abih* to *ackh*, &c. It is plain that the motion along AG is the same with that described in the enunciation of the proposition; for because the motion of the ordinate *az* along the axis *ag* is supposed to be uniform, the spaces *ab*, *ac*, *ad*, &c. are proportional to the times in which they are described, and may therefore be taken to measure or to represent those times.

73. Cor. 1. *In a motion continually varied, the velocities in the different points of the path are to each other in the limiting or ultimate ratio of the spaces described in equal times,* those times being supposed to diminish continually; for it is evident that if the equal moments *bc*, *cd*, *ef*, *fg*, are supposed to diminish continually till the instants *b* and *d* coalesce with *c*, and the instants *e* and *g* coalesce with *f*, then the ratio of *ck* to *fn* is the limit of the continually increasing ratio of *cp* to *fs*, or of the continually diminishing ratio of *cq* to *fr*. Sir Isaac Newton calls this the ultimate ratio of *cp* to *fs*, or of *cq* to *fr*. Now the ratio of *cp* to *fs* is, by construction, the same with the ratio of the rectangle *btpc* to the rectangle *fsxg*, and the ratio of *cq* to *fr* is the same with the ratio of the rectangle *cqvd* to the rectangle *eurf*. But the ratio of the rectangle *btpc* to the rectangle *fsxg* is the same with the ratio of the space *bikc* to the space *fnog;* that is (by hypothesis) the same with the ratio of the space BC to the space FG; and the ratio of the rectangles *cqvd* and *eurf* is the same with that of the spaces CD and EF. Therefore the ratio of the velocity at C to the velocity at F is the same with the ultimate ratio of the small increments BC, FG, or CD, EF of the spaces generated in very small and equal times.

It is also evident, that because the ratio of *ck* to *fn* is the limit both of the ratio of *cp* to *fs* and of the ratio of *cq* to *fr*, these ultimate ratios are the same, and that we may say that the velocity in C is to the velocity in F in the ultimate ratio of BC to EF, or in the ultimate ratio of CD to FG.

We also can easily perceive that the ratio of the area *bikc* to the area *emnf* approaches more near to the ratio of *ck* to *fn* as we take the moments *bc* and *ef* smaller. Therefore, in many cases of practice, where it may be easy to measure the spaces described in the different small moments of the motion, but difficult to ascertain their ultimate ratio, so as to obtain accurate measures of

Of cele- rat and Re ded M ons.

the proportions of the velocities, we may reduce the errors of measurement to something very insignificant, by taking these moments extremely small; and we shall diminish the error still more by taking the proportion of the half sum of BC and CD to the half sum of EF and FG for the proportion of the velocities in C and F.

It often happens that we have it not in our power to compare the spaces described in small moments which are precisely equal. Still we can find the exact proportion of the velocities, if we can ascertain the ultimate ratio of the increments of the spaces, and the ultimate ratio of the moments of time in which these increments are described; for it is plain, by considering the gradual approach of the points p and r to the points k and n, that the ratio of ck to fn is still the ultimate ratio of the bases of rectangles equal to the mixtilineal areas, whether the altitudes (representing the moments) are equal or not. Now the bases of two rectangles are in the proportion of the rectangles directly, and of their altitudes inversely. But the ultimate ratio of the altitudes is the ultimate ratio of the moments, and the ultimate ratio of the rectangles is the ultimate ratio of the spaces described in those unequal moments. Therefore, in such cases, we have,

74. Cor. 2. *The velocities are in the ratio compounded of the direct ultimate ratio of the momentary increments of the spaces, and the inverse ultimate ratio of the increments (or moments) of the times in which these increments of the spaces are made.*

If s, v, and t, are taken to represent the magnitudes of the spaces, velocities, and times, and if ds, dt, and dv, are taken always in the limiting or ultimate ratio of their momentary increments,[1] we shall have v always in the proportion of ds directly, and of dt inversely. We express this by the proportional equation $v \doteqdot \frac{ds}{dt}$, which is equivalent to the analogy $\mathrm{V} : v = \frac{d\mathrm{S}}{d\mathrm{T}} : \frac{ds}{dt}$, or $\mathrm{V} : v = d\mathrm{S}dt : dsd\mathrm{T}$.

75. N. B. Here observe that this is not the only way of stating the relation of space and time—the abscissa may be made the time, and the ordinate the space: then the velocity $= \frac{dy}{dx}$.

The converse of this proposition may be thus expressed.

C erse th rem.

76. *If the axis ag of the line hko represent the time of a varied motion along the line* AG, *and if the ordinates ah, bi, ck, &c. be as the velocities in the instants a, b, c, or in the points* A, B, C; *then the areas abih, ackh, adlh, &c. are proportional to the spaces* AB, AC, AD, &c.

This may be demonstrated in the same way with the former; but the indirect demonstration is more brief, and equally strict.

If the spaces AC, AF, &c. are not proportional to the areas $ackh$, $afnh$, &c. they are proportional to some other areas $ackh'$, $afn'h'$, &c. which are bounded by the same ordinates, and by another line $h'kn'$. But because the areas $ackh'$, $afn'h'$, &c. are always proportional to the spaces AC, AF, &c. described on the line AG, the velocity in the point C is to the velocity in the point F as the ordinate ck is to the ordinate fn'; but, by hypothesis, the velocity in C is to the velocity in F as ck to fn, and fn' is equal to fn, which is absurd. Therefore the spaces AC, AF, are not proportional to any other areas, &c.

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77. Cor. *The ultimate ratio of the momentary increments of the spaces is compounded of the ratio of the velocities, and the ultimate ratio of the increments of the times:* for when the moments bc, ef, are equal, it is evident that the ultimate ratio of the rectangles $bcpt$, $efru$ is the same with the ultimate ratio of the increments of the spaces. But the ultimate ratio of these rectangles is the same with that of their bases cp and fr; that is, the ratio of ck to fn, that is, the ratio of the velocities. And when the moments are unequal, the ratio of the rectangles is compounded of the ratio of their bases and the ratio of their altitudes; that is, compounded of the ratio of the velocities and the ultimate ratios of the moments of time.

We have therefore $d\mathrm{S} : ds = \mathrm{V}d\mathrm{T} : vdt$ and $ds \doteqdot vdt$.

It most commonly happens that we can only observe the accumulated results of varied motions, and in them we only observe a space passed over, and a certain portion of time that has elapsed during the motion; but being able to distinguish the portions of the whole space which are described in known portions of the whole time, and having made such observations in several parts of the motion, we discover the general law that the motion affects, and we affirm this law to hold universally, even though we have not observed it in *every* point. We do this with a degree of probability and confidence proportioned to the frequency of our observation. It is not till we have done this that we can make use of the first of these two propositions, which enables us to ascertain the velocity of the motion in its different moments. Thus, if we observe that a stone in falling descends one foot in the quarter of a second, 16 feet in a second, 64 feet in two seconds, and 144 feet in three seconds, the general law immediately observed is, "that the spaces described are as the squares of the times;" for 1 is to 16 as the square of $\frac{1}{4}$ to the square of 1. Again, 16 is to 64 as 1^2 to 2^2, and 16 is to 144 as 1^2 to 3^2. Hence we infer, with great probability, that the stone would fall 36 feet in a second and a half; for 16 is to 36 as 1^2 to $1\frac{1}{2}^2$; and we conclude in the same way for all other parts of the motion.

A good example of geometrical method.

78. This immediate observation of the analogy between the spaces and the squares of the times suggests an easy determination of the velocity in this particular kind of motion, and it merits particular notice, being very often referred to. We can take ag to represent the time, and then, because the areas which are to represent the spaces described must be proportioned to the squares of the portions of ag, we perceive that the line which comes in place of hko must be a straight line drawn from a; for example, the straight line $a\delta\gamma$; for this is the only boundary which will give areas $ab\beta$, $ae\varkappa$, $ad\delta$, &c. proportional to ab^2, ae^2, ad^2, &c. And we perceive that *any* straight line drawn from a will have this property.

Having thus got our representations of the times and the spaces, we say, on the authority of our theorem, that the velocity at the instant b is to the velocity at the instant d as $b\beta$ to $d\delta$, &c. And now we begin to make inferences purely geometrical, and express our discovery of the velocities in a very general and simple manner. We remark, that $b\beta$ is to $d\delta$ as ab is to ad; and we make the same affirmation concerning the magnitudes represented by these lines. We say that the velocity at the instant b is to the velocity at the instant d as the time ab is to the time ad. We say, in terms still more general, that the velocities are proportional to the times from the beginning of the motion. We moreover perceive, that the spaces are

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[1] In this article, as originally printed, the symbols $\dot{s}$, $\dot{t}$, and $\dot{v}$ were employed to represent the things here denoted by ds, dt, and dv: a like change in the notation of the fluxions of the quantities will be made throughout the article.

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also proportional to the squares of the acquired velocities; or the velocities are as the square roots of the spaces.

We can further infer, from the properties of the triangle, that the momentary increments of the spaces are proportional to the momentary increments of the squares of the times, or of the squares of the velocities.

We also observe, that not only the whole acquired velocities are proportional to the whole elapsed times, but that the increments of the velocities are proportional to the times in which they are acquired; for πn is to $\varrho\varphi$ as bc to df, &c. Equal increments of velocity are therefore acquired in equal times. Therefore such a motion may, in great propriety of language, be denominated a *uniformly accelerated motion;* that is, *a motion in which we observe the spaces proportioned to the squares of the times, is a motion uniformly accelerated;* and spaces in the duplicate ratio of the times form the ostensible characteristic of an uniformly accelerated motion.

79. Lastly, if we draw $\varepsilon\lambda$ parallel to the axis ab, we perceive that the rectangle $ae\varepsilon\lambda$ is double of the triangle $ae\varepsilon$. Now, because ae represents the time of the motion, and $e\varepsilon$ represents the acquired velocity, the rectangle $ae\varepsilon\lambda$ will represent the space which would be uniformly described with the velocity $e\varepsilon$ during the time ae. But the triangle $ae\varepsilon$ represents the space really described with the uniformly accelerated motion during the same time. Hence we infer, that the space that is described in any time, with a motion increasing uniformly from nothing, is one half of the space which would be uniformly described during the same time with the final velocity.

These are but a part of the inferences which we may draw from the geometrical properties of those representations which we had selected of the different measureable affections of motion. We may affirm, with respect to the motions themselves, all the inferences which relate to magnitude and proportion, and thus improve our knowledge of the motions.

We took the opportunity of this very simple and perspicuous example, to give our readers a just conception of the *mathematical method* of prosecuting mechanical knowledge, and to make them sensible of the unquestionable authority for every theorem deduced in this manner.

One of the most important is, to discover the accumulated result of a motion of which we only observe the momentary increments. This is to be done by finding the area, or portions of the area, of the mixtilineal space $agoh$; and it is evidently analogous to the inverse method of fluxions, or the integral calculus.

In most cases, we must avail ourselves of the corollary $ds \doteq vdt$, and we obtain the solution of our question only in the cases where our knowledge of the quantities ds, dt, and v (considered as geometrical magnitudes, that is, as lines and surfaces), enables us to discover s and t.

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80. Having thus discovered the proportions of the velocities in motions varying in any manner whatever, we can observe the variations which happen in them. These variations are the effects, and the only marks and measures, of the changing forces. They are the characteristics of their kinds (considered merely as moving forces); that is, the indications of the directions in which they act; for this is the only difference *in kind* of which they are susceptible in this general point of view. If they increase the velocity, their direction must be conceived as the same with that of the previous motion; because the result of the action of a force is equivalent to the composition of the motion which that force would produce in a quiescent body with the motion already existing; and an increase of velocity is equivalent to the composition of a motion in the same direction.

Having no other mark of the force but the acceleration, we have no other name for it in the abstract doctrines of dynamics, and we call it an *accelerating force.* Had it retarded the motion, we should have called it a *retarding force.*

In like manner we have no measure of the *magnitude* or *intensity* of an accelerating force, but the acceleration which it produces. In order therefore to investigate the powers which produce all the changes of motion, we must endeavour to obtain measures of the acceleration.

A continual increase of velocity is the effect of the continued action of accelerating forces. If equal increments of velocity are produced in every succeeding equal moment of time, we cannot conceive that there is any change in the accelerating force. Therefore a uniformly accelerated motion is the mark of the unvaried action of an accelerating force, that is, of the continued action of a constant force; of a force whose intensity is always the same. When therefore we observe a body describe spaces proportional to the squares of the times, we must infer that it is urged forward by a force whose intensity does not change; and, on the other hand, a constant force must produce a uniformly accelerated motion by its continued action. And if any previous circumstances assure us of this continued action of an invaried force, we may make all the inferences which were mentioned under the article of uniformly accelerated motion.

Meas of an acc rating force.

81. That force must surely be accounted double which produces a double increment of velocity in the same time by its uniform action; we can form no other estimation of its magnitude. And in general, *accelerating forces must be accounted proportional to the increments of velocity which they produce, by acting uniformly during the same or equal times.*

Anoth measu

Supposing them to act on a body at rest. Then the velocity produced is itself the increment; and we must say that accelerating forces are proportional to the velocities which they generate in a body in equal times. And because we found (No. 79), that the space described with a uniformly accelerated motion is half the space which would be uniformly described in the same time with the final velocity, which space is the direct measure of this velocity, and because halves have the same proportion with the wholes—we may say that *accelerating forces are proportional to the spaces through which they impel a body from rest in equal times by their uniform action.*

This is an important remark; because it gives us an easy measure of the force, without the trouble of first computing the velocities. It also gives us the only distinct notion that we have of the measurement of forces by the motions which they produce. When speaking of the composition of forces, we distinguished or denominated them by the sides and diagonal of a parallelogram. These lines must be conceived as proportional to the spaces through which the forces urge the body *uniformly* during the small and insensible time of their action, which time is supposed to be the same for both forces; for the sides of the parallelogram are supposed to be separately described in equal times, and therefore to be proportional to the velocities generated by the constituent forces. If indeed the forces do not act uniformly, nor similarly, nor during equal times, we cannot say (without farther investigation) what is the proportion of the intensity of the forces, nor can we infer the composition of their action. We must at least suppose, that in every instant of this very small time of their joint action, their direction remains unchanged, and that their intensities are in the

O Accele- ing and R arding rces.

same ratio. We shall see by and by, that with these conditions the sides of the parallelogram are still proportional to the velocities generated. In the mean time we may take the spaces through which a body is uniformly impelled from rest (that is, with a uniformly accelerated motion) as the measures of the forces; yet these spaces are but the halves of the measures of the velocities. Then, if a body be moving with the velocity of thirty-two feet per second, and an accelerating force acts on it during a second, and if this force be such that it would impel the body (from a state of rest) sixteen feet, it will add to the body a velocity of thirty-two feet per second. Accordingly, this is the effect of gravity—the weight of a pound of lead may be considered as a force which does not vary in its intensity. We know that it will cause the lead to fall sixteen feet in a second; but if the body has already fallen sixteen feet, we know that it is then moving with the velocity of thirty-two feet per second. And the fact is, that it will fall forty-eight feet farther in the next second, and will have acquired the velocity of sixty-four feet per second. It has therefore received an augmentation of thirty-two feet of velocity by the action of gravity during the second second; and gravity is in fact a constant force, causing equal increments of velocity in equal times, however great the velocities may be. It does not act like a stream of fluid, whose impulse or action diminishes as the solid body withdraws from it by yielding.

But supposing that we have not compared the increments of velocity uniformly acquired during equal times, in what manner shall we measure the accelerating forces? In such a case that force must be accounted double which generates the same velocity, by acting uniformly during half the time; for when the force is supposed invariable, the changes of velocity which it produces are proportional to the times of its action; therefore if it produces an equal velocity in half the time, it will produce a double velocity in an equal time, and is therefore a double force. The same may be said of every proportion of time in which an equal change of velocity is produced by the uniform action of an accelerating force. The force must be accounted greater in the same proportion that the time required for the production of a given velocity in a body is less. Hence we infer that *accelerating forces are inversely proportional to the times in which a given change of velocity is produced by their uniform action.*

82. By combining these two propositions, we establish this general theorem:

M sure of a lerat- i force.

Accelerating forces are proportional to the changes of velocity which they produce in a body by their uniform action directly, and to the times in which these changes are produced inversely.

If, therefore, A and a are the forces, V′ and v' the changes of velocity, and T′ and t' the portions of time in which they are uniformly produced, we have

$$A : a = V't' : v'T', = \frac{V'}{T'} : \frac{v'}{t'}$$

$$\text{and } a \doteqdot \frac{v'}{t'}.$$

The formula $a \doteqdot \frac{v'}{t'}$ is not restricted to any particular magnitude of v' and t'. It is true, therefore, when the portion of time is diminished without end; for since the action is supposed uniform, the increment of velocity is lessened in the same proportion, and the value of the fraction $\frac{v'}{t'}$ remains the same. The characters or symbols v' and t' are commonly used to express *finite* portions of v and t. The symbols $\dot{v}$ and $\dot{t}$ are used by Newton to express the same things taken in the ultimate or limiting ratio. (These have been changed to dv and dt throughout this article.) They are usually considered as *indefinitely small* portions of v and t. We shall abide by the formula $a \doteqdot \frac{dv}{dt}$.

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Is an abstract number.

83. It must always be kept in mind, that v and t are abstract numbers; and that v refers to some unit of space, such as a foot, an inch, a yard; and that t refers to some unit of time, such as an hour, a minute, a second; and especially that a is the number of the same units of space, which will be uniformly described in *one* unit of the time with the velocity generated, by the force acting uniformly during *that* unit. It is twice the space actually described by the body during that unit when impelled from rest by the accelerating force. It is necessary to keep hold of these clear ideas of the quantities expressed by the symbols.

Measure of a change of velocity.

On the other hand, when the measure of the accelerating force is previously known, we employ the theorem $at = v'$; that is, the addition made to the velocity during the whole or any part of the time of the action of the force is obtained by multiplying the acceleration of one unit of time by the number of such units contained in t'.

These measures express the greatest part of our knowledge of mechanical nature.

These are evidently leading theorems in dynamics, because all the mechanical powers of nature come under the predicament of accelerating or retarding forces. It is the collection of these in any subject, and the manner in which they accompany or are inherent in it, which determine the mechanical character of that subject; and therefore the phenomena by which they are brought into view are the characteristic phenomena. Nay, it may even be questioned whether the phenomena bring any thing more into view. This force, of which we speak so familiarly, is no object of distinct contemplation; it is merely a something that is proportional to $\frac{dv}{dt}$. And when we observe that the $\frac{dV}{dT}$, found in the motions that result from the vicinity of a body A, is double of the $\frac{dv}{dt}$ which results from the vicinity of another body B, we say that a force resides in A, and that it is double of the force residing in B. The accelerations are the things immediately and truly expressed by these symbols. And the whole science of dynamics may be completely taught without once employing the word *force*, or the conception which we imagine that we form of it. It is of no use till we come to study the mechanical history of bodies. Then, indeed, we must have some way of expressing the fact, that an acceleration $= \frac{32 \text{ feet}}{1''}$ is observed in every thing on the surface of this globe; and that an acceleration $= \frac{418 \text{ feet}}{1''}$ is observed over all the surface of the sun. These facts are characteristic of this earth and of the sun; and we express them shortly by saying that such and such forces reside in the earth and in the sun. It will preserve us from many mistakes and puzzling doubts, if we resolutely adhere to this meaning of the term *force;* and this will carry mathematical evidence through the whole of our investigations.

Another measure of accelerating force.

84. As velocity is not an immediate object of contemplation, and all that we observe of motion is a space and a time, it may be proper to give an expression of this measure of accelerating force which involves no other idea. Supposing the body to have been previously at rest, we

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have $a \doteqdot \frac{v}{t}$. Multiply both parts of the fraction by t which does not change its value, and we have $a \doteqdot \frac{vt}{t^2}$. But $vt = s$; and therefore $a \doteqdot \frac{s}{t^2}$.

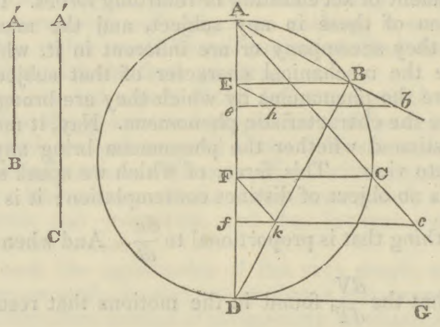
The formula $a = \frac{s}{t^2}$ is equivalent to the proportion $t^2 : 1 = s : a$; and a would then be the space through which the accelerating force would impel the body in one unit of the time t. But this is only half of the measure of the velocity which the accelerating force generates during that unit of time. For this reason we did not express the accelerating force by an ordinary equation, but used the symbol $\doteqdot$. In this case, therefore, of uniform action, we may express the accelerating force by $a = \frac{2s}{t^2}$.

85. The following theorem is of still more extensive use in all dynamical disquisitions.

Most general measure of accelerating force.

Accelerating forces are proportional to the momentary increments of the squares of the velocities directly, and as the spaces along which they are uniformly acquired inversely.

Fig. 16.



Let A'B, A'C, and AD (fig. 16) be three lines, described in the same or equal times by the uniform action of accelerating forces; the motions along these lines will be uniformly accelerated, and the lines themselves will be proportional to the forces, and may be employed as their measures. On the greatest of them, AD, describe the semicircle ABCD, and apply the other two lines A'B, A'C as chords AB, AC. Draw EB, FC perpendicular to AD. Take any small portions B*b*, C*c* of AB and AC, and draw *be*, *cf* perpendicular to AD, and E*h* and F*k* parallel to AB and AC.

Then, because the triangles DAB and BAE are similar, we have $AD : AE = AD^2 : AB^2$. And because AD is to AB as the velocity generated at D is to the velocity generated at B (the times being equal), we have AD to AE as the square of the velocity at D to the square of the velocity at B; which we may express thus:

$$AD : AE = V^2, D : V^2, B.$$

For the same reasons we have also

$$AD : AF = V^2, D : V^2, C. \text{ Therefore}$$
$$AE : AF = V^2, B : V^2, C.$$

But because in any uniformly accelerated motion, the spaces are as the squares of the acquired velocities, we have also

$$AE : Ae = V^2, B : V^2 b, \text{ and}$$
$$AF : Af = V^2, C : V^2 c.$$

Therefore E*e* is to F*f* as the increment of the square of the velocity acquired in the motion along B*b* to the increment of the square of the velocity acquired along C*c*.

But by similarity of the triangles ABD and E*eh*, we have

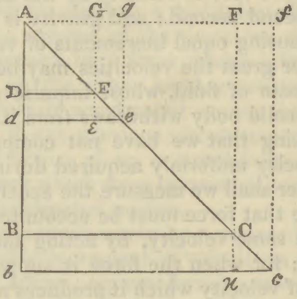
$$AB : AD = Ee : Eh; \text{ and in like manner,}$$
$$AD : AC = Fk : Ff. \text{ Therefore}$$
$$AB : AC = Ee \times Fk : Ff \times Eh.$$

Now AB and AC are proportional to the forces which accelerate the body along the lines A'B and A'C; E*e* and F*f* are proportional to the increments of the squares of the velocities acquired in the motions along the portions B*b* and C*c*; and E*h* and F*k* are equal to those portions respectively. The ratio of AB to AC is compounded of the direct ratio of E*e* to F*f*, and the inverse ratio of E*h* to F*k*. The proposition is therefore demonstrated.

The proportion may be expressed thus:

$AB : AC = \frac{Ee}{Eh} : \frac{Ff}{Fk}$, and may be expressed by the proportional equation $AB \doteqdot \frac{Ee}{Eh}$, or symbolically, $a \doteqdot \frac{d(v^2)}{ds}$.

Fig. 17.



REMARK.—Because the motion along any of these three lines is uniformly accelerated, the relation between spaces, times, and velocities, may be represented by means of the triangle ABC (fig. 17); where AB represents the time, BC the velocity, and ABC the space. If BC be taken equal to AB, the triangle is half of the square ABCF of the velocity BC; and the triangle ADE is half of the square ADEG of the velocity DE. Let D*d* and B*b* be two moments of time, equal or unequal. Then D*de*E and B*bc*C are half the increments of the squares of the velocities DE and BC, acquired during the moments D*d* and B*b*. It was demonstrated that the ratio of the area D*de*E to the area B*bc*C is compounded of the ratio of DE to BC, and the ultimate ratio of D*d* to B*b*. But D*d* and B*b* are respectively equal to ε*e* and κ*c*. Therefore D*de*E is to B*bc*C, in the ratio compounded of the ratio of DE to BC, and the ultimate ratio of ε*e* to κ*c*. If we represent DE and BC by V and v, then ε*e* and κ*c* must be represented by V' and v', the increments of V and v; and then the compound ratio will be the ratio of VV' to vv'; and if we take the ultimate ratio of the moments, and consequently the ultimate ratio of the increments of the velocities, we have the ratio of VdV to vdv. If therefore V^2 and v^2 represent the squares of the velocities, VdV and vdv will represent, not the increments of those squares, but half the increments of them.

We may now represent this proposition concerning accelerating forces by the proportional equation $a \doteqdot \frac{vdv}{ds}$; and we must consider this as equivalent with $a = \frac{V^2 - v^2}{2(S-s)}$; keeping always in mind that a, V, and v, relate to the same units of time and space, and that a is that number of units of the scale on which S and s are measured, which is run over in *one* unit of time.

This will be more clearly conceived by taking an example. Let us ascertain the accelerative power of gravity, supposing it to act uniformly on a body. Let the spaces be measured in feet and the time in seconds. It is a matter of observation, that when a body has fallen 64 feet, it has acquired a velocity of 64 feet per second; and that when it has fallen 144 feet, it has acquired the velocity of 96 feet per second. We want to determine what velocity gravity communicated to it by acting on it during one second. We have $V^2=9216$, and $v^2=4096$; and therefore $V^2-v^2=5120$. $S=144$, and $s=64$, and $S-s=80$, and $2(S-s)=160$. Now $a=\frac{5120}{160},=32$. Therefore gravity has generated the velocity 32 feet per second by acting uniformly during one second.

86. *The augmentation of the square of the velocity is proportional to the force and to the space jointly.* For, because $a=\frac{vdv}{ds}$, we have $ads=vdv$.

Thus we learn, that a given force, acting uniformly on a body along a given space, produces the same increment of the square of the velocity, whatever the previous velocity may have been. Also, in the same manner as we formerly found that the augmentation of the velocity was proportioned to the time during which the force has acted, so the augmentation of the square of the velocity is proportional to the space along which it has acted.

It is pretty plain, that all that we have said of the uniform action of an *accelerating* force may be affirmed of a *retarding* force, taking a diminution or decrement of velocity in place of an increment. A uniformly retarded motion is that in which the decrements of velocity in equal terms are equal, and the whole decrements are proportional to the whole times of action. Such a motion is the indication of a constant or invariable force acting in a direction opposite to that of the motion. We conceive this to be the case, when an arrow is shot perpendicularly upwards; its weight is conceived as a force continually pressing it perpendicularly downwards.

In such motions, however great the initial velocity may be, the body will come to rest; because a certain determined velocity will be taken from the body in each equal successive moment, and some multiple of this will exceed the initial velocity. Therefore the velocity will be extinguished before the end of a time that is the same multiple of the time in which the velocity was diminished by the quantity above mentioned. It is no less evident that the time in which any velocity will be extinguished by an opposing or retarding force, is equal to the time in which the same force would generate this velocity in the body previously at rest. Therefore,

87. (1.) The times in which different initial velocities will be extinguished by the same opposing force are proportional to the initial velocities.

88. (2.) The distances to which the body will go till the extinction of its velocity, are as the squares of the initial velocities.

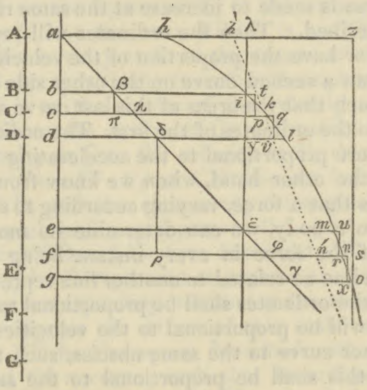
(3.) They are also as the squares of the times elapsed.

89. (4.) The distance to which a body, projected with any velocity, will go till its motion be extinguished by the uniform action of a retarding force, is one half of the space which it would describe uniformly during the same time with the initial velocity.

It very rarely happens that the force which accelerates the body acts uniformly, or with an unvaried intensity. The attraction of a magnet, for example, increases as the iron approaches it. The pressure of a spring diminishes as it unbends. The impulse of a stream of water or wind diminishes as the impelled surface retires from it by yielding. Therefore the effects of accelerating forces are very imperfectly explained, till we have shown what motions result from any given variation of force, and how to discover the variation of force from the observed motion. This last question is perhaps the most important in the study of mechanical nature. It is only thus that we learn what is usually called *the nature of a mechanical force.* This chiefly consists in the relation subsisting between the intensity of the force and the distance of the substance in which it resides. Thus the nature of that power which produces all the planetary motions, is considered as ascertained, when we have demonstrated that its pressure or intensity is inversely as the square of the distance from the body in which it is supposed to reside.

Acceleration expresses some relation of the velocity and time. This relation may be geometrically expressed in a variety of ways. In fig. 18 the uniform acceleration, or the unvaried relation between the velocity and the time, is very aptly expressed by the constant ratio of the ordinates and abscisses of the triangle *agγ*. The ratio of *dδ* to *ad* is the same with that of *eε* to *ae*, or that of *fφ* to *af*, &c.; or the ratio of the increment of velocity $\pi\varkappa$ to the increment of the time $\beta\pi$ or *bc*, or that of $\iota\varphi$ to $\varepsilon\iota$, &c. This ratio $\pi\varkappa : \beta\pi$ is equivalent to the symbol $\frac{dv}{dt}$.

Fig. 18.



But when the spaces described in a varied motion are represented by the areas bounded by a curve line *hko*, we no longer have that constant ratio of the increments of the ordinates and abscisses.

Their measures in such cases how obtained. Theorems of most extensive use.

90. Therefore, in order to obtain measures of the accelerating forces, or at least of their proportions, let the abscissa *aeg* (fig. 18) of the line *hko* again represent the time of a motion. But let the areas bounded by parallel ordinates now represent the velocities; that is, let the whole area increase during the time *ag* at the same rate with the velocities of the motion along the line AG. In this case the ordinates *bi*, *ck*, *dl*, &c. will be as the accelerations at the instants *b*, *c*, *d*, &c. or in the points B, C, D, &c.

This is demonstrated in the same way as the former proposition (No. 72). If the accelerating force be supposed constant during any two equal moments *bc* and *fg*, the rectangles *bcpt* and *fgxs* would express the increments of velocity uniformly acquired in equal times, and their bases *cp* and *fs* would have the ratio of the accelerations, or of the accelerating forces. But as the velocities expressed by the figure increase faster than the times during every moment, the force at the instant *c* is to the force at the instant *f* in a greater ratio than that of *cp* to *fs;* but, for similar reasons, it is in a less ratio than that of *cq* to *fr;* and therefore (as in the other proposition) the force at the instant *c* is to the force at the instant *f* as *ck* to *fu*.

91. *Cor.* Because *cp* is to *fs* in the ratio compounded of

Of Accelerating and Retarding Forces.

the direct ratio of the rectangle *cptb* to the rectangle *fsxg*, and the inverse ratio of the altitude *bc* to the altitude *fg*; and because these rectangles are proportional to the increments of velocity, and the ultimate ratio of the altitudes is the ultimate ratio of the moments or increments of the time, we must say that *the accelerating forces (that is, their intensities or pressures producing acceleration) are directly as the increments of velocity, and inversely as the increments of the times;* which proposition may be expressed in regard to two accelerations A and *a*, by this analogy:—

$$A : a = \frac{dV}{dT} : \frac{dv}{dt}.$$

Or by the proportional equation $a \doteqdot \frac{dv}{dt}$. Also $adt \doteqdot dv$, and $\int adt = v'$. And thus do these theorems extend even to the cases where there cannot be observed an immediate measure either of velocity or of acceleration, because neither the space nor the velocity increases uniformly.

The theorem $a \doteqdot \frac{dv}{dt}$ is employed when we would discover the variation in the intensity of some natural power.[1] We observe the motion, and represent it by a figure analogous to fig. 18, where the abscissa represents the times, and the area is made to increase at the same rate with the spaces described. Then the ordinates will represent the velocities, or have the proportion of the velocities. Then we may draw a second curve on the other side of the same abscissa, such that the areas of this last curve shall be proportional to the ordinates of the first. The ordinates of this last curve are proportional to the accelerating forces.

92. On the other hand, when we know from other circumstances that a force, varying according to some known law, acts on a body, we can determine its motion. The intensity of the force in every instant being known, we can draw a line so related to another line representing the time, that the ordinates shall be proportional to the forces. The areas will be proportional to the velocities. We can draw another curve to the same absciss, such that the ordinates of this shall be proportional to the areas of the other, that is, to the velocities of the motion. The areas of this second curve will be proportional to the spaces described.

All these theorems relate to *changes* of velocity; by which means they indicate *immediately* the operation of natural powers.

93. We must now observe, that all that has been said concerning the effects of accelerating forces continually varying, relates to *changes* of motion, independent of what the absolute motions may be. The areas of the line whose ordinates represent the velocities do not necessarily represent the spaces described, but the change made on the spaces described in the same time; not the motions, but the changes of motion. If, indeed, the body be supposed to be at rest when the forces begin to act, these areas represent the very spaces that are passed over, and the ordinates are the very velocities. In every case, however, the accelerations are the real increments of the velocities.

This circumstance gives a great extension to our theorems, and enables us to ascertain the disturbances of any species of regular motion, apart from the motions themselves, and thus avoid a complication which would frequently be inextricable in any other way. And this process, which is merely mathematical, is perfectly conformable to mechanical principles. It is in fact an application of the doctrine of the composition of motion; a doctrine rigidly demonstrated when we measure a mechanical force by the *change* of motion which it produces. Acceleration is the continual composition of a new motion with the motion already produced.

No fi chang veloc can b duced instar any a rating force.

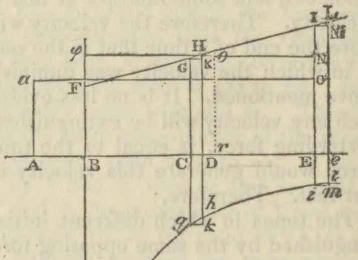
We may learn from this investigation of the value of an accelerating force, that no finite change of velocity is effected in an instant by the action of an accelerating force. When the fig. 18 is used for the scale of accelerations, and they are represented by the ordinates of the line *hko*, the increment of velocity is represented by an area, that is, by a slip of the whole area; which slip must have some altitude, or must occupy some portion of the abscissa which represents time. Some portion of time, however small it may be, must elapse before any measurable addition can be made to the velocity. The velocity must change *continually*. As no motion can be conceived as instantaneous, because this would be to conceive that in one instant the moving particle is in every point of its momentary path,—so no velocity can change, by a finite quantity, in one instant, because this would be to conceive that in that instant the particle had all the intervening velocities. The instant of change is at once the last instant of the preceding velocity, and the first of the succeeding, and therefore must belong to both. This cannot be conceived, or is absurd. As a body, in passing from one part of space to another, must pass in succession through all the intermediate places; so, in passing from one velocity to another, it must in succession have all the intermediate velocities. It must be *continually* accelerated—we must not say *gradually*—however small the steps.

But to return from this digression:

More venien manne consid ing th tion of forces, more f quentl coming into vi

94. The most frequent cases which come under examination do not show us the relation between the forces and times, but the relation between the forces and spaces. Thus, when a piece of iron is in the neighbourhood of a magnet, or a planet is considered in the neighbourhood of the sun, a force is acting on it in every point of its path, and we have discovered that the intensity of this force varies in a certain proportion. Thus, a spring varies in its pressure as it unbends; gunpowder presses less violently as it expands, &c. &c.

Fig. 19.



Our knowledge is generally confined to some such effect as this. We know, that while a body is moving along a line, ADE (fig 19), it is urged forward by a force, of which the intensity varies in the proportion of the ordinates BF, CG, DH, EI, &c. of the line FGHI.

To investigate the motion or change of motion produced by the action of this force, let CD be supposed a very small portion of the space *s*, which we may express by *s'*. Draw GK perpendicular to DH. Then, if we suppose that the

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[1] See Barrow's *Lect. Geometr.* passim.

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force acts with the unvaried intensity CG through the whole space CD, the rectangle CDKG will express half of the increment of the square of the velocity (No. 85). We may suppose that the force acts uniformly along the adjoining small space Dr with the intensity DH. The rectangle DHor will in like manner express another half increment of the square of the velocity. And in like manner we may obtain a succession of such increments. The aggregate or sum of them all will be half the difference between the square of the velocity at B and the square of the velocity at E.

If we employ f to express the indetermined or variable intensity of the accelerating force, and v to express the variable velocity, and v' its increment *uniformly* acquired, then the rectangle CDKG will be expressed by fs'. We have seen that this is equal to vv'. Therefore, in every case where we can tell the aggregate of all the quantities fs, it is plain that we will obtain half the difference between the squares of the velocities in B and E, on the supposition that the intensity of the force was constant along each little space, and varied by starts. Then, by increasing the number and diminishing the magnitude of those little portions of the space without end, it is evident that we terminate in the expression of the real state of the case, *i. e.* of a force varying continually; and that in this case the aggregate of these rectangles occupies the whole area AEIF, and is equivalent to the fluent of fds, or to the symbol $\int fds$, used to express this fluent, which is conceived an aggregate of small rectangles fs'. And we see that this area expresses half of the augmentation of the square of the velocity. Therefore,

st im- tant orem.

95. *If the abscissa* AE (fig. 19) *of a line* FGI *is the path along which a body is urged by an accelerating force, and if the ordinates* BF, CG, DH, *&c. are proportional to the forces acting in the points* B, C, D, *&c. the intercepted areas* BCGF, BEIF, *&c. are proportional to the augmentations of the square of the velocity.*[1]

Observe that the areas BCGF and DEIH are also proportional to the augmentations made on the squares of the velocities in B and in D.

Observe also, that it is indifferent what may have been the original velocity. The action of the forces represented by the ordinates make always the same addition to its square; and this addition is half the square of the velocity which those forces would generate in the body by impelling it from rest in the point A.

96. Lastly, on this head, observe, that we can state what constant or variable force will make the same augmentation of the square of the velocity by impelling the body uniformly along the same space BE, or along what space a given force must impel the body in order to produce the same increase of the square of its velocity. In the first case, we have only to make a rectangle BENφ, equal to the area BEIF, and then Bφ is the intensity of the constant force wanted. In the second case, in which the force EO is given, we must make the rectangle AαOE equal to the area BEIF, and AE is the space required.

nverse.

97. The converse of this proposition, viz. *if the areas are as the increments of the square of the velocity, the ordinates are as the forces*, is easily demonstrated in the same way; for if the elementary areas CDKG and EIMe represent increments of the squares of the velocity, the accelerating forces are in the ratio compounded of the direct ratio of these rectangles and the inverse ratio of their altitudes, because these altitudes are the increments of the space (No. 85). Now the base CG of the rectangle CDKG is to the base EI of the rectangle EIMe in the same compounded ratio; therefore the force in C is to the force in E as CG to EI.

Of Accelerating and Retarding Forces.

Scales of force, velocity, acceleration, time, &c.

98. The line hko (fig. 18) was called by Dr Barrow (who first introduced this extensive employment of motion into geometry) the SCALE *of velocities;* and the line FHL (fig. 19) was named by him the *scale of accelerations.* Hermann, in his *Phoronomia*, calls it the *scale of forces.* We shall retain this name, and we may call hko of fig. 18 the *scale* of accelerations, when the areas represent the velocities. Sir Isaac Newton added another scale of very great use, viz. a scale of times. It is constructed as follows.

99. Let ABE (fig. 19) be the line along which a body is accelerated, and let FHI be the scale of forces, that is, having its ordinates FB, HD, IE, &c. proportional to the forces acting at B, D, E, F, &c.; let fhi be another line so related to ABE, that Cg is to Ei in the inverse subduplicate ratio of the area BFGC to the area BFIE; or, to express it more generally, let the squares of the ordinates to the line fgi be inversely as the areas of the line FHI intercepted between these ordinates and the first ordinate drawn through B; then the times of the bodies moving from a state of rest in B are as the intercepted areas of the curve fgi.

For let CD and Ee be two very small portions of the space described in equal times. They will be ultimately as the velocities in C and E. The area FBCG is to the area FBEI as the square of Ei to the square of Cg (by construction); but the area FBCG is to FBEI as the square of the velocity at C to the square of the velocity at E (by the proposition); therefore the square of the velocity at C is to the square of the velocity at E as the square of Ei to the square of Cg; therefore Ei is to Cg as the velocity at C to the velocity at E, that is, as CD to Ee: but since Ei : Cg = CD : Ee, we have Ei × Ee = Cg × CD, and the elementary rectangles C$gk$D and Eime are equal, and may represent the equal moments of time in which CD and Ee were described. Thus the areas of the line fgl will represent or express the times of describing the corresponding portions of the abscissa.

We may express the nature of this scale more briefly thus. Let BE be the space described with any varied motion, and fgl a curve, such that its ordinates are inversely as the velocities in the different points of the abscissa, then the area will be as the times of describing the corresponding portions of the abscissa.

Example of the application of No 95.

100. In all the cases where our mathematical knowledge enables us to assign the values of the ordinates of the figure 19, we can obtain the law of action of the forces, or the nature of the force; and where we can assign the value of the areas from our knowledge of the proportions of the ordinates or forces, we can ascertain the velocities of the motion. We shall give an example or two, which will show the way in which we avail ourselves of the geometrical properties of figure in order to ascertain the effects of mechanical forces.

(1.) In fig. 19, let the accelerating force which impels the body along the line AB be constant, and let the body be previously at rest in B; the line which bounds the ordinates that represent the forces must be some line φHN parallel to AB. The area BDHφ is to the area BENφ as the square of the velocity at D to the square of the velocity at E. These areas, having equal bases DH and EN, are as their altitudes BD and BE; that is, the spaces described are as the squares of the acquired velocities. And we see that this characteristic mark of uniformly accelerated motion is included in this general proposition.

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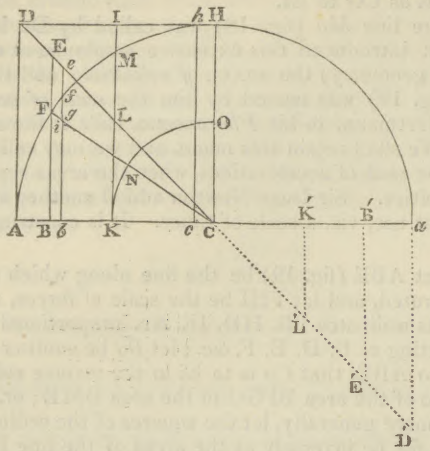
[1] Newton's *Principia*, i. 39.

Of Accelerating and Retarding Forces.

Fig. 20.



101. (2.) Let us suppose that the body is impelled from A (fig. 20), towards the point C, by a force proportional to its distance from that point. This force may be represented by the ordinates DA, EB, *eb*, &c. to the straight line DC. We may take any magnitude of these ordinates; that is, the line DC may make any angle with AC. It will simplify the investigation if we make the first force AD = AC. About C describe the circle AH*a*, cutting the ordinate EB in F; let *eb* be another ordinate, cutting the circle in *f* very near to F; draw CH perpendicular to AC, and make the arch H*h* = *f*F, and draw *hc* parallel to HC; join FC and DH, and draw F*g* perpendicular to *fb*. Let IML be another ordinate.

The area DABE is to the area DAKL as the square of the velocity at B to the square of the velocity at K. But DABE is the excess of the triangle ADC above the triangle EBC, or it is half of the excess of the square of CA or CF above the square of CB, that is, half the square of BF. In like manner, the area DAKL is equal to half the square of KM; but halves have the same ratio as the integers; therefore the square of BF is to the square of KM as the square of the velocity at B to the square of the velocity at K; therefore the velocity at B is to the velocity at K as BF is to KM. The velocities are proportional to the sines of the arches of the quadrant AFH described on AC.

Cor. 1. The final velocity with which the body arrives at C is to the velocity in any other point B as radius to the sine of the arch AF.

Cor. 2. The final velocity is to the velocity which the body would acquire by the uniform action of the initial force at A as 1 to $\sqrt{2}$; for the rectangle DACH expresses the square of the velocity acquired by the uniform action of the force DA; and this is double of the triangle DAC; therefore the squares of these velocities are as 1 and 2, and the velocities are as $\sqrt{1}$, and $\sqrt{2}$, or as 1 to $\sqrt{2}$.

102. *Cor.* 3. The time of describing AB is to the time of describing AC as the arch AF to the quadrant AFH.

For when the arch F*f* is diminished continually, it is plain that the triangle *fi*F is ultimately similar to CFB, by reason of the equal angles C*ib* (or CFB) and *fi*F, and the right angles CBF and *f*F*i*; therefore the triangles *fg*F and CBF are also similar. Moreover, B*b* is equal to F*g*, F*f* is equal to *h*H, which is ultimately equal to *c*C; therefore, since the triangles *fg*F and CFB are similar, we have F*g* : F*f* = FB : CF = FB : HC; therefore B*b* is to *c*C as FB to HC, that is, as the velocity at B to the velocity at C; therefore B*b* and *c*C are described in equal moments when indefinitely small; therefore equal portions F*f*, *h*H, of the quadrant correspond to equal moments of the accelerated motion along the radius AC; and the arches AF, FM, MH, &c. are proportional to the times of describing AB, BK, KH, &c.

Cor. 4. The time of describing AC with the unequally accelerated motion, is to the time of describing it uniformly with the final velocity as the quadrantal arch is to the radius of a circle; for if a point move in the quadrantal arch so as to be in F, *f*, M, H, &c. when the body is in B, *b*, K, C, it will be moving uniformly, because the arches are proportional to the times of describing those portions of AC; and it will be moving with the velocity with which the body arrives at C, because the arch *h*H is ultimately = C*c*. Now if two bodies move uniformly with this velocity, one in the arch AFH, and the other in the radius AC, the times will be proportional to the spaces uniformly described; but the time of describing AFH is equal to the time of the accelerated motion along AC, therefore the proposition is manifest.

103. *Cor.* 5. If the body proceed in the line C*a*, and be retarded in the same manner that it was accelerated along AC, the time of describing AC uniformly with the velocity which it acquires in C is to the time of describing AC*a* with the varied motion, as the diameter of a circle to the circumference; for because the momentary retardations at K′, B′, &c. are equal to the accelerations at K and B, &c. the time of describing AC*a* is the same with that of describing AH*a* uniformly with the greatest velocity; that is, to the time of describing AC uniformly as AH*a* to AC, or as the circumference of a circle to the diameter; therefore, &c. N. B. In this case of retarding forces it is convenient to represent them by ordinates K′L, B′E, *a*D′, lying on the other side of the axis AC*a*; and to consider the areas bounded by these ordinates as subtractive from the others. Thus the square of the velocity at K′ is expressed by the whole area DACK′L′C, the part C′K′L′ being negative in respect of the point DAC. This observation is general.

Cor. 6. The time of moving along KC, the half of AC, by the uniform action of the force at A, is to that of describing AC*a* by the varied action of the force directed to C, and proportional to the distance from it, as the diameter of a circle to the circumference; for when the body is uniformly impelled along KC by the constant force IK, the square of the velocity acquired at C is represented by half the rectangle IKCH, and therefore it is equal to the velocity which the variable force generates by impelling it along AC (by the way, an important observation). The body will describe AC uniformly with this velocity in the same time that it is uniformly accelerated along KC. Therefore by *Cor.* 5 the proposition is manifest.

Cor. 7. If two bodies describe AC and KC by the action of forces which are everywhere proportional to the distances from C, their final velocities will be proportional to the distances run over, and the times will be equal.

For the squares of the final velocities are proportiona to the triangle ADC, LKC, that is, to AC^2, KC^2, and therefore the velocities are as AC, KC. The times of describing AC and KC uniformly, with velocities proportional to AC and KC, must be equal; and these times are in the same ratio (viz. that of radius to $\frac{1}{4}$ of the circumference) to the times of describing AC and KC with the accelerated motion. Therefore, &c.

Thus, by availing ourselves of the properties of the circle, we have discovered all the properties or characters of a motion produced by a force always directed to a fixed point, and proportional to the distance from it. Some of these are remarkable, such as the last corollary; and they are all important, for there are innumerable cases where this law of action obtains in nature. It is nearly the law

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of action of a bowstring, and of all elastic bodies, when their change of figure during their mutual action is moderate; and it has been by the help of this proposition first demonstrated in a particular case by Lord Brouncker and Mr Huygens, that we have been able to obtain precise measures of time, and consequently of actual motions, and consequently of any of the mechanical powers of nature. It is for this reason, as well as for the easy and perspicuous employment of the mathematical method of proceeding, that we have selected it.

Instead of giving any more particular cases, we may observe in general, that if the intensity of the force be proportional to any power whose index is $n-1$ of the distance, and if a be the distance from the fixed point at which the body begins to be accelerated, and x its distance from the point in any part of the motion, the velocity will be $\doteqdot\sqrt{a^n - x^n}$. This is very plain, because the increment CGHD of the area of fig. 19, which is also the increment of the square of the velocity, is $\doteqdot x^{n-1}dx$, and the area is $\doteqdot x^n$; and the whole area, corresponding to the distance a, is a^n. Therefore the portion of the area lying beyond the distance x is $a^n - x^n$. This is as the square of the velocity, and therefore the velocity is as the square root $\sqrt{a^n - x^n}$ of this quantity.

This proposition, $fds \doteqdot vdv$, or $f \doteqdot \frac{vdv}{ds}$, is the 39th of the first book of Newton's *Principia*, and is perhaps the most important in the whole doctrine of dynamics, whether employed for the investigation of forces or for the explanation of motions. It furnishes the most immediate data for both purposes, but more especially for the last. By its help Sir Isaac Newton was able to point out the numerous disturbances of the planetary motions, and to separate them from each other; thus unravelling, as it were, that most intricate motion in which all are blended together. He has given a most wonderful specimen of its application in his Lunar Theory.

We now are able to explain all the puzzling facts which were adduced by Leibnitz and his partisans in support of their measure of the forces of bodies in motion. We see why four springs, equally bent, communicate but a double velocity, and nine springs but a triple velocity; why a bullet moving twice as fast will penetrate an earthen rampart to a quadruple depth, &c. &c.

Cserva- t virium vrum.

This theorem also gives a most perspicuous explanation of the famous doctrine called *conservatio virium vivarum*. When perfectly elastic bodies act on each other, it is found that the sum of the masses multiplied by the squares of the velocities is always the same. This has been substituted, with great encomiums, by the German philosophers, in place of Descartes's principle, that the quantity of motion in the universe, estimated in one direction, remains always the same. They are obliged, however, to acknowledge, that in the actions of perfectly hard bodies, there is always a loss of *vis viva*, and therefore have denied the existence of such bodies. But there is the same loss in the mutual actions of all soft or ductile, or even imperfectly elastic, bodies; and they are miserably puzzled how to explain the fact; but both the *conservatio* and the *amissio* are necessary consequences of this theorem.

In the collision of elastic bodies, the whole change of motion is produced during the short time that the bodies are compressed, and while they regain their figure. When this is completed, the bodies are at the same distance from each other as when the mutual action began. Therefore the preceding body has been accelerated, and the following body has been retarded along equal spaces; and in every point of this space the accelerating and the retarding force has been equal. Consequently the same area of fig. 20 expresses the change made on the square of the velocity of both bodies. Therefore, if V and U are the velocities before collision, and v and u the velocities after collision, of the two bodies A and B, we must have $A \times \overline{V^2 - v^2} = B \times \overline{u^2 - U^2}$, and therefore $A \times V^2 + B \times U^2 = A \times v^2 + B \times u^2$.

Of Accelerating and Retarding Forces.

But in the other class of bodies, which do not completely regain their figure, but remain compressed, they are nearer to each other when their mutual action is ended than when it began. The foremost body has been accelerated along a shorter space than that along which the other has been retarded. The mutual forces have in every instant been equal and opposite. Therefore the area which expresses the diminution of the square of the velocity must exceed the area expressing the augmentation by a quantity that is always the same when the permanent compression is the same; that is, when the relative motion is the same. $A \times \overline{V^2 - v^2}$ must exceed $B \times \overline{u^2 - U^2}$, and $A \times V^2 + B \times U^2$ must exceed $A \times v^2 + B \times u^2$.

This same theorem is of the most extensive use in all practical questions in mechanic arts; and without it mechanics can go no farther than the mere statement of equilibrium.

History of No. 95 is curious.

Hermann, professor of mathematics at Pavia, one of the ornaments of the mathematical class of philosophers, has given a pretty demonstration of this valuable proposition, in the *Acta Eruditorum Lipsiæ* for 1709; and says, that having searched the writings of the mathematicians with great care, he found himself warranted to say, that Newton was the undoubted author, and boasts of his own as the first synthetical demonstration. The purpose of this assertion was not very apparent at the time; but long after, in 1746, when Hermann's papers, preserved in the town-house of Pavia, were examined, in order to determine a dispute between Maupertuis and Koenig about the claim to the discovery of *the principle of least action*, letters of Leibnitz's were found, requesting Hermann to search for any traces of this proposition in the writings of the mathematicians of Europe. Leibnitz was by this time the envious detractor from Newton's reputation, and could not but perceive that all his contorted arguments for his doctrine received a clear explanation by means of this proposition, in perfect conformity to the usual measure of moving forces. Newton had discovered this theorem long before the publication of the *Principia*, and even before the discovery of the chief proposition of that book in 1666; for in his Optical Lectures, the materials of which were in his possession in 1664, he makes frequent use of a proposition founded on this. (See No. 42.) We may here remark, that Hermann's demonstration is in every step the same with Dr Barrow's demonstration of it as a theorem merely geometrical, without speaking of moving forces (see *Lect. Geometr.* xi. p. 85, edit. 16), but giving it as an instance of the transformation of curves, which he calls *scales* of velocity, of time, of acceleration, &c. It is very true that Barrow in these mathematical lectures approached very near to both of Newton's discoveries, the fluxionary geometry, and the principles of dynamics; and the junto on the Continent, who were his continual detractors, charge him with impudent plagiarism from Dr Barrow, and even say that he has added nothing to the discoveries of his teacher. But surely Dr Barrow was the best judge of this matter; and, so far from resenting the use which Newton has made of what he had taught him, he was charmed with the genius of the *juvenis spectatissimus* his scholar, and of his own accord gave him his professorial chair, and ever after lived in the utmost harmony and friendship with him. Nay, it would even appear from some expressions in those very lectures, that Dr Barrow owed to young Newton the first thought of making such extensive use of motion in geometry. We recommend this work of Barrow's to the serious perusal of our readers, who wish to acquire clear notions of the science of motion, and an elegant taste in their mechanical disquisitions. After all the cultivation of this science by the commentators and followers of Newton, after the *Phoronomia* of Hermann, the *Mechanica* of Euler, the *Dynamique* of D'Alembert, and the *Mechanique Analytique* of De la Grange, which are undoubtedly works of transcendent merit and utility, the *Principia* of Newton will still remain the most pleasing, perspicuous, and elegant specimen of the application of mathematics to the science of *universal mechanics*, or what we call DYNAMICS.

The two fundamental theorems $fdt = dv$, and $fds = vdv$, enable us to solve every question of motion accelerated or retarded by the action of the mechanical powers of nature. But the employment of them may be greatly expedited and simplified by noticing two or three general cases which occur very frequently.

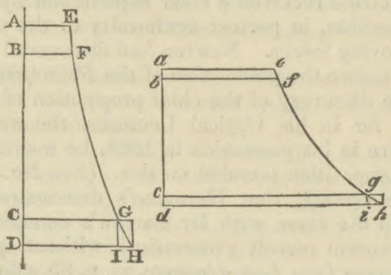
Similar instants and points, what.

104. *These may be called similar instants of time, and similar points of space which divide given portions of time, and of space in the same ratio.* Thus the middle is a similar instant of an hour or of a day, and is the similarly situated point of a foot or of a yard. The beginning of the 21st minute, and of the 9th hour, are similar instants of an hour and of a day. The beginning of the fifth inch, and of the second foot, are similar points of a foot and of a yard.

Similar actions, what.

105. *Forces may be said to act similarly when their intensities in similar instants of time, or in similar points of space, are in a constant ratio.* Thus in fig. 20, when one body is impelled towards C from A, and another from K, each with a force proportional to the distance of every point of its motion from C, these forces may be said to act similarly along the spaces AC and KC, or during the times represented by the quadrantal arches AFH, KNO. The following propositions on similar actions will be found very useful on many occasions; but we must premise a geometrical lemma.

Fig. 21.

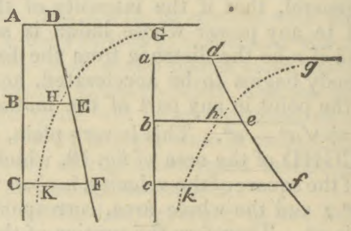


106. If there be two lines EFGH (fig. 21), *efgh*, so related to their abscisses AD, *ad*, that the ordinates BF, *bf*, drawn from similar points B and *b* of the abscisses, are in the constant ratio of AE to *ae*; then the area ADHE is to the area *adhe* as the rectangle of AD × AE to the rectangle *ad* × *ae*.

For, let each abscissa be divided into the same number of equal and very small parts, of which let CD and *cd* be one in each. Inscribe the rectangles CGID, *cgid*. Then because the number of parts in each axis is the same, the lengths of the portions CD and *cd* will be proportional to the whole abscisses AD and *ad*. And because C and *c* are similar points, CG is to *cg* as AE is to *ae*. Therefore $CD \times CG : cd \times cg = AD \times AE : ad \times ae$. This is true of each pair of corresponding rectangles, and therefore it is true of their sums. But when the number of these rectangles is increased, and their breadth diminished without end, it is evident that the ultimate ratio of the sum of all the rectangles, such as CDHG, to the sum of all the rectangles *cdhg*, is the same with that of the area ADHE to the area *adhe*, and the proposition is manifest.

107. *If two particles of matter are similarly impelled during given times, the changes of velocity are as the times and as the forces jointly.*

Fig. 22.



Let the times be represented by the straight lines ABC (fig. 22), and *abc*, and the forces by the ordinates AD, BE, CF, and *ad*, *be*, *cf*. Then if B and *b* are similar instants (suppose the middles) of the whole times, we have $BE : be = AD : ad$. Therefore, by the lemma, the area ACFD is to *acfd* as AC × AD to *ac* × *ad*. But these areas are proportional to the velocities (No. 72), and the proposition is demonstrated. For the same reason, the change of velocity during the time AB is to the change during *ab* as AB × AD to *ab* × *ad*.

Cor. 1. If the times and forces are reciprocally proportional, the changes of velocity are equal; and if the forces are inversely as the times, the changes of velocity are equal.

108. *If two particles be similarly urged along given spaces, the changes made on the squares of the velocities are as the forces and spaces jointly.*

For if AC (fig. 22) and *ac* are the spaces along which the particles are impelled, and the forces are as the ordinates AD and *ad*, the areas ACFD and *acfd* are as the changes on the squares of the velocities. But these areas are as AC × AD, and *ac* × *ad*. Therefore, &c.

Cor. 2. If the spaces are inversely as the forces, the changes of the squares of the velocities are equal; and if these are equal, the spaces are inversely as the forces.

Cor. 3. If the spaces along which the particles have been impelled from a previous state of rest, are directly as the forces, the velocities are also as the forces. For, because the changes of the squares of the velocities are as the spaces and forces jointly, they are in this case as the squares of the forces or of the spaces; but the changes of the squares of the velocities are in this case the whole squares of the velocities; therefore the squares of the velocities are as the squares of the forces, and the velocities are as the forces. N. B. This includes the motions represented in fig. 20.

109. *If two particles be similarly impelled along given spaces, from a state of rest, the squares of the times are proportional to the spaces directly, and to the forces inversely.*

Let ABC (fig. 22), *abc*, be the spaces described, and AD, *ad*, the accelerating forces at A and *a*. Let V, B express the velocity at B, and *v*, *b* the velocity at *b*.

Let GHK and *ghk* be curves whose ordinates are inversely as the velocities at the corresponding points of the abscissa. These curves are therefore exponents of the times (No. 99). Then, because the forces act similarly, we have, by the last theorem, $AC \times AD : ac \times ad = V^2, B : v^2, b, = hb^2 : HB^2$. Therefore $HB : hb = \sqrt{ac \times ad} : \sqrt{AC \times AD}$, and therefore in a con-

Of accelerating and Retarding Forces.

stant ratio. Call this the ratio of m to n. But since the ordinates of the lines GHK, *ghk*, are inversely as the velocities, the areas are as the times (No. 99); and since these ordinates are in the constant ratio of m to n, the areas are in the ratio of $\mathrm{AC} \times m$ to $ac \times n$. Therefore (calling the times of the motions T and t), we have

$$\mathrm{T} : t = m \times \mathrm{AC} : n \times ac; \text{ and therefore}$$
$$\mathrm{T}^2 : t^2 = m^2 \times \mathrm{AC}^2 : n^2 \times ac^2. \text{ But}$$
$$m^2 : n^2 = ac \times ad : \mathrm{AC} \times \mathrm{AD}. \text{ Therefore}$$
$$\mathrm{T}^2 : t^2 = ac \times ad \times \mathrm{AC}^2 : \mathrm{AC} \times \mathrm{AD} \times ac^2,$$
$$\text{or } \mathrm{T}^2 : t^2 = ad \times \mathrm{AC} : \mathrm{AD} \times ac.$$
$$\text{Or } \mathrm{T}^2 : t^2 = \frac{\mathrm{AC}}{\mathrm{AD}} : \frac{ac}{ad}.$$

The attentive reader will observe that these three propositions give a great extension to the theorems which were formerly deduced from the nature of uniformly accelerated motion, or of uniform action of the forces, and were afterwards demonstrated to obtain in the momentary action of forces any how variable.

The first of the three propositions, $\mathrm{V} : v = \mathrm{F} \times \mathrm{T} : f \times t$, is the extension of the theorem $fdt = dv$. The second, $\mathrm{V}^2 : v^2 = \mathrm{F} \times \mathrm{S} : f \times s$, is the extension of the theorem $fds = vdv$. And the third, $\mathrm{T}^2 : t^2 = \frac{\mathrm{S}}{\mathrm{F}} : \frac{s}{f}$, is the extension of $f = \frac{ds}{d(t^2)}$, or of $fd\,(t^2) = ds$. These theorems hold true of all *similar* actions; and, only for this reason, are true of uniformly accelerated motions, or uniform actions.

Aggregate of any equal accelerating forces.

There remains one thing more to be said concerning the action of accelerating forces. Their magnitude is ascertained by their effect. Therefore that is to be considered as a double force which produces a double quantity of motion. Therefore when a body A contains twice the number of equal atoms of matter, and acquires the same velocity from the action of the force F, that another body *a*, containing half the number of atoms, acquires from the action of a force *f*, we conceive F to be double of *f*. That this is a legitimate inference appears clearly from this, that we conceive the sensible weight of a body, or that pressure which it exerts on its supports, as the aggregate of the equal pressure of every atom accumulated perhaps on one point; as when the body hangs by a thread, and, by its intervention, pulls at some machine. Without inquiring in what manner or by what intervention this accumulation of pressure is brought about, we see clearly that it results from the equal accelerating force of gravity acting immediately on each atom. When this weight is thus employed to move another body by the intervention of the thread, which is attached to one point perhaps of that body, it puts the whole into motion, generating a certain velocity v in every atom, by acting uniformly during the time t. We conceive each atom to have sustained the action of an equal accelerating force whose measure is $\frac{v}{t}$. Without considering how this force is exerted on each atom, or by what it is immediately exerted, or how it is diffused through the body from the point to which the weight of the other body is applied by means of the thread; we still consider it as the aggregate of the action of gravity on each atom of that other body. Moreover, attending only to the motion produced by it, and perhaps not knowing the weight of the impelling body, we measure it, as a moving force, by considering it as the aggregate of the forces propagated to each atom of the impelled body, and measured by $\frac{v}{t}$. If we know that the impelled body contains the number m of atoms, the aggregate of forces is $m\frac{v}{t}$, or $\frac{mv}{t}$.

Of Deflecting Forces.

But since we measure forces by the quantity of motion which they produce, we must conceive, that when the same force is applied to a body which consists of n particles, and produces the velocity u, by acting uniformly during the same time t, the force $n\frac{u}{t}$ is equal to the force $m\frac{v}{t}$.

Moving force, motive force, vis motrix, as distinguished from accelerating force.

110. Sir Isaac Newton found it absolutely necessary, in the disquisitions of natural philosophy, to keep this circumstance of acceleration clear of all notions of quantity of matter, or other considerations, and to contemplate the affections of motion only. He therefore considered $\frac{v}{t}$ as the true original measure of accelerating force, and $m\frac{v}{t}$ as an aggregate. He therefore calls the aggregate a *vis motrix*, a *moving force*, measured by the *quantity of motion* that it generates. And he confines the term *accelerating force* to the quantity $\frac{v}{t}$ measured by the *acceleration* or *velocity* only. It would be convenient, therefore, also to confine the symbol f to $m\frac{v}{t}$, and to retain the symbol a for expressing the accelerating force $\frac{v}{t}$.

This appellation of *motive force* is perfectly just and simple; for we may conceive it as the same with the accelerating force which produces the velocity m times v in one particle, by acting on it uniformly during the time t. This motion of one particle having the velocity mv, is the same with that of m particles having each the velocity v.

If therefore a motive force f act on a body consisting of m particles, the accelerating force a is $= \frac{f}{m}\frac{v}{t}$.

Therefore the three last propositions concerning the similar, the uniform, or the momentary actions of *moving* forces, when expressed in the most general terms, are,

$$v' \doteqdot \frac{f}{mt'},$$
$$v^{2\prime} \doteqdot \frac{fs'}{m}, \text{ or } vdv = \frac{fds}{m},$$
$$t^2 \doteqdot \frac{ms'}{f}.$$

OF DEFLECTING FORCES.

Deflecting forces.

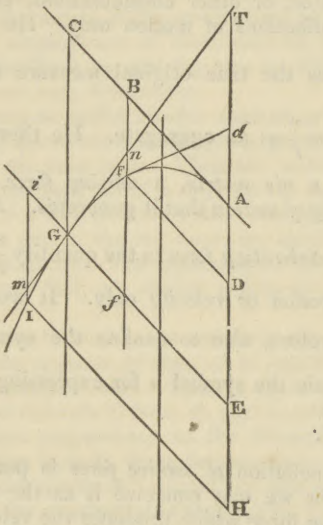
111. When we observe the direction of a body to change, we unavoidably infer the agency of a force which acts in a direction that does not coincide with that of the body's motion; and we may distinguish this circumstance by calling it a *deflecting force*. We have already shown how to estimate and measure this deflecting force, by considering it as competent to the production of that motion which, when compounded with the former motion, will produce the new motion (No. 44). Now, as all changes of motion are really compositions of motions or forces, it

is evident that we shall explain the action of deflecting forces when we show this composition.

Alteration of deflections are continual, and produce curvilineal motions.

We may almost venture to say *a priori*, that all deflections must be continual, or exhibit curvilineal motions: for as no finite velocity, or change of velocity, can be produced in an instant by the action of an accelerating force, no polygonal or angular deflection can be produced; because this is the composition of a finite velocity produced in an instant. Deflective motions are all produced by the composition of the former motion, having a finite velocity, with a transverse motion continually accelerated from a state of rest. Of this we can form a very distinct notion, by taking the simplest case of such accelerated motion, namely, a uniformly accelerated motion.

Fig. 23.



Example. Determination of the path,

112. Let a body be moving in the direction AC (fig. 23) with any constant velocity, and when it comes to A, let it be exposed to the action of an accelerating force, acting uniformly in any other direction AE. This alone would cause the body to describe AE with a uniformly accelerated motion, so that the spaces AD, AE, would be as the squares of the times in which they are described. Therefore, if AB be the space which it would have described uniformly in the time that it describes AD by the action of the accelerating force, and AC the space which it would have described uniformly while it describes AE by the action of the accelerating force, nothing more is wanted for ascertaining the real motion of the body but to compound the uniform motion in the direction AC with the uniformly accelerated motion in the direction AE. AD is to AE as the square of the time of describing AD to the square of the time of describing AE; that is, as the square of the time of describing AB to the square of the time of describing AC; that is, as AB^2 to AC^2 (by reason of the uniform motion in AC). This composition is performed by taking the simultaneous points B, D, and the simultaneous points C, E, and completing the parallelograms ABFD, ACGE. The body will be found in the points F and G in the instants in which it would have been found at B and C by the uniform motion, or in D and E by the accelerated motion. In the same manner may be found as many points of the real path as we please. It is plain that these points will be in a line AFG, so related to AE that $AD : AE = DF^2 : EG^2$; or so related to the original motion AC, that $AB^2 : AC^2 = BF : CG$, &c. This line is therefore a parabola, of which AE is a diameter, DF and EG are ordinates, and which touches AC in A.

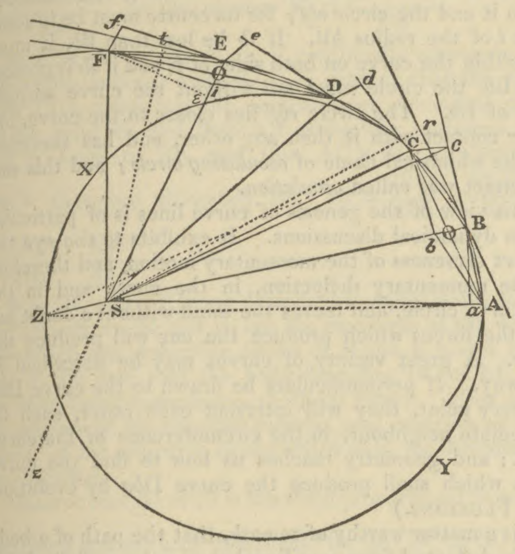
Having thus ascertained the path of the body, we can also ascertain the motion in that path; that is, the velocity in any point of it. We know that the velocity in the point G is to the velocity of the uniform motion in the direction AC as the tangent TG is to the ordinate EG; because this is the ultimate ratio of the momentary increment of the arch AFG to the momentary increment of the ordinate EG. Thus is the velocity in every point of the curve determined. We have taken it for granted that the line of projection touches the path, and that the direction in every point is that of the tangent. To suppose that the curve, in any portion of it, coincides with the tangent, is to suppose that the body is not deflected, that is, is not acted on by a transverse accelerating force; and to suppose that the tangent makes a finite angle with any part of the path, is to suppose that the deflection is not continual, but by starts, both of which are contrary to the conditions of the case. No straight line can be drawn between the direction of the body and the succeeding portion of the path, otherwise we must again suppose that the deflection is subsultory, and the motion angular.

113. But while the investigation is so easy when the direction and intensity of the deflecting force in every point of the curve are known, the investigation of the deflecting force from the observed motion is by no means easy. The observed curvilineal motion always arises from a composition of a uniform motion in the tangent with some transverse motion; but the same curvilineal motion may be produced by compounding the uniform motion in the tangent with an infinity of transverse motions, and the law of action will be different in these transverse motions according as their directions differ. We must learn not only the intensity of the deflecting force, and the law of its variation, but also its direction in every point of the curve. It is not easy to find general rules for discovering the direction of the transverse force; most commonly this is indicated by extrinsic circumstances. The deflecting force is frequently observed to reside in or to accompany some other body. It may be presumed, therefore, that it acts in the direction of the line drawn to or from that body; yet even this is uncertain. The most general rule for this investigation is to observe the place of the body at several intervals of time before and after its passing through the point of the curve, where we are interested to find its precise direction. We then draw lines joining those places of the tangent where the body would have been by the uniform motion only. We shall perhaps observe these lines of junction keep in parallel positions: we may be assured that the direction of the transverse force is the same with that of any of these lines. This is the case in the example just now given of a parabolic motion; but when these lines change position they will change it gradually, and their position in the point of contact is that to which their positions on both sides of it gradually approximate.

But all this is destitute of the precision requisite in philosophical discussion. We are indebted to Sir Isaac Newton for a theorem which ascertains the direction of the transverse force with all exactness, in the cases in which we most of all wish to attain mathematical accuracy, and which not only opened the access to those discoveries which have immortalized his name, but also pointed out to him the path he was to follow, and even marked his first steps. It therefore merits a very particular treatment.

'Deflect-
g Forces.

Fig. 24.



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114. If a body describes a curve line ABCDEF (fig. 24) lying in one plane, and if there be a point S so situated in this plane that the line joining it with the body describes areas ASB, ASC, ASD, &c. proportional to the times in which the body describes the arches AB, AC, AD, &c. the force which deflects the body from rectilineal motion is continually directed to the fixed point S.

Let us first suppose that the body describes the polygon ABCDEF, &c. formed of the chords AB, BC, CD, DE, EF, &c. of this curve, and, for greater simplicity of argument, let us consider areas described in equal successive times; that is, let us suppose that the triangles ASB, BSC, CSD, &c. are equal, and described in equal times. Make B*c* = AB, and draw *c*S.

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Had the motion AB suffered no change in the point B, the body would have described B*c* in the equal moment succeeding the first; but it describes BC. The body has therefore been deflected by an external force, and BC is the diagonal of a parallelogram (No. 45, 46), of which B*c* is one side, and *c*C is another. The deflecting force will be discovered, both in respect of direction and intensity, by completing the parallelogram B*c*C*b*. B*b* is the space which the deflecting force would have caused the body to describe in the time that it describes B*c* or BC. Because B*c* is equal to BA, the triangles BS*c*, BSA are equal. But, by the nature of the motion, BSA is equal to BSC; therefore the triangles BSC and BS*c* are equal. They are also on the same base BS; therefore they lie between the same parallels, and C*c* is parallel to SB. But *c*C is parallel to B*b;* therefore B*b* coincides with BS, and the deflecting force at B is directed toward S. By the same argument, the deflecting force at the angles D, E, F, &c. is directed to S.

Now, let the sides of the polygon be diminished, and their number increased without end. The demonstration remains the same, and continues, when the polygon finally coalesces with the curve, and the deflection is continual.

When areas are described proportional to the times, equal areas are described in equal times; and therefore the deflection is always directed to S. Q. E. D.

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The point S may, with equal propriety of language, be called the *centre of deflection*, or *the centre of forces;* and forces which are thus continually directed to one fixed point may be distinguished from other deflecting forces by the name *central forces.*

Of Deflecting Forces.

Radius vector.

The line joining the centre of forces with the body, and which may be conceived as a stiff line carrying the body round, is usually named the *radius vector.*

Central forces produce areas proportional to the times.

115. The converse of this proposition, viz. that if the deflecting forces be always directed to S, the motion is performed in one plane, in which S is situated, and areas are described proportional to the times, is easily demonstrated by reversing the steps of this demonstration. The motion will be in the plane of the lines SB and B*c*, because the diagonal BC of the parallelogram of forces is in the plane of the sides. Areas are described proportional to the times; for C*c* being parallel to SB, the triangles SCB and S*c*B are equal; and therefore SCB and SAB are equal, &c. &c.

Velocity is inversely as the perpendicular from the centre.

116. *Cor.* 1. When a body describes areas round S proportional to the times, or when it is continually deflected toward S, or acted on by a transverse force directed to S, the velocities in the different points A and E of the curve are inversely proportional to the perpendiculars S*r* and S*t*, drawn from the centre of forces to the tangents in those points; that is, to the perpendiculars from the centre on the momentary directions of the motion: for since the triangles ASB, ESF are equal, their bases AB, EF are inversely as their altitudes S*r*, S*t;* but these bases being described in equal times, are as the velocities, and they ultimately coincide with the tangents at A and E.

117. *Cor.* 2. If Bα and Fε be drawn perpendicular to SA and SE, we have SA × Bα = SE × Fε, and SA : SE = Fε : Bα. For SA × Bα is double of the triangle BSA, and SE × Fε is double of the equal triangle SFE.

Angular velocity is inversely as the square of the distance from the centre of forces.

118. *Cor.* 3. The angular velocity round S, that is, the magnitude of the angle described in equal times by the radius vector, is inversely proportional to the square of the distance from S. For when the arches AB, EF are diminished continually, the perpendiculars Bα and Fε will ultimately coincide with arches described round S with the radii SB and SF. Now the magnitude of an angle is proportional to the length of the arch which measures it directly, and to the radius of the arch inversely. In any circle, an arch of two inches long measures twice as many degrees as an arch one inch long; and an arch one inch long contains twice as many degrees of a circle whose radius is twice as short. Therefore, ultimately, the angle ASB is to the angle ESF as Bα to Fε, and as SF to SB jointly; that is, as Bα × SF to Fε × SB. But Bα : Fε = SE : SA (Cor. 2); therefore ASB : ESF = SE × SF : SB × SA, = ultimately $SE^2 : SB^2$.

This corollary gives us an ostensible mark, in many very important cases, of the action of a deflecting force being always directed to a fixed point. We are often able to measure the angular motion when we cannot measure the real velocities.

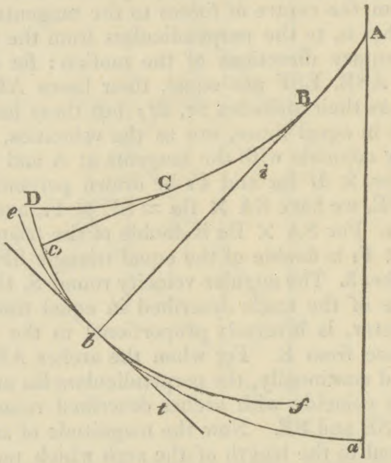
Intimate connection of dynamics and the higher geometry.

Having thus discovered the chief circumstances which enable us to ascertain the direction of the deflecting force, we proceed to investigate the quantity of this deflective determination in the different points of a curvilineal motion. This is a more difficult task. The momentary effect of the deflecting force is a small deviation from the tangent; and this deviation is made with an accelerated motion. The law of this acceleration regulates the curvature of the path, and is to be determined by it. We may be allowed to observe by the way, that it appears clearly, from the form in which Newton has presented all his dynamical theorems, that we are indebted to these problems for the immense improvement which he has made in geometry by his invention of fluxions. The purposes he had in view suggested to his penetrating mind the means for attaining them; and the connection between dynamics and geometry is so intimate, that the same theorems are in a manner common to both. This is particularly the case in all that relates to curvature. Or shall we say that the geometry of Dr Barrow suggested the dynamical theorems to Newton? We have seen how the curvature of a parabola is produced by a force acting uniformly. The *momentary* action of all finite forces may be considered as uniform, and therefore the curvature will be that of some portion of some parabola; but it will be difficult to determine the precise degree without some farther help. We are best acquainted with the properties of the circle, and will have the clearest notions of the curvature of other curves by comparing them with circles.

Measure of curvature.

The curvature of a circular arch of given length is so much greater as its radius is shorter, for it will contain so many more degrees in the same length; and therefore the change of direction of its extremities is so much greater. Curvatures may always be measured by the length of the arch directly, and the radius inversely.

Fig. 25.



Evolution and involution of curves.

119. Suppose a thread made fast at one end of a material curve ABCD (fig. 25), and applied to it in its whole length. Taking hold of its extremity D, unfold it gradually from the curve DCBA; the extremity D will describe another curved D*cba*. This geometrical operation is called the *evolution* of curves, and D*cba* is called the *evolute* of DCBA, which is called the *involute* of D*cba*. Perhaps this denomination has been given from the genesis of the area or surface contained by the two lines, which is folded up and unfolded somewhat like a fan. When the describing point is in *b*, the thread *b*B is undoubtedly the momentary radius of a circle *ebf*, whose centre is B, the point of the involute which it is just going to quit. The momentary motion of *b* is the same, whether it is describing an arch of the evolute passing through *b*, or an arch of a circle round the centre B. The same line *bt*, perpendicular to the thread *b*B, touches the circle *ebf* and the curve D*ba* in the point *b*. This circle *ebf* must lie within the curve D*ba* on the side of *b*B toward *a*, because on this side the momentary radius is continually increasing. For similar reasons, the circle *ebf* lies without the curve on the other side of *b*B. Therefore the circle *ebf* both touches and cuts the curve D*ba* in the point *b*. Moreover, because every portion of the curve between *b* and D is described with radii that are shorter than *b*B, it must be more incurvated than any portion of the circle *ebf*. For similar reasons, every portion of the curve between *b* and *a* must be less incurvated than this circle; therefore the circle has that precise degree of curvature that belongs to the curve in the point *b*; it is therefore called the *equicurve circle*, or the *circle of curvature*, and B is called the centre, and B*b* the *radius of curvature*. It is easy to perceive that no circle can be described which shall touch the curve in *b*, and come between it and the circle *ebf*; for its centre must be in some point *i* of the radius *b*B. If *ib* be less than B*b*, it must fall within the curve on both sides of *b*, and if *ib* is greater than B*b*, the circle must fall without the curve on both sides of B*b*. The circle *ebf* lies closer to the curve, has closer contact with it than any other, and has therefore got the whimsical name of *osculating circle;* and this sort of contact was called *osculation*.

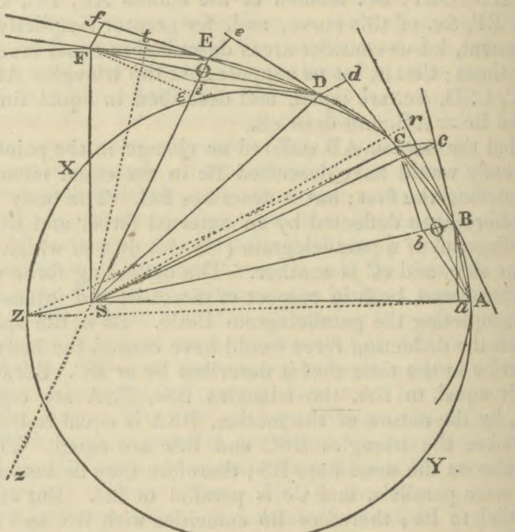
Circle of curvature. Equicurve circle.

This view of the genesis of curve lines is of particular use in dynamical discussions. It exhibits to the eye the perfect sameness of the momentary motion, and therefore of the momentary deflection, in the curve and in the equicurve circle, and leaves the mind without a doubt but that the forces which produce the one will produce the other. A great variety of curves may be described in this way. If perpendiculars be drawn to the curve D*ba* in every point, they will intersect each other, each its immediate neighbour, in the circumference of the curve DBA; and geometry teaches us how to find the curve DBA which shall produce the curve D*ba* by evolution. (See FLUXIONS.)

It is a matter worthy of remark, that the path of a body that is deflected from rectilineal motion by a *finite* force, varying according to any law whatever, may always be described by evolution. This includes almost every case of the action of deflecting forces; none being excepted but when, by the opposite action of different forces, the body is in equilibrio in one single point of its path.

Our task is now brought within a very narrow compass, namely, to measure the deflection in the arch of a circle.

Fig. 26.



Had the motion represented in fig. 26 been polygonal, it is plain that the deflecting force in the point B is to that in the point E as the diagonal B*b* of the parallelogram ABC*b* to the diagonal E*i* of the parallelogram DEF*i;* therefore let ABCZY be a circle passing through the points A, B, and C, and let the radius vector BS cut the circumference in Z; draw AZ, CZ, and the diagonal AC, which necessarily bisects and is bisected by the diagonal B*b*. The triangles *b*BC and CBZ are similar; for the angle C*b*B is equal to the alternate angle AB*b* or ABZ, which is equal to the angle ACZ, standing on the same chord AZ. And the angle CB*b*, or CBZ, is equal to CAZ, standing on the same chord CZ; therefore the remaining angle *b*CB is equal to the remaining angle

Ofeflect- in orces. AZC; therefore ZA is to AC as BC to B*b*, and B*b* $= \frac{AC \times BC}{AZ}$. In like manner E*i* $= \frac{DF \times EF}{Dz}$.

M sure of de cting for s. Now let the points A and C continually approach, and ultimately coalesce with B; it is evident that the circle ABCZY is ultimately the equicurve or coinciding circle at the point B, and that AS ultimately coalesces with and is equal to BS, and that AC × BC is ultimately 2BC²; therefore ultimately $Bb : Ei = \frac{2BC^2}{BZ} : \frac{2EF^2}{Ez}$, or $= \frac{BC^2}{\frac{1}{2}BZ} : \frac{EF^2}{\frac{1}{2}Ez}$.

Now BC and EF being described in equal times, are as the velocities: B*b* and E*i* are the measures of the velocities which the deflective forces at B and E would generate in the time that the body describes BC or EF, and are therefore the measures of those forces. *They are as the squares of the velocities directly, and inversely as those chords of the equicurve circles which have the directions of the deflection.*

Observe that B*b* or E*i* is the third proportional to half of the chord and the arch described; for $Bb : BC = BC : \frac{BZ}{2}$.

It is evident, that as the arches AB, BC, continually diminish, AC is ultimately parallel to the tangent B*r*, and BO is equal to the actual deflection from the tangent. The triangles BOC and AOZ are similar, and $BO = \frac{OC^2}{OZ}$, or ultimately $= \frac{BC^2}{BZ}$. We may measure the forces by the actual deflections, because they are the halves of the measures of the generated velocities; and we may say that

asure of ection. 120. *The actual momentary deflection from the tangent is a third proportional to the deflective chord of the equicurve circle and the arch described during the moment.*

ution. Either of these measures may be taken, but we must take care not to confound them. The first is the most proper, because the change produced on the body (which is the *immediate* effect and measure of the force) is the determination left inherent in it to move with a certain velocity. This is the measure also which we obtain by means of the differential or fluxionary calculus; but the other measure must be obtained when our immediate object is to mark the actual path of the body. The steps of this demonstration, which is Newton's, naturally terminate in the equicurve circle, and give at once the immediate measure of the deflecting force. At the same time the reader must perceive that this measure does not depend on the force being always directed to one centre; it is enough that the two sides of the polygon, in immediate succession, are described in equal times. This is necessary in order that ABC*b* may be a parallelogram, and that the diagonals AC and B*b* may mutually bisect each other.

Thus have we obtained a measure of deflecting force, and, in the most important cases, a method of discovering its direction. It only remains to point out the relation between the intensity of the force, the curvature of the path, and the velocity of the motion. These three circumstances have a necessary connection; for we see that the intensity is expressed by certain values of the other two in the formula $f \doteq \frac{\text{Arch}^2}{\frac{1}{2}\,\text{Chord}}$, or $f = \frac{2\,BC^2}{BZ}$. The deflective velocity B*b* is acquired in the time that the body describes BC; therefore the deflective velocity is to the velocity in the curve as B*b* to BC. The velocity B*b* is acquired by an accelerated motion along BO; for while, by progressive motion, the body describes BC, it deflects from the tangent through a space equal to the half of B*b*, because the momentary action of the deflecting force may be considered as uniform. The progressive velocity BC may be generated by the same force uniformly acting through a space greater than BC; call this space *x*. The spaces along which a body must be uniformly impelled in order to acquire different velocities are as the squares of those velocities; therefore $Bb^2 : BC^2 = Bo : x$; but $Bb : BC = BC : \frac{1}{2}BZ$; therefore $Bb^2 : BC^2 = Bb : \frac{1}{2}BZ$, and $Bb : \frac{1}{2}BZ = Bo : x$, and $Bb : Bo = \frac{1}{2}BZ : x$; but B*o* is $\frac{1}{2}$ of B*b*, therefore *x* is $\frac{1}{4}$ of BZ; that is,

Of Deflecting Forces.

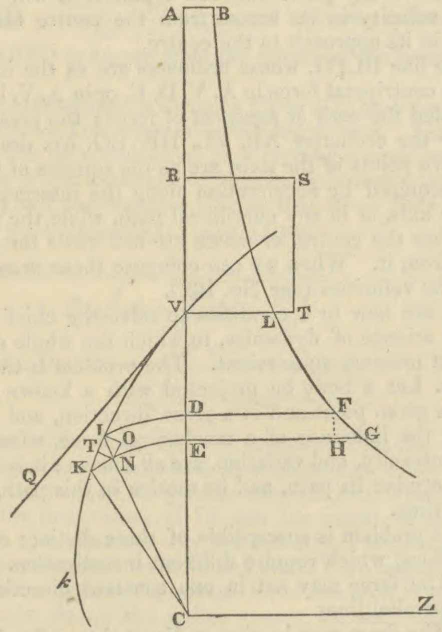
121. *The velocity in any point of a curvilineal path is that which the deflecting forces in that point would generate in the body by impelling it uniformly along one fourth part of the deflective chord of the equicurve circle.* If the velocity increase, the chord of the equicurve circle must increase; that is, the path becomes less incurvated. If the force be increased, the curvature will also increase, for the chord of curvature will be less.

There is another general observation to be made on the velocity of a curvilineal motion, which greatly assists us in our investigation.

Comparison of orbital motion with direct approach to the centre.

122. *If a body describes a curve by the action of a force always directed to a fixed point, and varying according to any proportion whatever of the distances from that point, and if another body, acted on by the same centripetal force, move toward the centre in a straight line, and if in any one case of equal distances from the centre of force the two bodies have equal velocities, they will have equal velocities in every other case of equal distances from the centre.*

Fig. 27.



Let one body be impelled from A (fig. 27) toward C along the straight line AVDEC, and let another be deflected along the curve line VIK*k*. About the centre C describe concentric arches ID, KE, very near to each other, and cutting the curve in I and K, and the line AC in D and E; draw IC, cutting KE in N, and draw NT perpendicular to the arch IK of the curve, and complete the parallelogram ITNO. Let the bodies be supposed to have equal velocities at I and at D.

Then, because the centripetal forces are supposed to be the same for both bodies when they are at equal distances, the accelerating forces at D and I may be represented by the equal lines DE and IN; but the force IN is not wholly employed in accelerating the body along the arch IK, but, acting transversely, it is partly employed in incurvating the path. It is equivalent to the two forces IO and IT, of which only IT accelerates the body. Now IKN is a right-angled triangle, as is also the triangle INT; and they are similar; therefore IN : IT = IK : IN, or DE : IT = IK : DE; that is, the force which accelerates the body along DE is to the force which accelerates the body along IK as the space IK is to the space DE; therefore (No. 86) the increment of the square of the velocity acquired along DE is equal to the increment of the square of the velocity acquired along IK. But the velocities at D and I were equal, and consequently their squares were equal; and these having received equal increments, therefore the squares of the velocities at E and K are equal, and the velocities themselves are equal. And since this is the case in all the corresponding points of the line AC and the curve VIK, the velocities at all equal distances from C will be equal.

It is evident that the conclusion will be the same, if the bodies, instead of being accelerated by approaching the centre in the straight line AC, and in the curve VIK, are moving in the opposite directions from E to A, or from I to V, and are therefore retarded by the centripetal force.

Retarded curvilineal motion always accompanied by recess from the centre.

123. *Cor.* Hence it follows, that if a body be projected from any point, such as V, of the curve, in a line tending straight from the centre, with the velocity which it had in that point of the curve, it would go to a distance VA, such, that if it were impelled along AV by the centripetal force, it would acquire its former velocity in the point V; also in any point between V and A it will have the same velocity in its recess from the centre that it has there in its approach to the centre.

The line BLFG, whose ordinates are as the intensities of the centripetal force in A, V, D, E, or in A, V, I, K, may be called the *scale* or *exponent* of force; the areas bounded by the ordinates AB, VL, DF, EG, &c. drawn from any two points of the axis, are as the squares of the velocity acquired by acceleration along the intercepted part of the axis, or in any curvilineal path, while the body approaches the centre, or which are lost while the body retires from it. When we can compute these areas we obtain the velocities (see No. 102).

We are now in a condition to solve the chief problem in the science of dynamics, to which the whole of it is in a great measure subservient. The problem is this:

Inverse problem of centripetal forces.

124. Let a body be projected with a known velocity from a given point and in a given direction, and let it be under the influence of a mechanical force, whose direction, intensity, and variation, are all known; it is required to determine its path, and its motion in this path, for any given time.

This problem is susceptible of three distinct classes of conditions, which require different investigation.

1. The force may act in one constant direction; that is, in parallel lines.

2. The force may be always directed to a fixed point.

3. It may be directed to a point which is continually changing its place.

1. When the force acts in parallel lines, the problem is solved by compounding the rectilineal accelerated motion which the force would produce in its own direction with the uniform motion which the projection alone would have produced. The motion must be curvilineal when the accelerating force is transverse, in any degree whatever, to the projectile motion; and the curvilineal path must be concave on that side to which the deflecting force tends, for the force is supposed to act incessantly. The place of the body will be had for any time, by finding where the body would have been at the end of that time by each force acting alone, and by completing the parallelogram. Thus, suppose a body projected along AB (fig. 23), while it is continually acted on by a force whose direction is AD. Let D and B be the places where the body would be at the end of a given time. Then the body will, at the end of that time, be in F, the opposite angle of the parallelogram ABFD. But it has not described the diagonal AF, because its motion has been curvilineal, as we shall find by determining its place at other instants of this time.

The velocity in any point F is found by first determining the velocity at D, and making D*d* to DF as the velocity at D to the velocity at B (that is, the velocity of projection, because the motion along AB is uniform). Then draw *d*F. Then AB is to *d*F as the constant velocity of projection to the velocity at F. We have seen already (No. 112–119) that *d*F is a tangent to the curve in F. Hence we may determine the velocity at F in another way. Having determined the form of the path in the way already described, by finding its different points, draw the tangent F*d*, cutting the line DA in *d*. Then the velocity at A is to that at F as AB to *d*F. Hence also we see that the velocities in every point of the curve are proportional to the portion of the tangents at those points which are intercepted between *any* two lines parallel to AD.

Either of these methods for ascertaining the velocity, in this case of parallel deflections, will in general be easier than the general method in No. 121, by the equicurve circle.

It was thus that Galileo discovered the parabolic motion of heavy bodies.

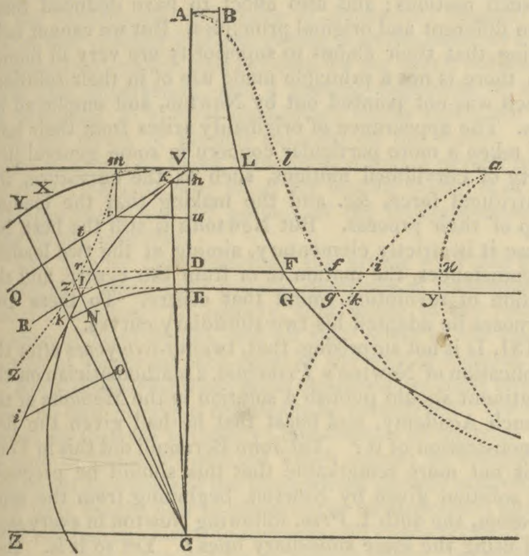
2. We must consider the motions of bodies affected by centripetal or centrifugal forces, always tending to one fixed point. This is the celebrated *inverse problem of centripetal forces*, and is the forty-second proposition of the first book of Newton's *Principia*. We shall give the solution after the manner of its illustrious author, because it is elementary in the purest sense of the word, keeping in view the two leading circumstances, and these only, namely, the motion of approach and recess from the centre, and the motion of revolution. By this judicious process, it becomes a pattern by which more refined, and, in some respects, better solutions should be modelled. At the same time we shall supply some steps of the investigation which his elegant conciseness has made him omit.

125. Let a body which tends to C (fig. 28) with a force proportional to the ordinates of the exponent BLFG, having the axis CA, be projected from V in the direction VQ, with the velocity which the centripetal force would generate in it by accelerating it along AV. It is required to determine the path or orbit VIKI of the body, and its place I in this orbit, at the end of the assigned time T.

Suppose the thing done, and that I is the place of the body. About the centre C, with the distances CV and CI, describe the circles YV and ID. Draw CIX to the circumference, and draw the ordinate DF of the exponent of forces, producing it toward x, and produce the ordinate VL toward a. Let Vt be the distance to which the body would go along the tangent VQ in the time T, and join tC. Let this be supposed done for every point of the curve. Let aik and axy be two curves so related to the curve VIK, that the ordinate DF cuts off an area V$ai$D equal to the orbital sector VCI, and an area V$ax$D equal to the circular sector VCX.

Then, because the velocity of projection is given, the distance V*t* is known, and the area of the triangle VC*t*. But this is equal to the area VCI, by the laws of central forces. (No. 115.) Therefore the area V*ai*D is given. Also, because the area VCI increases in the proportion of the time, the area V*ai*D increases at the same rate.

Fig 28.



Therefore, having these subsidiary curves *aik*, *axy*, the problem is solved as follows:

Draw an ordinate D*i*, cutting off an area V*ai*D proportional to the time, and describe a circle DIR. Then draw a line CX, cutting off a sector VCX, equal to the area V*ax*D cut off by the ordinate D*ix*. This line will cut the circle DR in the point I, which is the point of the orbit that was demanded.

But the chief difficulty of the problem consists in the description of the two subsidiary curves *aik* and *axy*, into which the lines VIK and VXY are transformed. We attain this construction by resolving the motion in the arch of the orbit into two motions, one of which is in the direction of the transverse force, or of the radius vector, and the other is in the direction of revolution, or perpendicular to the radius.

Let V*k* and IK be two very small arches described in equal moments, and therefore ultimately in the ratio of the velocities in V and I (No. 73). Describe the circle KE, cutting IC in N. Draw KC and *k*C, and *kn* perpendicular to VC.

The element ICK of the orbit is $= \frac{\mathrm{IC} \times \mathrm{KN}}{2}$, or to $\frac{1}{2}\mathrm{IC} \times \mathrm{KN}$. This is equal to the element D*ik*E of the area V*ai*D, or to D*i* × DE, or to D*i* × IN. Therefore $\mathrm{IN} : \mathrm{KN} = \frac{1}{2}\mathrm{IC} : \mathrm{D}i$, or $2\mathrm{IN} : \mathrm{KN} = \mathrm{IC} : \mathrm{D}i$, and $\mathrm{D}i = \frac{\mathrm{IC} \times \mathrm{KN}}{2\mathrm{IN}}$.

Now let A*lfgh* be the exponent of the velocities, that is (No. 86), let Vl^2 be to Df^2 as ABLV to ABFD, or V*l* : D*f* = $\sqrt{\mathrm{ABLV}} : \sqrt{\mathrm{ABFD}}$. Make V*v* and I*i* in the tangents respectively equal to V*l* and D*f*. Draw *vu* and *i*O perpendicular to VC and IC, and *vm* perpendicular to LV produced. Let *mrz* be an equilateral hyperbola, having VC, ZC, for its asymptotes, and cutting FD produced in *r*. Then the ordinates V*m*, D*r*, are inversely proportional to CV, CD, or V*m* : D*r* = CD : CV, = CI : CV. But because the momentary sectors VC*k* and ICK are equal, *kn* : KN = CI : CV. Therefore,

$$\mathrm{V}m : \mathrm{D}r = kn : \mathrm{KN};$$

$$\text{but } \mathrm{V}v : \mathrm{V}m = \mathrm{V}k : kn,$$

$$\text{and } \mathrm{I}i \text{ (or } \mathrm{D}f) : \mathrm{V}v = \mathrm{IK} : \mathrm{V}k,$$

$$\text{therefore } \mathrm{I}i : \mathrm{D}r = \mathrm{IK} : \mathrm{KN};$$

$$\text{but } \mathrm{I}i : i\mathrm{O} = \mathrm{IK} : \mathrm{KN}, \text{ by sim. triang.}$$

$$\text{therefore } \mathrm{D}r = i\mathrm{O}, \text{ and } i\mathrm{O} : \mathrm{V}m = \mathrm{VC} : \mathrm{CI}.$$

Also, by similarity of triangles, IO : *i*O = IN : KN, and 2IO : *i*O = 2IN : KN.

Now it was shown, that in order that the space D*ik*E may be equal to the space ICK, we must have

$$2\mathrm{IN} : \mathrm{KN} = \mathrm{IC} : \mathrm{D}i,$$

$$\text{or } 2\mathrm{IO} : i\mathrm{O} = \mathrm{IC} : \mathrm{D}i;$$

$$\text{but } i\mathrm{O} : \mathrm{V}m = \mathrm{VC} : \mathrm{IC},$$

$$\text{therefore } 2\mathrm{IO} : \mathrm{V}m = \mathrm{VC} : \mathrm{D}i,$$

$$\text{and } \mathrm{D}i = \frac{\mathrm{VC} \times \mathrm{V}m}{2\mathrm{IO}}.$$

Having obtained D*i*, we easily get D*x*; for the ultimate ratio of ICK to XCY is that of IC^2 to VC^2. Therefore make

$$\mathrm{IC}^2 : \mathrm{VC}^2 = \mathrm{D}i : \mathrm{D}x.$$

Thus are the points of the two subsidiary curves *aik*, *axy*, determined.

The rectangle VC × V*m* is a constant magnitude, and is given because VC is given, and V*m* is the given velocity V*l*, diminished in the ratio of radius to the sine of the given angle CVQ.

But the line 2IO is of variable magnitude; but it is also given by means of known quantities. IO^2 is $= \mathrm{I}i^2 - i\mathrm{O}^2$, $= \mathrm{D}f^2 - \mathrm{D}r^2$, and $\mathrm{IO} = \sqrt{\mathrm{D}f^2 - \mathrm{D}r^2}$. Moreover, $\mathrm{D}f^2 = \mathrm{ABFD}$, and $\mathrm{D}r^2 = \frac{\mathrm{VC}^2 \times \mathrm{V}m^2}{\mathrm{IC}^2}$. Therefore $2\mathrm{IO} = 2\sqrt{\mathrm{ABFD} - \frac{\mathrm{VC}^2 \times \mathrm{V}m^2}{\mathrm{IC}^2}}$, expressed in known quantities, because ABFD is known from the nature of the centripetal force.

Let the indeterminate distance CI or CD be $= x$, and let the ordinate DF, expressing the force, be *y*. Let VC be *a*, and V*m* be *c*, and let *ab* be a rectangle equal to the whole area of the exponent of force lying between the ordinate AB and the ordinate CZ, so that $ba - \int y dx$ may represent the indeterminate area ABFD.

$$\text{We have } \mathrm{D}i = \frac{ac}{2\sqrt{ab - \int y dx - \frac{a^2 c^2}{x^2}}}$$

$$\text{and } \mathrm{D}x = \frac{a^3 c}{2x^2\sqrt{ab - \int y dx - \frac{a^2 c^2}{x^2}}}.$$

Remark.—We have hitherto supposed that the velocity of projection is acquired by acceleration along AV. But this was merely for greater simplicity of argument, and that the final values of D*i* and D*x* might be easier conceived. In whatever way the velocity is acquired, it will still be true, that when in any point V we make V*l* to V*m* as the momentary increment V*k* of the arch is to the perpendicular *kn* on the radius vector, we shall have in every other point, such as I, the line D*f* to the line D*r* as the increment IK of the arch to KN. And in the final equation D*f* will still be expressed by $\sqrt{ab - \int y dx}$.

126. *Cor.* 1. The angle which the path of the projectile makes with the radius vector is determined by this solution; for I*i* is to *i*O as radius to the sine of this angle; which sine is therefore $= \frac{ac}{x\sqrt{ab - \int y dx}}$.

Apsides determined;

127. *Cor.* 2. When the magnitude $\frac{ac}{x}$ is equal to $\sqrt{ab - \int y dx}$, the path is perpendicular to the radius vec-

tor, and the body is at one of the apsides of its orbit, and begins to recede from the centre after having approached to it, or begins to approach after having receded.

and curvature.

128. *Cor.* 3. The curvature of the orbit VIK is also determined in every point; for the curvature of any line is inversely as the radius of the equicurve circle, and this is to the chord which passes through C as radius to the sine of the angle CI*i*. Because the velocity in any point I is $= \sqrt{\text{ABFD}}$, and is equal to what the centripetal force at I would produce, by impelling the body along one fourth of the deflective chord of the equicurve circle, we have this chord $= 4\,\frac{\text{ABFD}}{\text{DF}}$. Or we obtain it by taking a third proportional to the momentary deflection and the momentary arch of the curve, or by other processes of the higher geometry, all proceeding on the quantities furnished in this investigation.

Newton the inventor.

129. Such is the solution of this celebrated problem given by Sir Isaac Newton, who may justly be called the inventor of the science of which it is the chief result, as well as of the geometry by help of which it is prosecuted. For we cannot give this glory to Galileo; for his simple problem of the motion of bodies affected by uniform and parallel gravity, however just and elegant his solution may be, was peculiar; and the same must be said of Mr Huygens's doctrine of centrifugal forces. Besides, these theorems had been investigated by Newton several years before, *suâ mathesi facem preferente*, as corollaries which he could not pass unnoticed, from his general method. This is proved by letters from Huygens. Newton's investigation is extremely but elegantly concise, and is one of the best exertions of his sagacious mind.

History of this problem.

130. Whether we consider this problem as a piece of mere mathematical speculation, or attend to its consequences, which include the whole of the celestial motions in all their extent and complication, we must allow it to be highly interesting, and likely to have engaged much attention in the period of ardent inquiry which closed the last century. Accordingly, it was no sooner known, by the publication of the *Mathematical Principles of Natural Philosophy* in 1686, than it occupied the talents of the most eminent mathematicians; and many solutions were published, some of which differ considerably from Newton's, and some are more expeditious, and better fitted for computation. Of these, the most remarkable for originality and ingenuity are those of De Moivre, Hermann, Keill, and Stewart. The last differs most from the methods pursued by others. M'Laurin's propositions on this subject, and in that part of his fluxions which treats of curvature, are highly valuable, classing the chief affections of curvilineal motions geometrically, as they are suggested by the fluxionary method; and then showing, in a very instructive manner, the connection between these mathematical affections of motion and the powers of nature which produce them. This part of his excellent work is a fine example of the real nature of all inquiries in dynamics, showing that it differs from geometry little more than in the language, in which the word *force* is substituted for *acceleration*, *retardation*, or *deflection*. We recommend the careful perusal of these propositions to all who wish to have clear conceptions of the subject. Dr John Keill and Dr Horsley (bishop of Rochester) have given particular treatises on the motions of bodies deflected by centripetal forces inversely proportional to the cubes of the distances; induced by the singular motions which result from this law of action, and the multitude of beautiful propositions which they suggest to the mathematician. Newton, indeed, first perceived both of these peculiarities, and has begun this branch of the general problem. He first demonstrated the description of the logarithmic and hyperbolic spirals, and indicated a variety of curious recurring elliptical spirals, which would be described by means of this force, showing that they are all susceptible of accurate quadrature. Several of those authors affect to consider their solutions as more perfect than Newton's, and as more immediately indicating the remarkable properties of such motions; and also affect to have deduced them from different and original principles. But we cannot help saying that their claims to superiority are very ill founded; there is not a principle made use of in their solutions which was not pointed out by Newton, and employed by him. The appearance of originality arises from their having taken a more particular concern in some general property of curvilineal motions, such as the curvature, the centrifugal force, &c. and the making that the leading step of their process. But Newton's is still the best, because it is strictly elementary, aiming at the two leading circumstances, the motion to or from the centre, and the motion of revolution round that centre. To these two purposes he adapted his two subsidiary curves.

Singul boast John noulli.

131. Is it not surprising, that, twenty-five years after the publication of Newton's *Principia*, a mathematician on the Continent should publish a solution in the Memoirs of the French Academy, and boast that he had given the first demonstration of it? Yet John Bernoulli did this in 1710 Is it not more remarkable that this should be precisely the solution given by Newton, beginning from the same theorem, the 40th I. *Prin.* following Newton in every step, and using the same subsidiary lines? Yet so it is. Bernoulli actually reduces the whole to two functions, namely,

$$\frac{ac}{\sqrt{ab - \int \varphi dx - \frac{a^2c^2}{x^2}}} \text{ and } \frac{a^2c}{\sqrt{abx^4 - x^4\int \varphi dx - a^2c^2x^2}};$$

which last is plainly the same with Newton's

$$\frac{\text{Q} \times \text{CX}^2}{\text{A}^2\sqrt{\text{ABDF} - \text{Z}}};$$

because Newton's $\frac{\text{Q}}{\text{A}}$ is the same with $\frac{ac}{x}$, and Newton's $\text{A}^2\sqrt{\text{ABFD} - \text{Z}^2}$ is the same with

$$x^2\sqrt{ab - \int \varphi dx - \frac{a^2c^2}{x^2}},$$

which Bernoulli has changed into

$$\sqrt{abx^4 - x^4\int \varphi dx - a^2c^2x^2}.$$

Bernoulli's chief boast in this dissertation is, that *now* philosophers may be assured that the planets will always describe conic sections; a truth of which they had not as yet received any proof; because, says he, Newton's argument for it in the corollary of the 13th proposition is inconclusive, and because he had not been able to accommodate his demonstration of the 41st and 42d propositions to the particular case of the planetary gravitation. Newton's demonstration in the corollary of the 13th proposition is just founded on the principle on which the very demonstration of the 42d, adopted by Bernoulli, proceeds, and without which that demonstration is of no force; namely, that a body, in given circumstances of situation, velocity, direction, and centripetal force, can describe no other figure than what it really describes. Newton did not accommodate the demonstration of the 42d proposition to the planetary motions, because he had already demonstrated the nature of their orbits; but mentions the case of a force proportional to the reciprocal of the cubes of their distance, not as a deduction from the 42d, but because it *was not* a deduction from it, and admitted a very singular and beautiful investigation by methods totally and essentially different.

Co lusion.

132. It cannot be expected that, in the narrow limits prescribed to a work like ours, we can proceed to consider the various departments of this celebrated problem. We are only giving the outlines of the general doctrines of dynamics; and we have bestowed more time on those which are purely elementary than some readers may think they deserve. We were anxious to give just conceptions of the fundamental principles of dynamics; because we know that nothing else can entitle it to the name of a demonstrative science, and because we see much indistinctness and uncertainty, and a general vagueness or want of precision, in several elementary works which are put into the hands of persons entering on the study. This leads to errors of more consequence than a person is apt to think; because they affect our leading thoughts of mechanism itself, and our notions of the intimate nature of the visible universe.

U versal re ction is a v of the m erial w d.

133. But we must conclude the article with this great problem. Many very general doctrines of dynamics remain untouched; all, namely, that relate to the rotative motion of rigid bodies, and all that relate to the mutual action of bodics on each other in the way of impulse.

Notwithstanding these great omissions, we must observe that no new principle remains to be considered. We have given all that are necessary; and there is no question that occurs in the cases omitted which cannot be completely answered by means of the propositions already established. We have taught how to discover the existence and agency of a mechanical force, to measure and characterize it, and then to state what will be its various effects, according to the circumstances of the case.

134. Proceeding by these principles, men have discovered an universal fact, that every *action* of one body on another is accompanied by an equal *re-action* of that other on the first in the opposite direction; that is, to express it in the language of dynamics, "all the phenomena which make us infer that the body A possesses a force by which it changes the motion of the body B, show, at the same time, that B possesses a force by which it makes an equal and opposite alteration in the motion of A." This, however, is not a doctrine of abstract dynamics; it docs not flow from our idea of force; therefore it was not included in our list of the *laws of motion.* It is a part of the mechanical history of nature, just as the law of universal gravitation is; and it might be called the law of *universal re-action.* Sir Isaac Newton has, in our humble apprehension, deviated from his accustomed logical accuracy, when he admits, as a third *axiom* or law of motion, that re-action is always equal and contrary to action. It is a physical law, in as far as it is *observed* to obtain through the whole extent of the solar system. But Newton himself did not, in the subsequent part of his noble work, treat it as a logical axiom; that is, as a law of human thought with respect to motion; for he labours with much solicitude, and with equal sagacity, to prove, by *fact and observation,* that it really obtains through the whole extent of the solar system; and it is in this discovery that his chief claim to unequalled penetration and discernment appears.

pulsion lained t,

135. Availing ourselves of this fact, we, with very little trouble, state all the laws of impulsion. The body A, for example, moving to the westward at the rate of eight feet per minute, overtakes the double body B, moving at the rate of four feet per minute. What must be the consequence of their impenetrability, and of the equality and contrariety of action and re-action? Their motions must be such that both sustain equal and opposite changes. They must give, in some way or other, *this* indication of possessing equal and opposite forces. This will be the case if, when the changes are completed, A and B move on in contact at the rate of four feet per minute; for here A has produced in each half of B a change of motion two, and therefore a totality of change equal to four. This is the effect, the mark, the measure of the *impulsive* force of A; for it is the whole *impulsion.* B has produced in A a change of motion four, equal to the former, and in the opposite direction. This is the effect, mark, and measure of the *repulsive* force of A; for it is the whole *repulsion.* And this is all that we observe in the collision of two lumps of clay; and the observation is one of the facts on which the reality of the physical law of equal action and re-action is founded; and we can make no further inference from *this* fact.

Conclusion.

But the event might have been very different. A and B may be two magnets floating on corks on water, with their north poles fronting each other. We know, by other means, that they really possess forces by which they equally repel each other. The dynamical principles already established tell us also what must happen in this case. That both conditions of equal re-action and sensible repulsion may be fulfilled, A must come to rest, and B must move forward at the rate of four feet per minute. The same thing must happen in the meeting of perfectly elastic bodies, such as billiard balls. If elasticities are known to be imperfect in any degree, our dynamical principles will still state the effect of their collision in conformity to the law of equal reaction.

and rotation.

136. In like manner, all the motions of rotation are explained or predicted by means of the same principles of dynamics applied to the force of cohesion. This is considered as a moving force, because, when the attraction of a magnet acts on a bit of iron attached to one end of a long lath floating on water, the whole lath is moved, although the magnet does not act on it at all; some other force acts on it; it is its cohesion, which is therefore a moving force, and the subject of dynamical discussion.

137. And thus it appears that these subjects do not come necessarily, nor perhaps with scientific propriety, under the category of dynamics, but are parts of the mechanical history of nature. Yet, did a work like ours give room in this place, the study of mechanical nature might be considerably improved, by giving a system of such *general* doctrines as involve no other notions but those of force and its measures, and the hypothesis of equal re-action. Some very general, nay universal, consequences of this combination might be established, which would greatly assist the mechanician in the solution of difficult and complicated problems. Such is the proposition, that *the mutual actions of bodies depend on their relative motions only, and require no knowledge of their real motions.* This principle simplifies in a wonderful manner the most difficult and the most frequent cases of action which nature presents to our view; but at the same time gives a severe blow to human vanity, by forcing us to acknowledge that we know nothing of the real motion of any thing in the universe, and never shall know any thing of it, till our intellectual constitution, or our opportunities of observation, are completely changed.

138. M. d'Alembert had made this principle still more serviceable for extricating ourselves from the immense complication of actions that occurs in all the spontaneous phenomena of nature, by presenting it to us in a different form, which more distinctly expresses what may be called the *elements* of the actions of bodies on each other. His proposition is as follows (see his *Dynamique*, page 73):

D'Alembert's general principle of dynamics.

"In whatever manner a number of bodies change their motions, if we suppose that the motion which each body would have in the following moment, if it were perfectly free, is decomposed into two others, one of which is the motion which it really takes in consequence of their mutual actions, the other will be such, that if each body were impressed by this force alone (that is, by the force which would produce this motion), the whole system of bodies would be in equilibrio."

This is almost self-evident; for if these second constituent forces be not such as would put the system in equilibrio, the other constituent motions could not be those which the bodies really take by the mutual action, but would be changed by the first.

For example, let there be three bodies P, Q, R, and let the forces A, B, C, act on them, such as would give them the velocities p, q, r, in any directions whatever, producing the momenta, or quantities of motion, $P \times p$, $Q \times q$, $R \times r$, which we may call A, B, C, because they are the proper measures of the moving force. Let us moreover suppose, that, by striking each other, or by being any how connected with each other, they cannot take these motions, A, B, and C, but really take the motions a, b, and c. It is plain that we may conceive the motion A impressed on the body P, to be composed of the motion a, which it really takes, and of another motion α. In like manner, B may be resolved into b, which it takes, and another β; and C into c and $\varkappa$. The motions will be the same, whether we act on P with the force A, or with the two forces a and α; whether we act on Q with the force B, or with b and β; and on R with the force C, or with c and $\varkappa$. Now, by the supposition, the bodies actually take the motions a, b, and c; therefore the motions α, β, and $\varkappa$, must be such as will not derange the motions a, b, and c; that is to say, that if the bodies had only the motions α, β, and $\varkappa$, impressed on them, they would destroy each other, and the system would remain at rest.

M. d'Alembert has applied this proposition with great address and success to the very difficult questions that occur in the motions and actions of fluids, and many other most difficult problems, such as the precession of the equinoxes, &c. The cause of its utility is, that in most cases it is not difficult to find what forces will put a system in equilibrio; and, combining these with the known extraneous forces whose effects we are interested to discover, we obtain the motions which really follow the mutual action of the bodies.

This is not, properly speaking, a principle; it is a form in which a general fact may be conceived. In the same way the celebrated mathematician De la Grange observed, that a system of bodies, acting on each other in any way, is in equilibrio, if there be impressed on its parts forces in the inverse proportion of the velocities which each body takes in consequence of their action or connection; and he expresses this universal fact by a very simple formula; and, calling this also a principle, he solves every question with ease and neatness, by reducing it to the investigation of those velocities. In this way he has written a complete system of dynamics, to which he gives the title of *Méchanique Analytique*, full of the most ingenious and elegant solutions of very interesting and difficult problems; and all this without drawing a line or figure, but accomplishing the whole by algebraic operations.

But this is not teaching mechanical philosophy; it is merely employing the reader in algebraic operations, each of which he perfectly understands in its quality of an algebraic or arithmetical operation, and where he may have the fullest conviction of the justness of his procedure. But all this may be (and, in the hands of an expert algebraist, it generally is), without any notions, distinct or indistinct, of the things or the process of reasoning that are represented by the symbols made use of. (B. B. B.)

DYNANOMETER, an instrument for ascertaining the relative strength of men and animals.* Of an instrument of this kind, invented by Regnier, and of which a description is given in the *Journal de l'Ecole Polytéchnique*, tom. ii. the author thus speaks: "Some important knowledge might be acquired, had we the easy means of ascertaining, in a comparative manner, our relative strength at the different periods of life, and in different states of health. Buffon and Guéneau, who had some excellent ideas on this subject, requested me to endeavour to invent a portable machine, which, by an easy and simple mechanism, might conduct to a solution of this question, on which they were then engaged. These philosophers were acquainted with that invented by Graham, and improved by Dr Desaguliers, at London; but this machine, constructed of wooden work, was too bulky and heavy to be portable; and, besides, to make experiments on the different parts of the body, several machines were necessary, each suited to the part required to be tried. They were acquainted also with the dynanometer of citizen Leroy of the Academy of Sciences at Paris. It consisted of a metal tube ten or twelve inches in length, placed vertically on a foot like that of a candlestick, and containing in the inside a spiral spring, having above it a graduated shank terminating in a globe. This shank, together with the spring, sunk into the tube in proportion to the weight acting upon it, and thus pointed out, in degrees, the strength of the person who pressed on the ball with his hand.

"This instrument, though ingenious, did not appear sufficient, however, to Buffon and Guéneau; for they wished not merely to ascertain the muscular force of a finger or hand, but to estimate that of each limb separately, and of all the parts of the body. I shall not here give an account of the attempts I made to fulfil the wishes of these two philosophers, but only observe, that in the course of my experiments I had reason to be convinced that the construction of the instrument was not so easy as might have been expected. Besides the use which an enlightened naturalist may make of this machine, it may be possible to apply it to many other purposes. For example, it may be employed with advantage to determine the strength of draught cattle; and, above all, to try that of horses, and compare it with the strength of other animals. It may serve to make known how far the assistance of well-constructed wheels may favour the movement of a carriage, and what is its *vis inertiæ* in proportion to the load. We might appreciate by it, also, what resistance the slope of a mountain opposes to a carriage, and be able to judge whether a carriage is sufficiently loaded in proportion to the number of horses that are to be yoked to it. In the arts, it may be applied to machines of which we wish to ascertain the resistance, and when we are desirous to calculate the moving force that ought to be adapted to them. It may serve, also, as a Roman balance to weigh burdens. In short, nothing would be more easy than to convert it into an anemometer, to discover the absolute force of the wind, by fitting to it a frame of a determined size filled up with wax cloth; and it would not be impossible to ascertain by this machine the recoil of fire-arms, and consequently the strength of gunpowder.

"This dynanometer, in its form and size, has a near resemblance to a common graphometer. It consists of a spring twelve inches in length, bent into the form of an ellipsis; from the middle of which arises a semicircular piece of brass, having engraved upon it the different degrees that express a force of the power acting on the spring. The whole of this machine, which weighs only two pounds and a half, opposes, however, more resistance

nasty
||
E.

Dyscrasy
||
Eadmerus.

than may be necessary to determine the action of the strongest and most robust horse."

DYNASTY, among ancient historians, signifies a race or succession of kings of the same family or line. Such were the dynasties of Egypt. The word is formed from the Greek δυναστεια, of δυνατεω, *to be powerful.*

DYSÆ, in *Mythology*, inferior goddesses among the Saxons, being the messengers of the great Odin, whose province it was to convey the souls of such as died in battle to his abode, called *Valhalla* or the hall of slaughter, where they were to drink, with him and their other gods, *cerevisia*, a kind of malt liquor, in the skulls of their enemies. The *Dysæ* conveyed those who died a natural death to *Hela*, the goddess of hell, where they were tormented with hunger, thirst, and every kind of evil.

DYSART, a royal burgh of Scotland, in the county of Fife, is situated on the coast of the Frith of Forth, about a mile to the eastward of Kirkaldy. It consists of three narrow streets, with a species of square in the centre. In the principal street there are a number of antique houses, the fronts of which are generally decorated with inscriptions and dates. Formerly this town enjoyed a considerable trade, and on this account was ennobled with the popular name of "Little Holland." The state of trade now, however, is far from corresponding with that ambitious title. The principal article manufactured is salt, which, together with coal, is exported in quantities. The weaving of checks, ticks, and similar fabrics, is also carried on, and affords employment to a number of the inhabitants. The harbour of the town is tolerably good. Dysart was erected into a royal burgh in the beginning of the sixteenth century, and is at present governed by two bailies, a treasurer, and twenty-two councillors. Besides the parish church, there is a congregation connected with the Relief body. The town possesses a news-room and a mechanics' institution. The population of the burgh and parish amounted in 1821 to 6529, and in 1831 to 7104.

DYSCRASY, among physicians, denotes an ill habit or state of the humours, as in the scurvy, jaundice, and other diseases.

DYSENTERY, in *Medicine*, a diarrhœa or flux, wherein the stools are mixed with blood, and the bowels miserably tormented with gripes. See MEDICINE.

DYSOREXY, among physicians, denotes a want of appetite, proceeding from a weakly stomach.

DYSPEPSY, a difficulty of digestion.

DYSPNŒA, a difficulty of breathing, usually called *asthma.*

DYVOUR, in *Scotch Law*, otherwise *Bare-man*, a person who, being involved in debt, and unable to pay the same, makes cession of his effects in favour of his creditors. The word is used in the same sense as BANKRUPT.

E.

E, the second vowel, and fifth letter of the alphabet. This letter is most probably derived from the old character in the ancient Hebrew and Phœnician alphabets, reversed by the Greeks to this position, E, not from the Hebrew ה, as some have supposed. From the same origin is also derived the Saxon *e*, which is the first letter in their alphabet that differs from the Latin one. It is formed by a narrower opening of the larynx than the letter A; but the other parts of the mouth are used nearly in the same manner as in that letter. E has a long and short sound in most languages. The short sound is audible in *bed, fret, den*, and other words ending in consonants; the long sound is produced by a final *e*, or an *e* at the end of words, as in *glebe, here, hire, scene, sphere, interfere, revere, sincere*, and the like, in most of which it sounds like *ee*. In some other cases, this letter, by coming after *i*, is long, as in *believe, chief, grief, reprieve;* and sometimes the long sound is expressed by *ee*, as in *bleed, beer, creed*, and so on. Sometimes the final *e* is silent, and only serves to lengthen the sound of the preceding vowel, as in *rag, rage, stag, stage, hug, huge.* The sound of *e*, however, is obscure in the following words: *oxen, heaven, bounden, fire, massacre, maugre*, and other words. The Greeks have their long and short *e*, which they call *epsilon* ε, and *êta* η. The French have several kinds of *e;* the Latins have likewise a long and short *e*. In some instances the latter also write *e* instead of *a*, as *dicem* for *dicam*; and this is no doubt the reason why *a* is so often changed into *e* in the preter-perfect tense, as *ago, egi; facio, feci*, and the like.

As a numeral, E stands for 250, according to the verse,

> E, quoque ducentos et quinquaginta tenebit.

In music it denotes the tone *e-la-me;* in the calendar it is the fifth of the dominical letters; and in sea charts it distinguishes all the easterly points. In ancient contractions and abbreviations E represents *Est, Ennius, Edilis;* EB, *Ejus Bona;* ED, *Ejus Domus;* EE, *Ejus Ætas;* EF, *Ejus Filius;* and so on.

EACHARD, JOHN, an English divine of great learning and wit in the seventeenth century, was bred at Cambridge, and was the author of *The Grounds and Occasions of the Contempt of the Clergy and Religion inquired into*, 1670. In 1675 he was chosen master of Catharine Hall upon the decease of Dr John Lightfoot; and the year following was created doctor in divinity by royal mandate. He died in 1697.

EACHARD, *Laurence*, an eminent English historian of the eighteenth century, was nearly related to Dr John Eachard. He was the son of a clergyman, who, by the death of his elder brother, became master of a good estate in Suffolk. He was educated in the university of Cambridge, entered into holy orders, and was presented to the living of Welton and Elkington in Lincolnshire, where he spent above twenty years of his life, and distinguished himself by his writings, especially his History of England, which was attacked by Dr Edmund Calamy and by Mr John Oldmixon. His *General Ecclesiastical History, from the Nativity of Christ to the first Establishment of Christianity by Human Laws under the Emperor Constantine the Great*, has passed through several editions. He was installed as archdeacon of Stowe and prebendary of Lincoln in 1712. He died in 1730.

EADMERUS, EADMER, or EDMER, an esteemed historian, was an Englishman by birth, but his parents, and the particular time and place of his nativity, are not known. He received a learned education, and early discovered a taste for history, by recording every remarkable event which came to his knowledge. Being a monk in the cathedral of Canterbury, he had the happiness to become the bosom friend and inseparable companion of two arch-

Eagle.

bishops of that see, St Anselm and his successor Ralph. To the former of these he was appointed spiritual director by the pope; and that prelate did nothing without his approbation. In the year 1120 he was sent for by King Alexander I. of Scotland, to be raised to the primacy of that kingdom; and having obtained leave of King Henry and the Archbishop of Canterbury, he departed for Scotland, where he was kindly received by the king, and on the third day after his arrival elected bishop of St Andrews; but on the day after his election a dispute unfortunately arose between the king and him, in a private conference about his consecration. Eadmerus having been a constant companion of two archbishops of Canterbury, was a violent stickler for the prerogatives of that see; and therefore told the king that he was determined to be consecrated by none but the Archbishop of Canterbury, whom he believed to be the primate of all Britain. Alexander, who was naturally a fierce prince, and supported the independence of his crown and kingdom with great spirit, was so much offended that he broke off the conference in a violent passion, declaring that the see of Canterbury had no pre-eminency over that of St Andrews. This breach between the king and the bishop-elect became daily wider, until at length Eadmerus, despairing of recovering the royal favour, sent his pastoral ring to the king; laid his pastoral staff upon the high altar, whence he had taken it; and abandoning his bishopric, returned to England. He was kindly received by the Archbishop and clergy of Canterbury, though they disapproved of his stiffness, and thought him too hasty in forsaking the honourable station to which he had been called. Nor was it long before Eadmerus became sensible of his error, and desirous of correcting it. With this view he wrote a long submissive letter to the king of Scotland, entreating his leave to return to the bishopric, and promising compliance with his royal pleasure in every thing respecting his consecration; which letter was accompanied by an epistle to the same purpose from the archbishop. These overtures, however, which were made in the year 1122, did not produce the desired effect. But Eadmerus is most worthy of the grateful remembrance of posterity for his historical works, particularly for his history of the affairs of England in his own time, from the year 1066 to the year 1122; a work in which he has inserted many original papers, and preserved many important facts which are nowhere else to be found. This work has been highly commended for its authenticity, as well as for regularity of composition and purity of style. It is indeed more free from legendary tales than any other work of this period; and it is impossible to peruse it with attention, without conceiving a favourable opinion of the learning, good sense, sincerity, and candour of its author.

EAGLE. See ORNITHOLOGY.

EAGLE, in *Heraldry*, is accounted one of the most noble bearings in armory, and, according to the learned in this science, ought to be given to none but such as greatly excel in the virtues of generosity and courage, or have rendered singular service to their sovereigns; in which case they may be allowed a whole eagle, or an eagle naissant, or only the head or such other parts as may be judged most agreeable to their exploits.

The eagle has been borne as an ensign or standard by several nations. The first who seem to have assumed the eagle were the Persians, according to the testimony of Xenophon; but subsequently it was adopted by the Romans, who, after a great variety of standards, at length fixed on the eagle, in the second year of the consulate of C. Marius, having till that period used indifferently wolves, leopards, and eagles, according to the humour of the commander. The Roman eagles, it must be observed, were not painted on a cloth or flag, but were figures in relief, formed of silver or gold, and borne on the tops of pikes; the wings being displayed, with frequently a thunderbolt in the talons. Under the eagle on the pike were piled bucklers, and sometimes crowns.

Constantine is said to have been the first who introduced the eagle with two heads, to intimate, that though the empire seemed divided, it had yet only one body. Others say that it was Charlemagne who resumed the eagle as the Roman ensign, and added to it a second head; but that opinion is destroyed by an eagle with two heads, observed by Lipsius on the column of Antoninus, as also by the eagle's having only one head on the seal of the golden bull of the Emperor Charles IV. The conjecture, therefore, of Menestrier appears more probable; namely, that the emperors of the East, when there were two on the throne at the same time, struck their coins with the impression of a cross with a double traverse, which each of them held in his hand, as being the symbols of the Christians; and that they did the like with the eagle in their ensigns, and instead of doubling, joined them together, representing them with two heads; a practice in which they were followed by the emperors of the West. But this conjecture of Menestrier is not confirmed by ancient coins, without which Papebroche inclines to think the use of the eagle with two heads to have been merely arbitrary, though he admits it to be probable that it was first introduced on occasion of there being two emperors on the same throne.

The eagle on medals is, according to Spanheim, a symbol of divinity and providence, and, according to all other antiquaries, of empire. The princes on whose medals it is most usually found are the Ptolemies, and the Seleucidæ of Syria. An eagle with the word *consecratio* expresses the apotheosis of an emperor.

EAGLE, in *Astronomy*, is a constellation of the northern hemisphere, having its right wing contiguous to the equinoctial. See AQUILA.

White EAGLE, is a Polish order of knighthood, instituted in 1325 by Vladislaus V. on marrying his son Casimir to a daughter of the grand duke of Lithuania. The knights of this order were distinguished by a gold chain which they wore on the stomach, and to which was suspended a silver eagle crowned.

Black EAGLE, a similar order instituted in 1701 by the elector of Brandenburg, on his being crowned king of Prussia. The knights of this order wore an orange-coloured ribbon, to which was suspended a black eagle.

EAGLE ISLAND, an island in the South Pacific Ocean, near the north-east coast of New Holland, between Lizard Island and Cape Flattery. Lat. 14. 32. S.

EAGLES, a name frequently found in the ancient histories of Ireland, and used to express a sort of base money which was current in that kingdom in the early part of the reign of Edward I. that is, about the year 1272. There were, besides the eagles, lionines, rosades, and many other coins of the same sort, named according to the figures they were impressed with.

The current coin of the kingdom at that time was a composition of copper and silver, in determinate proportions; but these were so much inferior to the standard proportion of that time, that they were not intrinsically worth half so much as the others. They were imported from France and other foreign countries. When Edward had been a few years established on the throne, he set up mints in Ireland for coining good money, and then decried the use of eagles, and other kinds of base coin, making it death, with confiscation of effects, to import any more of them into the kingdom.

EAGLET, a diminutive of eagle, properly signifying a young eagle. In heraldry, when there are several eagles on the same escutcheon, they are termed *eaglets*.

EALDERMAN, or Ealdorman, among the Saxons, was of the same import with earl among the Danes. The word was also used for an elder, senator, or statesman; and hence, at this day, we call those functionaries *aldermen* who are associates to the chief officer in the common council of a city or corporate town.

EALING, a town of the county of Middlesex, five miles and a half from London, divided into two parts, distinguished by the names of East and West Ealing. It is in the hundred of Ossulston, and the parish includes the town of Old Brentford. It contains a handsome modern church, and several chapels for separatists, with some elegant villas. The population amounted in 1801 to 5035, in 1811 to 5361, in 1821 to 6608, and in 1831 to 7783.

EAR. (See Anatomy.) The ear has its beauties, which a good painter ought by no means to disregard; and where it is well formed it would be an injury to the head were it hidden. Suetonius insists particularly on the beauty of Augustus's ears; and Ælian, describing the beauties of Aspasia, observes that she had short ears. Martial also ranks large ears amongst the number of deformities. Amongst the Athenians it was a mark of nobility to have the ears bored or perforated; but amongst the Hebrews and Romans this was a type of servitude.

Ear, in *Music*, denotes a kind of internal sense, by which we perceive and judge of harmony and musical sounds. In music we seem universally to acknowledge something like a sense distinct from the external one of hearing, and call it a *good ear;* and a similar distinction we should probably acknowledge in other affairs, if we had distinct names by which to denote these powers of perception. Thus a greater capacity of perceiving the beauties of painting, sculpture, and architecture, is called a *fine taste.*

EARING, in nautical language, is that part of the bolt rope which at the four corners of the sail is left open, in the shape of a ring. The two uppermost parts are put over the ends of the yard-arms, and so the sail is made fast to the yard; and into the lowermost earings the sheets and tacks are seized or bent at the clew.

EARL, a British title of nobility, next below a marquis, and above a viscount. The title is so ancient, that its origin cannot now be clearly traced out. It seems tolerably certain, however, that amongst the Saxons they were called *ealdormen*, elder men, a word of the same signification with *senior* or *senator* among the Romans; and also *schiremen*, because they had each of them the civil government of a civil division or shire. On the irruption of the Danes they changed their names to *eorels*, which, according to Camden, had the same signification in their language. In Latin they are called *comites*, a title first used in the empire, from being the king's attendants; *a societate nomen sumpserunt, reges enim tales sibi associant.* After the Norman conquest they were for some time called *counts*, from the French; but they did not long retain that name themselves, though their shires are thence denominated *counties* to this day. It is now become a mere title, the holders of which have nothing to do with the government of the county, that being now entirely devolved on the sheriff, the earl's deputy or *vicecomes.* In writs, commissions, and other formal instruments, the king, when he mentions any peer of the degree of an earl, usually styles him trusty and well-beloved cousin; an appellation as ancient as the reign of Henry IV., who being, either by his wife, his mother, or his sisters, actually related or allied to every earl in the kingdom, artfully and constantly acknowledged that connection in all his letters and other public acts; whence the usage descended to his successors, though the reason has long ago failed.

EARNEST (Arrhæ), money advanced in order to bind the parties to the performance of a verbal bargain. By the civil law, he who recedes from his bargain loses his earnest, and if the person who received the earnest give back, he must return the earnest double. But with us, the person who gives it is in strictness obliged to abide by his bargain; and in case he decline it, he is not discharged upon forfeiting his earnest, but may be sued for the whole money stipulated.

EARTH, amongst ancient philosophers, one of the four elements of which the whole system of nature was believed to be composed.

Earth, in *Astronomy* and *Geography*, one of the primary planets, being the terraqueous globe which we inhabit. (See the articles Figure of the Earth, and Geology.)

EARTHS, in *Chemistry*. These bodies will be found described in the article Chemistry, under the heads *Alkaline Bases* and *Earthy Bases.*

EASEL Pieces, among painters, such small pieces, whether portraits or landscapes, as are painted on the easel, or frame whereon the canvass is laid. They are thus denominated in order to distinguish them from larger pictures drawn on walls, ceilings, and the like.

EASING, in the sea language, signifies the slackening of a rope or the like. Thus, to ease the bow line, or sheet, is to let them go slacker; to ease the helm, is to let the ship go more large, more before the wind, or more larboard.

EASINGWOLD, a market-town in the north riding of the county of York, 208 miles from London and 11 from York. It is in the wapentake of Bulmer. It has a market on Friday, where much butter and bacon, cured in the neighbourhood, are disposed of for distant places. The population amounted in 1801 to 1467, in 1811 to 1576, in 1821 to 1912, and in 1831 to 2381.

EAST, one of the four cardinal points of the world, being that point of the horizon where the sun is seen to rise when in the equinoctial. The word *east* is Saxon. In Italy, and throughout the Mediterranean, the east wind is called the *levante;* in Greek, ανατολη and απηλιωτης, because it comes from the side of the rising sun, απ' ἡλιου, in Latin *Eurus.*

EASTBOURNE, a town on the coast of Sussex, in the hundred of that name, within the rape of Pavensey. It is 63 miles from London, and is one of those places which, from the prevalence of sea-bathing, has within the last fifty years been raised from a fishing village to be a large and populous town. It is situated in a chasm between two cliffs, through which runs a small stream. One of these, Beachy Head, is the loftiest headland on the English Channel. It consists of three distinct parts, each near half a mile from the other. The resident population amounted in 1801 to 1668, in 1811 to 1806, in 1821 to 2607, and in 1831 to 2726; but the visitors are said to be much more numerous during the bathing season.

EAST Island, a small island in the Eastern Seas, near the coast of Patawan. Long. 118. 36. E. Lat. 8. 40. N. Also a small island on the east coast of Borneo. Long. 109. 38. E. Lat. 2. 40. N. Likewise an island in the South Pacific Ocean, on the coast of New Zealand, near Cape East.

EASTER, a festival of the Christian church, observed in memory of our Saviour's resurrection. The Greeks call it *pasga*, the Latins *pascha*, from a Hebrew word signifying *passage*, applied to the Jewish feast of the passover. It is called *Easter* in English, from the goddess Eostre, who was worshipped by the Saxons with peculiar ceremonies in the month of April. The Asiatic churches kept their Easter upon the very same day on which the Jews observed their passover, and others on the first Sunday after the first full moon in the new year. This controversy was determined in the council of Nice, when it was ordained that Easter should be kept upon one and the same day, which should always be a Sunday, in all Christian churches in the world.

Easter Island, an island in the South Sea, lying in Long. 109. 46. W. Lat. 27. 5. N. See the article Polynesia.

EASTON, a post-town and burgh of Pennsylvania, and capital of the county of Northampton, United States. It is situated on the Delaware, at the junction of the Lehigh River and Canal, and also near the western end of the Morris Canal, which connects it with New York. It is regularly laid out, handsomely built, and possesses a considerable trade. In the vicinity of this place there are several valuable mills. The situation of the town is low, and it is surrounded by considerable eminences. Here there is a bridge across the Delaware, 570 feet in length. The population in 1820 amounted to 2370, and has since increased. It is distant 60 miles north of Philadelphia, and 73 west of New York.

EASTPORT, a post-town and sea-port of Maine, in the county of Washington, situated at the most eastern limit of the United States, on Morse Island, in Passamaquoddy Bay. It is a flourishing commercial place, and is very well situated for trade, having ample facilities for communication with the interior, by means of two rivers which flow into the bay. Its harbour is very capacious, and of safe entrance, and is considered as one of the best in the United States. About 1500 tons of shipping belong to it. The exports consist of lumber, and provisions of various kinds. The population in 1820 amounted to 1937. Long. 66. 56. W. Lat. 44. 54. N.

EAUZE, an ancient city of the department of Gers, in France, said to have been taken by the Saracens in 722. It is situated on the river Selise, was formerly called Elusa, and is the chief place in Aquitain. It now contains 3220 inhabitants. Long. 0. 3. W. Lat. 43. 56. N.

EAVES, in *Architecture*, the margin or edge of the roof of a house, being the lowest tiles, slates, or the like, which hang over the walls, in order to throw off water to a distance from the foundations.

Eaves-Droppers, are such persons as stand under the eaves or walls and windows of a house, by night or by day, to hearken after news, and carry it to others, and thereby cause strife and contention in the neighbourhood. They are called by the *Stat. of West.* i. c. 33, *evil members of the commonwealth.*

EBDOMARIUS, or Hebdomarius, in ecclesiastical writings, an officer formerly appointed weekly to superintend the performance of divine service in cathedrals, and prescribe the duties of each person attending in the choir, as to reading, singing, praying, and the like. For this purpose the hebdomary, at the beginning of his week, drew up in form a bill or writing of the respective persons, and their several offices, called *tabula*, and the persons there entered were styled *intabulati.*

EBDOME, Εβδομη, in *Antiquity*, a festival kept on the seventh of every lunar month, in honour of Apollo, to whom all seventh days were sacred, because one of them was his birth-day; and hence he was sometimes called *Ebdomagenes.*

EBERBACH, a bailiwick in the circle of the Neckar, in the duchy of Baden, in Germany, comprehending one city and nineteen villages, with 7890 inhabitants. The capital, of the same name, is situated on the Neckar, and has 2843 inhabitants.

EBERHARD, John Augustus, an eminent German theologian and philosopher, was born at Halberstadt, in Lower Saxony, on the 31st of August 1739. His father was the singing-master at the church of St Martin's in that town, and also teacher of the school of the same name; a man, it is said, of a lively disposition, and considerable literary attainments. Young Eberhard was educated partly at home and partly in the school above mentioned. In the seventh year of his age he repaired to the University of Halle, with the view of prosecuting his theological studies. Towards the end of the year 1759 he returned to his native town, and became tutor to the eldest son of the Baron Von der Horst, to whose family he attached himself for a number of years. In the year 1763 he was appointed con-rector of the school of St Martin's, and second preacher in the Hospital Church of the Holy Ghost; but he soon afterwards resigned these offices, and followed his patron to Berlin.

The advantages he enjoyed, in this family, of being introduced into the best company, tended to polish his manners, and to form, even at an early period, a style of writing which served as a model to many of his contemporaries. His residence at Berlin gave him an opportunity of extending his knowledge, and of cultivating the acquaintance of some of the most eminent literary characters in Germany. Amongst these were Nicholai and Mendelssohn, with whom he associated upon terms of intimate friendship.

In the year 1768 he accepted the situation of preacher or chaplain to the work-house at Berlin, along with that of preacher in the neighbouring fishing village of Stralow. The income from these livings was small; but his object was to continue at Berlin, and he had at the same time the promise of further preferment upon the first vacancy. He now applied, with renewed ardour, to the study of theology, philosophy, and history; and the first fruits of his talents and application soon appeared in his *New Apology of Socrates;* a work exhibiting such originality of thought and eloquence of style as at once established his character as a writer. This work was occasioned by an attack which was made on the sentiments contained in the fifteenth chapter of Marmontel's *Belisarius*, by one Peter Hofstede, a clergyman of Rotterdam, who, with a contemptible industry, raked up the vices of the most celebrated characters in the pagan world, and even went so far as to maintain that the most virtuous amongst the heathen were no fit objects of divine mercy. He seemed particularly desirous to blacken the character of Socrates; and from this circumstance Eberhard was induced to give to his work the title which we have mentioned above. The greater part of it is occupied with an investigation of some of those peculiar doctrines which have been admitted as dogmas of the Christian church, upon the authority of some of the early fathers; and an examination of those texts of Scripture upon which they are founded. The *Apology* itself, which constitutes but a small part of the book, is esteemed a masterpiece of clear, dignified, and persuasive eloquence. The whole work exhibits much reading and philosophical reflection; but the liberality of his reasoning gave great offence to many of the strictly orthodox divines of his time, and is believed to have obstructed his preferment in the church.

In the year 1774 he was appointed to the living of Charlottenburg; and he employed the leisure he had in this situation in publishing a second volume of his *Apology;* in which he not only endeavours to obviate some objections which were taken to the former part, but continues his inquiries into the doctrines of the Christian religion, religious toleration, and the proper rules for interpreting the Scriptures. Perceiving that his further promotion in the church would be attended with difficulty, he resolved, although reluctantly, to accept the situation of professor of philosophy at the University of Halle, which became vacant in 1778, by the death of G. F. Moier. But however excellent as a writer, and however just his ideas upon philosophical subjects, he does not appear to have been peculiarly qualified to excel as a teacher. He was highly esteemed, indeed, both by professors and students; but his lectures, although they attracted at first a considerable concourse, never acquired any degree of popularity. He continued, however, to lecture very regularly; and published several manuals for the use of his pupils.

On his arrival at Halle, the philosophical faculty presented him with a diploma as doctor in philosophy and master of arts. In 1786 he was admitted a member of the Berlin Academy of Sciences; and in 1805 the king of Prussia conferred upon him the honorary title of a privy councillor. In 1808 he obtained the degree of doctor in divinity, which was given him as a reward for his theological writings. He married in 1778, but had no children. He died on the 6th of January 1809, being then in the seventieth year of his age.

Eberhard's attainments in philosophy and literature were extensive and profound. He was master of the learned languages, spoke and wrote French with facility and correctness, and understood English, Italian, and Dutch. He had read a great deal, was thoroughly versed in the philosophical sciences, and possessed a just and discriminating taste for the fine arts. He was a great lover of music, and was himself a proficient in that science. His manners were mild and unassuming; and his amiable and cheerful disposition, no less than his talents and virtues, endeared him to a numerous circle of friends.

The following is a list of his works:

Neue Apologie des Socrates, &c. 2 vols. 8vo. The first volume was published in 1772, the second in 1778; both have been since republished.

Allgemeine Theorie des Denkens und Empfindens, &c. Berlin, 1776, 8vo. This essay obtained the prize assigned by the Royal Society of Berlin for that year. A new edition appeared in 1786.

Von dem Begriff der Philosophie und ihren Theilen, Berlin, 1778, 8vo. A short essay, in which he announced the plan of his lectures on being appointed to the professorship at Halle.

Lobschrift auf Herrn Johann Thunmann, Prof. der Weltweisheit und Beredsamkeit auf der Universität zu Halle. Halle, 1779, 8vo.

Amyntor, eine Geschichte in Briefen. Berlin, 1782, 8vo. This work was written with the view of counteracting the influence of those sceptical and Epicurean principles in religion and morals which were then so prevalent in France, and thence rapidly spreading amongst the higher ranks in Germany. It is composed with great elegance and perspicuity, and exhibits much philosophical reflection, and knowledge of the world. The story is simple, and seems to have been merely intended as a vehicle for the sentiments.

Ueber die Zeichen der Aufklärung einer nation, &c. Halle, 1783, 8vo. A lecture delivered at Halle, in presence of his Serene Highness the reigning Duke of Wurtemberg.

Theorie der Schönen Kunste und Wissenschaften, &c. Halle, 1783, 8vo. 3d ed. 1790.

Vermischte Schriften. Halle, 1784.

Neue vermischte Schriften. Ib. 1786.

Allgemeine Geschichte der Philosophie, &c. Halle, 1788, 8vo; 2d ed. with a continuation and chronological tables, 1796. Eberhard published also an abridgment of this work in 1794.

Versuch einer Allgemeinen-Deutschen Synonymik, &c. Halle and Leipsic, 1795–1802, 6 vols. 8vo. This is esteemed a classical work on the Synonymes of the German Language. An abridgment of it was published by the author in one large volume 8vo. Halle, 1802.

Handbuch der Aesthetik, &c. Halle, 1803–1805, 4 vols. 8vo.

Besides the works above mentioned, Eberhard contributed a number of small tracts and essays to various periodical and scientific publications, and translated several foreign works. He was also the editor of the *Philosophical Magazine*, Halle, 1788–1792, and of the *Philosophical Archives*, Halle, 1793–1795. These two periodical works, which are now little read, were instituted for the purpose of controverting the metaphysical principles of Kant, and of vindicating the doctrines of Leibnitz and Wolf.

Frederick Nicolai published a Memoir on the life and character of Eberhard, Berlin and Stettin, 1810, 8vo. See also K. H. Jördens, *Lexicon Deutscher Dichter und Prosaisten;* and *Biographie Universelle.*

EBERMANSTADT, a bailiwick of the circle of the Upper Maine, in the kingdom of Bavaria, extending over ninety-two square miles, containing one city, two market-towns, and thirty-three villages, with 9690 inhabitants. The chief place is the town of that name, situated on the river Wiesent, with 650 inhabitants.

EBERN, a bailiwick of the circle of the Lower Maine, in the kingdom of Bavaria, extending over seventy-one square miles. It contains one city, one market-town, and 11,400 inhabitants. It is watered by the river Baunach, has excellent pasture, and moderate corn land. The capital, of the same name, contains 207 houses, and 1100 inhabitants employed in making glass and porcelain wares.

EBERSBACH, a town of the circle of Lausatia, in the kingdom of Saxony. It contains 700 houses and 5400 inhabitants, who have more than 1500 looms at work making linen.

EBERSBERG, a bailiwick in the circle of the Isar, of the kingdom of Bavaria, extending over 240 square miles. It contains three market-towns, 148 villages, and 3436 houses, with 16,187 inhabitants. The chief town is of the same name, and contains 176 houses and 940 inhabitants.

EBERSDORF, a market-town of the principality of Reuss of the Branch. It contains the prince's castle, and 1270 inhabitants, of whom about 400 are industrious Hernhutters or Moravians. It is the capital of a bailiwick of the same name, which comprehends one other town and fourteen villages. There is a town of the same name in Austria, but very small, and known as the lodging of Bonaparte the night before the battle of Aspern.

EBESFALVA, a city of the Austrian kingdom of Hungary, in the province of Magyaren and circle of Kohelburg. It is well built, and contains an Arminian, a Greek, and a Calvinist church, with 4200 inhabitants, employed in manufactures and trade. Long. 13. 30. 16. E. Lat. 46. 11. 48. N.

EBHER, a town of Persia, in the province of Irak, situated on a river of the same name, in a fertile country. It contains 1000, or, as some say, 2500 houses, and has mosques, caravanserais, bazars, and other public edifices. It is thirty miles west of Casbin.

EBINGEN, a city of the kingdom of Bavaria, in the province of the Black Forest and circle of Bahlingen. It stands on the river Schmeica, and contains 4350 inhabitants, the most industrious manufacturers of woollen goods, hosiery, hats, and leather of any in that kingdom. Most of the goods made by them are disposed of at the fairs of Frankfort and of Zurzach. Long. 10. 58. E. Lat. 48. 13. 40. N.

EBION, the author of the heresy of the Ebionites, was a disciple of Cerinthus, and successor to that person. He improved upon the errors of his master, and added to them new absurdities of his own. He began his preaching in Judea; and he taught in Asia, and even at Rome. His tenets infected the isle of Cyprus. St John opposed both Cerinthus and Ebion in Asia; and it is thought that this apostle wrote his gospel in the year 97 in order to overthrow this heresy.

EBIONITES, ancient heretics, who appeared in the church in the first ages, and formed themselves into a sect in the second century, denying the divinity of Jesus Christ.

Origen conceives them to have been so called from the Hebrew word *ebion*, signifying *poor*, because, according to him, they were poor in sense, and wanted understanding. Eusebius, with a view to the same etymology, is of opinion they were so called from having poor thoughts of Jesus Christ, by taking him for a mere man. But it is more probable the Jews gave this appellation to the Christians in general out of contempt; because in the first ages there were few except poor people who embraced the Christian religion. This opinion Origen himself seems to incline to in his book against Celsus, where he says that they called those among the Jews who believed that Jesus was truly the expected Messiah, Ebionites. It might even be urged, with some probability, that the primitive Christians assumed the name themselves, in conformity with their profession; and it is certain that they valued themselves on being poor, in imitation of the apostles. Epiphanius, however, is of opinion that there had been a man named Ebion, the chief and founder of the sect of Ebionites, and contemporary with the Nazarenes and Cerinthians; and he gives a long account of the origin of the Ebionites, stating that they arose after the destruction of Jerusalem, when the first Christians, called Nazarenes, went out in order to live at Pella.

The Ebionites were little else than a branch of Nazarenes, only that they altered and corrupted in many things the purity of the faith as held by the first adherents of Christianity. For this reason Origen, in his answer to Celsus, distinguishes two kinds of Ebionites; one of whom believed that Jesus Christ was born of a virgin, and the other that he was born after the manner of other men. The first were orthodox in every thing, except that to the Christian doctrine they joined the ceremonies of the Jewish law, together with the traditions of the Pharisees. They differed from the Nazarenes, however, in several things, particularly as to the authority of the sacred writings; for the Nazarenes received all as Scripture that was contained in the Jewish canon, whereas the Ebionites rejected the prophets, holding the very names of David, Solomon, Isaiah, Jeremiah, and Ezekiel in abhorrence, and also the Epistles of St Paul, whom they treated with the utmost disrespect. They received nothing of the Old Testament except the Pentateuch; a circumstance which indicates that they were descended rather from the Samaritans than from the Jews. They agreed with the Nazarenes in using the Hebrew gospel of St Matthew, otherwise called the Gospel of the Twelve Apostles; but they had corrupted their copy in many places, and, particularly, had left out the genealogy of our Saviour, which was preserved entire in that of the Nazarenes, and even in those used by the Cerinthians.

Some, however, have made this gospel canonical, and of greater value than our present Greek gospel of St Matthew. The Nazarenes, whose sentiments as to the birth of our Saviour were the same with those of the Ebionites, built their error on this very genealogy.

Besides the Hebrew gospel of St Matthew, the Ebionites had adopted several other books, under the names of St James, St John, and the other apostles; they also made use of the travels of St Peter, which are supposed to have been written by St Clement, but altered them so that scarcely any truth was left in them; and in order the better to authorize their own practices, they even made that saint tell a number of falsehoods. (See St Epiphanius, who is very diffusive on the ancient heresy of the Ebionites, *Hær.* 30. But his account deserves little credit, as, by his own confession, he has confounded the other sects with the Ebionites, and has charged them with errors to which the first adherents of this sect were utter strangers.)

EBONY, a species of wood, exceedingly hard and heavy, susceptible of a very fine polish, and on that account used in mosaic and inlaid works, toys, and the like. There are different kinds of ebony, but the most usual amongst us are black, red, and green, and almost all of them the product of the island of Madagascar, where the natives call them indifferently *hazon mainthi*, or *black wood*. The island of Mauritius likewise furnishes part of the ebonies used in Europe. Authors and travellers give very different accounts of the tree which yields the black ebony. According to some of their descriptions, it would appear to be a sort of palm tree; but according to others, a cytisus. The most authentic of these is that of Falcourt, who resided many years in Madagascar as governor. He assures us that it grows very high and large, its bark being black, and its leaves resembling those of our myrtle, of a deep dusky green colour. Tavernier says that the islanders always take care to bury their trees when cut down, in order to make them blacker, and to prevent their splitting when wrought. Plumier mentions another black ebony tree, discovered by him at St Domingo, which he calls *spartium portulacæ foliis aculeatum ebeni materiæ*.

Pliny and Dioscorides state that the best ebony comes from Ethiopia, and the worst from India; but Theophrastus prefers that of India. Black ebony is much preferred to that of other colours. The best is a jet black, free of veins and rind, very massive, astringent, and of an acrid pungent taste. Its rind, infused in water, is said to purge pituita, and cure venereal disorders; and hence Matthiolus took guaiacum for a sort of ebony. It yields an agreeable perfume when laid on burning coals; when green it readily takes fire from the abundance of its fat. If rubbed against a stone it becomes brown. The Indians make statues to their gods and sceptres for their princes out of this wood. It was first brought to Rome by Pompey after he had subdued Mithridates. It is now much less used amongst us than anciently, since the discovery of so many ways of giving other hard woods a black colour.

As to the green ebony, besides Madagascar and the Mauritius, it grows likewise in the Antilles, and especially in the isle of Tobago. The tree which yields it is very bushy; its leaves are smooth, and of a fine green colour. Beneath its bark there is a white blea, about two inches thick; and all beneath this, to the very heart, is a deep green, approaching towards a black, though sometimes streaked with yellow veins. Its use is not confined to mosaic work; it is likewise employed in dyeing, as yielding a fine green tincture. As to red ebony, called also *grenadilla*, we know little more of it than the name.

EBRO, a river of Spain. It has its source in the province of Toro, about ten miles west of Reynosa, from out of the two springs of Fontibre, whence it runs south-east, divides Burgos and Soria from Alava and Navarre, passes through Aragon, becomes navigable near Logrono, and, after a course of 362 miles near Amposta, empties itself into the Gulf of Alfaques. Its tributary streams are the Tadorra, the Ega, the Queiles, the Alhama, the Xalon, the Gallega, the Guadalupe, and the Segre.

EBUDÆ, or HEBUDES, in *Ancient Geography*, islands off the west coast of Scotland, now called the *Western Isles*, also *Hebrides*.

ECALESIA, Εϰαλησια, in *Antiquity*, a festival held in honour of Jupiter, surnamed *Hecalus*, or *Hecalesius*, from *Hecale*, one of the boroughs in Attica.

ECASTOR, in *Antiquity*, an oath in which Castor was invoked. It was a custom for the men never to swear by Castor, nor the women by Pollux.

ECATÆA, Εϰαταια, in *Antiquity*, statues erected to the goddess Hecate, for whom the Athenians had a great veneration, believing that she was the overseer of their families, and that she protected their children.

ECATESIA, Εϰατησια, in *Antiquity*, an anniversary solemnity, observed by the Stratonicensians, in honour of Hecate. The Athenians likewise had a public entertainment or supper every new moon, in honour of the same goddess. The supper was provided at the charge of the more affluent; and it was no sooner brought to the accustomed place than the poor people carried all off, giving out that Hecate had devoured it. For the rest of the ceremonies observed on this occasion, see Potter, *Arch. Græc.* lib. ii. cap. 20.

ECATOMBÆON, Εϰατομϐαιων, in *Chronology*, the first month of the Athenian year. It consisted of thirty days, and began on the first new moon after the summer solstice, and consequently answered to the latter part of our June and beginning of July. The Bœotians called it *Hippodromus*, and the Macedonians *Lous*. The word is a derivation from the Greek ἡϰατομϐη, a *hecatomb*, because of the number of hecatombs sacrificed in it.

ECAVESSADE, in the manège, is a term used for a jerk of the cavesson.

ECBATANA, more properly written Agbatana, the chief city of Media, and the summer residence of its princes. Its foundation is ascribed by Herodotus to Dejoces, first king of Media, who reigned about 733 B. C.; but as this period of history is involved in much obscurity, we have some reason to doubt the correctness of his statement. The account of Diodorus, ii. 13, proves that it existed at a still earlier period, and belonged to that era in the Median history which preceded the reign of Semiramis. That princess, who is supposed to have lived about 1916 B. C., indulged her love of magnificence by the erection of a royal palace within its walls; and finding the city in great want of water, she constructed a splendid aqueduct, which furnished a plentiful supply of that first necessary of life. Pliny, vi. 14, would have us believe that Seleucus Nicator was the founder; but as this prince lived about 320 B. C. we cannot give credit to this statement, except he means that Seleucus became its second founder, after it had suffered from the calamities of war.

The citadel was remarkable for strength, and constructed in a very peculiar manner. Being situated upon a hill, it was surrounded by seven walls, in such a way that the bulwarks of the one wall rose high above those of the other, whilst each of them was distinguished by its own particular colour. The circumference of the outermost wall was equal to that of the city of Athens, or rather to 240 stadia, according to Diodorus; but this wonderful account ought to be received with some degree of hesitation.

Ecbatana was from the most ancient times the place of the royal residence, and seems in splendour and magnificence to have far exceeded all other cities. It was to it that Cyrus carried the captive Crœsus, 546 B. C. when he put an end to the Lydian empire; and in the later years of his life, when the infirmities of age made him more susceptible of the vicissitudes of the seasons, he used to retire for the summer months to its cool and delicious shades. (Xen. Cyrop. viii. 6.) Here Artaxerxes assembled his army to oppose the designs of his brother Cyrus (Diodorus xiv. 22); and when the fate of Persia was decided by the battle of Arbela, this was the spot chosen by Darius as the rallying point for his fugitive soldiers. (xvii. 64.) But no sooner did Alexander show his determination to attack it, than Darius ingloriously fled, and Ecbatana fell, with all its riches, into the hands of the Macedonian conqueror. (Arrian, 3, 19, 4.) The magnificence of its palace is particularly remarked by Polybius, who tells us that the wood was all of cedar or of cypress; the beams, the ceilings, and the pillars that supported the porticoes, were covered, some with plates of silver, and some with plates of gold. The tiles likewise were all of silver. It was of course plundered by the Macedonians; yet in the time of Antiochus, 209 B. C. he still found there pillars cased with gold, and a large quantity of silver tiles laid together in a heap. Amidst all the changes of empire in the East we find that Ecbatana continued to a very late period one of its principal cities. Vologeses held his court within its walls 64 A. D. (Tacit. *Ann.* xv. 31.)

The site of this ancient town seems unquestionably to have been near Hamadan in Al Djebal, though some are inclined to place it at Tebriz in Aderbidjon; and a late writer, Mr Williams, has even attempted to prove it to have been at Ispahan. This opinion he supports with great ability, but it is nothing else than a splendid paradox. The chief authorities adduced to prove its position are the following: It is situated at the foot of Mount Orontes, Polyb. x. 27; twelve stadia distant from it, Diodor. ii. 13; twelve long days' journey from the Caspian Gates, Arrian, iii. 20; 450 miles from Gaza, the capital of Atropatene, Plin. vi. 13; from Susa fifteen days' journey, Diodor. xvii. 110; and twenty from Persepolis, xix. 46.

The country round Hamadan at present abounds in gardens, vineyards, and pasturages; and though it is a gloomy abode during winter, on account of the cold, it is a delightful residence during the summer months. The tomb of Esther is still pointed out, and continues to be visited by Jewish pilgrims (Otter, *Voyage en Turquie*, vol. i. p. 182); and also the tomb of Avicenna. Abdool Kerim's *Travels from India to Mecca*, p. 97. See MOUNT ORONTES.

ECCHELLENSIS, ABRAHAM, a learned Maronite, whom the president Le Jai employed in the edition of his Polyglott Bible. Gabriel Sionita, his countryman, brought him to Paris in order to make him his fellow-labourer in publishing that Bible. But they quarrelled, upon which Gabriel complained to the parliament, and cruelly defamed his associate. This dispute made a great noise. The congregation *de Propaganda Fide* associated him in 1636 with those whom they had employed in making an Arabic translation of the Scriptures; they recalled him from Paris, and he laboured in that translation at Rome in the year 1652. Whilst he was professor of the oriental languages at Rome, he was selected by Duke Ferdinand II. to translate from Arabic into Latin the fifth, sixth, and seventh books of Apollonius's Conics; a task in which he was assisted by John Alphonso Borelli, who added commentaries to them. He died at Rome in 1644.

ECCLES, one of those large manufacturing towns which within a few years have risen from villages. It is 185 miles from London and four from Manchester, in the hundred of Salford, and county of Lancaster. The inhabitants are chiefly occupied in the several branches of the cotton manufacture; and amounted in 1801 to 6197, in 1811 to 12,300, in 1821 to 23,331, and in 1831 to 28,083.

ECCLESAL-BIERLOW, a large township of the parish of Sheffield, about three and a half miles from that town. The inhabitants are chiefly occupied in the various branches of the metal manufactures; and amounted in 1801 to 5362, in 1811 to 6569, in 1821 to 9113, and in 1831 to 14,279.

ECCLESFIELD, a large manufacturing parish of the west riding of Yorkshire, in the wapentake of Strafforth and Tickhill, 167 miles from London and five from Sheffield, with the trade of which place it is very much connected. The population amounted in 1801 to 5114, in 1811 to 5805, in 1821 to 7163, and in 1831 to 7911.

ECCLESHALL, a market-town of the county of Stafford, 148 miles from London. It is in the hundred of Pirehill, on the banks of the river Sow; is a well-built town, in a pleasant district; and was formerly the residence of the bishops of Lichfield. The chief part of the inhabitants are employed in manufactures. The market is held on Thursday. The population amounted in 1801 to 3487, in 1811 to 3901, in 1821 to 4227, and in 1831 to 4471.

ECCLESIASTES, a canonical book of the Old Testament, the design of which is to show the vanity of all sublunary things. It was composed by Solomon, who enumerates the several objects on which men place their happiness, and then shows the insufficiency of all worldly enjoyments. The Talmudists made King Hezekiah the author of this book; while Grotius ascribes it to Zorobabel, and others to Isaiah; but the generality of commentators believe it to be the product of Solomon's repentance, after having experienced all the follies and pleasures of life.

ECCLESIASTICAL, an appellation given to whatever belongs to the church. Thus we say ecclesiastical polity, jurisdiction, history, and so forth.

ECCLESIASTICUS, an apocryphal book, generally bound up with the Scriptures, and so called from its being read in the church, *ecclesia*, as a book of piety and instruction, but not of infallible authority. The author of this book was a Jew, called Jesus the son of Sirach. The Greeks call it the Wisdom of the Son of Sirach.

ECCLOO, a city in the province of West Flanders, which contains 6269 inhabitants. It is the capital of the circle of the same name, comprehending three cantons, with a population of 42,484 persons.

ECCOPROTICS, in *Medicine*, laxative or loosening remedies, which purge gently, by softening the humours and excrements, and fitting them for expulsion. The word is composed of the Greek particle εκ, and κοπρος, *fæces*.

ECDALA, or AKDALA, an ancient town and fortress of Bengal, in the district of Dacca, which is frequently mentioned in the histories of Bengal, but of which there are now scarcely any remains. In the year 1353 Ilyas Hajy, the second independent king of Bengal, took refuge here, and defended the place until the setting in of the rains, when the siege was raised. Long. 96. 45. E. Lat. 24. 4. N.

ECDICI, Εκδικοι, amongst the ancients, patrons of cities, who defended their rights, and took care of the public money. Their office resembled that of the modern syndics.

ECHALLANS, a bailiwick in the canton of Vaud, in Switzerland, containing 6954 inhabitants, whose capital is of the same name, and situated on the river Talent, containing 850 inhabitants.

ECHAPE, in the manège, a horse begotten between a stallion and a mare of different breeds and countries.

ECHAPER, in the manège, a gallicism used in the academies, implying to give a horse head, or to put him to full speed.

ECHINADES, a group of islands off the coast of Acarnania, at the mouth of the river Achelous. They are mentioned by Homer as having sent a detachment of troops to Troy under Meges. The chief island seems to have been Dulichium, which some of the ancients considered as only another name for Cephallenia; but Strabo strenuously maintained that it was the Dolicha of his period, at the mouth of the Achelous. It is curious that Herodotus (xi. 10), tells us that more than half of these islands had been joined in his time to the mainland by the depositions of the river, and Thucydides (xi. 102), enters into a learned disquisition to prove that they must all ere long be united to the shore. This observation of Thucydides had attracted the attention of the inquisitive Pausanias; and as he found that the prediction had not been verified, he was only able to account for it by supposing that the lands had ceased to be cultivated on its banks, and that thus it was no longer supplied with the same quantity of sediment as before. Strabo states that they were rugged and barren. "At present the Echinades belong to the inhabitants of Ithaca, and produce corn, oil, and a scanty pasture for sheep and goats. The name of the group is *Curzolari*." Dodwell's *Classical Tour*, v. p. 109. Gell states that several of these islands, now hills in the plain, appear to have ruins. *Itiner. of Greece*, p. 298.

ECHINATE, or ECHINATED, an appellation given to whatever is prickly, or resembling the hedgehog.

ECHINITES, the name by which authors call the fossil centronia, frequently found in chalk pits.

ECHINODERMATA, the first class of the fourth great division of the animal kingdom (see vol. iii. p. 179 of this work), commonly called Zoophytes, or radiated animals; it includes, among numerous other species, the star-fish, sea urchins, &c. We shall describe the animals of this class under the term ZOOPHYTES, to which the reader is referred.

ECHINUS. See ZOOPHYTES.

ECHO, a sound reflected or reverberated from a solid concave body, and so repeated to the ear. The word is formed from the Greek ηχος, *sound*, which comes from the verb ηχεω, *sono*.

The ancients being wholly unacquainted with the true cause of the echo, ascribed it to several which are sufficiently whimsical. But the moderns, who know sound to consist in a certain tremor or vibration in the sonorous body, communicated to the contiguous air, and by that means to the ear, give a more consistent account of echo. For a tremulous body, striking on another solid body, may evidently be repelled without destroying or diminishing its tremor; and consequently a sound may be redoubled by the resilition of the tremulous body, or air. But a simple reflection of the sonorous air is not enough to explain the echo; for then every plain surface of a solid hard body, as being fit to reflect a voice or sound, would redouble it, which we find does not hold. In order to produce an echo, therefore, it should seem that a kind of concameration or vaulting is necessary, in order to collect, and by collecting to heighten and increase, and afterwards reflect, the sound, as we find is the case in reflecting the rays of light, where a concave mirror is required. In effect, as often as a sound strikes perpendicularly on a wall, behind which is any thing of a vault or arch, or even another parallel wall, so often will it be reverberated in the same line, or other adjacent ones. For an echo to be heard, therefore, it is necessary that the ear should be in the line of reflection; for the person who made the sound to hear its echo, it is necessary that he should be perpendicular to the place which reflects it; and for a manifold or tautological echo, it is necessary that there should be a number of walls, and vaults or cavities, either placed behind or fronting each other. A single arch or concavity can scarcely ever stop and reflect all the sound; but if there be a convenient disposition behind it, part of the sound propagated thither, being collected and reflected as before, will return another echo; or if there be another concavity, opposed at a due distance to the former, the sound reflected from the one upon the other will be tossed back again by the latter.

Echoes may be produced in circumstances wholly different. For, first, a *plane* obstacle reflects back the sound in its due tone and loudness, allowance being made for the proportionable decrease of the sound, according to its distance; secondly, a *convex* obstacle reflects the sound somewhat smaller and somewhat quicker, though weaker, than otherwise it would be; and, thirdly, a *concave* obstacle echoes back the sound larger, slower, and also inverted, but never according to the order of words. Nor does it seem possible to contrive any single echo that shall invert the sound, and repeat backwards; because, in such a case, the word last spoken, that is, which last occurs to the obstacle, must be repelled first, which cannot be. For where in the mean time should the first words hang and be concealed; or how, after such a pause, could they be revived and animated again into motion? From the determinate concavity or arching of the reflecting bodies, it may happen that some of them shall only echo back one determinate note, and only from one place. Fourthly, the echoing body being removed farther off, it reflects more of the sound than when nearer, which is the reason why some echoes repeat but one syllable, some one word, and some many. Fifthly, echoing bodies may be so contrived and placed, that by reflecting the sound from one to the other, either directly and mutually, or obliquely and by succession, out of one sound, a multiple echo or many echoes shall arise. Add to this, that a multiple echo may be made, by so placing the echoing bodies at unequal distances, that they may reflect all one way, and not one on the other. By this means a manifold successive sound will be heard, one clap of the hands like many, one *ha* continued like laughter, one single word like many of the same tone and accent, and one viol like many of the same kind imitating each other. Lastly, echoing bodies may be so arranged that from any one given sound they shall produce many echoes different both as to tone and intention. By this means a musical room may be so contrived that one instrument playing therein shall not only seem as many of the same sort and size, but even as a concert of different ones; which is effected by placing certain echoing bodies so that any note placed shall be returned by them in thirds, fifths, and eighths.

Echo is also used for the place where the repetition of the sound is produced or heard.

Echoes are distinguished into different kinds. *Single echoes* are those which return the voice but once. Of these some are *tonical*, which only return a voice when modulated into some particular musical tone; and others, *polysyllabical*, which return many syllables, words, and sentences. *Multiple* or *tautological* echoes are those which return syllables and words the same oftentimes repeated.

In echoes, the place where the speaker stands is called the *centrum phonicum*, and the object or place that returns the voice the *centrum phonocampticum*.

At the sepulchre of Metella, wife of Crassus, there was an echo, which repeated what was said five times. Authors mention a tower at Cyzicus, where the echo repeated seven times. One of the finest echoes we read of is that mentioned by Barthius, in his notes on the *Thebais* of Statius (lib. vi. 30), which repeated the words uttered seventeen times; it was situated on the banks of the Naha, between Coblentz and Bingen. Barthius assures us that he had proved what he writes, and had counted seventeen repetitions.

Echo, in *Architecture*, a term applied to certain kinds of vaults and arches, most commonly of the elliptic and parabolic figures, used to redouble sounds, and produce artificial echoes.

Echo, in *Poetry*, a kind of composition in which the last words or syllables of each verse contain some meaning, which, being repeated apart, answers to some question or other matter contained in the verse. Thus, in the line of Virgil:

Crudelis mater magis, an puer improbus ille?
Improbus ille puer, crudelis tu quoque mater.

Echo, in fabulous history, a daughter of the Air and Tellus, who chiefly resided in the vicinity of the Cephisus. She was once an attendant of Juno's, and became the confidant of Jupiter's amours. Her loquacity, however, displeased Jupiter, and she was deprived of the power of speech by Juno, and only permitted to answer to the questions which were put to her. Pan had formerly been one of her admirers, but he never enjoyed her favours. Echo, after she had been punished by Juno, fell in love with Narcissus; but being despised by him, pined away, having nothing left but her disembodied voice.

ECHOMETER, among musicians, a kind of scale or rule, with several lines on it, serving to measure the duration and length of sounds, and to determine their intervals and ratios.

ECIJA, a city of Spain, in that division of Andalusia denominated the kingdom of Seville. It is situated on the right bank of the river Xenil, which is here crossed by a neat bridge of modern erection. The surrounding country suffers much from a scarcity of water; but when the summer happens to be rainy, it is abundantly productive in grain of every kind, and in wine, and feeds considerable herds of cattle. It was a considerable city when the Romans ruled the peninsula, and was then called Astigi. Many inscriptions of ancient date are found in the city and its vicinity. It contains six churches, sixteen monasteries, fifteen hospitals, 6000 houses, and 28,176 inhabitants. There are some tanneries here, and a trade in leather is carried on. Cotton is grown in the surrounding country. It is thirty miles from Cordoba. Long. 4. 34. 19. W. Lat. 37. 31. 51. N.

ECKIUS, or Echius, John, an eminent and learned controversialist, professor in the university at Ingolstadt, and remarkable for the opposition he gave to Luther, Melancthon, Carlostadius, and other leading Protestants in Germany, was born in Suabia in 1486. He wrote many polemical tracts; and amongst the rest a *Manual of Controversies*, printed in 1535, in which he discourses upon most of the heads contested between the Protestants and Roman Catholics. He also wrote a Commentary on Seligenstadt, 1536, *Homilies*, &c.; and died in 1543.

ECLECTICS (*eclectici*), a name given to some ancient philosophers, who, without attaching themselves to any particular sect, took whatever they judged good and solid from each; and hence their denomination. Laertius observes that they were also, for the same reason, denominated *analogetici*; but that they call themselves *philalethes*, or lovers of truth. The chief or founder of the eclectics was Potamon of Alexandria, who lived under Augustus and Tiberius, and who, weary of doubting of all things with the Sceptics and Pyrrhonists, formed the eclectic sect, called by Vossius the eclective.

Towards the close of the second century, a sect arose in the Christian church under the denomination of Eclectics, or modern Platonists, professing to make truth the only object of their inquiry, and to be ready to adopt from all the different systems and sects such tenets as they thought agreeable to it. However, they preferred Plato to the other philosophers, and looked upon his opinions concerning God, the human soul, and things invisible, as conformable to the spirit and genius of the Christian doctrine. One of the principal patrons of this system was Ammonius Saccas, who laid the foundation of that sect afterwards distinguished by the name of the New Platonists in the Alexandrian school.

Eclectics were also a certain sect of physicians among the ancients, of whom Archigenes, who lived under Trajan, was the chief, and selected from the opinions of all the other sects those which appeared to be best and most rational. Hence they are called *eclectics*, and their prescriptions *medicina eclectica*.

ECLIPSE, in *Astronomy*, the deprivation of the light of the sun, or of some heavenly body, by the interposition of another heavenly body between us and that body. See ASTRONOMY.

ECLIPSE ISLANDS, a cluster of small rocky barren islands in the South Pacific Ocean, near the south-west coast of New Holland.

ECLIPTIC, in *Astronomy*, a great circle of the sphere, supposed to be drawn through the middle of the zodiac, making an angle with the equinoctial of about 23° 30′, which is the sun's greatest declination; or, more strictly speaking, it is that path or way among the fixed stars, which the earth appears to describe to an eye placed in the sun. (See ASTRONOMY.) Some call it *via solis*, or the way of the sun, because the sun in his apparent annual motion never deviates from it, as all the other planets do more or less.

ECLIPTIC, in *Geography*, a great circle on the terrestrial globe, not only answering to, but falling within, the plane of the celestial ecliptic. See GEOGRAPHY.

ECLODE, a town of Hindustan, in the province of Malwah, belonging to the predatory chieftain Meer Khan. Long. 77. 55. E. Lat. 24. 5. N.

ECLOGUE, in *Poetry*, a kind of pastoral composition, in which shepherds are introduced conversing together. The word is formed from the Greek *εκλογη choice;* so that, according to the etymology, eclogue should be a select or choice piece; but custom has assigned to it a further signification, namely, a little elegant composition in a simple, natural style and manner.

Idyllion and eclogue, in their primary sense, are the same. Thus the *idyllia, ειδυλλια*, of Theocritus, are pieces written perfectly in the same vein with the *eclogæ* of Virgil. But custom has made a difference between them, and appropriated the name of *eclogue* to pieces in which shepherds are introduced speaking; and *idyllion* to those written, like the eclogue, in a simple, natural style, but without any pastoral interlocutors.

Of the Idyl, as the word is generally written, Germany in particular, amongst modern nations, has produced some highly finished specimens. England can boast of comparatively few eclogues so called. Those of Collins are esteemed the best.

ECONOMISTS.

IT is not generally known how much the science of politics, that master science, the late offspring of the improved reason of modern times, is indebted to the philosophers who are known to the world by the title of economists. They were, it is true, preceded in this country by Hobbes and by Locke, and in France by Montesquieu; but in analysing the frame of civil society, they added considerable lights to those which had been communicated by their predecessors; and they attempted to point out the mode of combining the various springs of social action in a more liberal and beneficent system than had yet been recommended to the world.

It is worthy of remark, that the merits of this sect, in the secondary department of *political economy*, have so much obscured their important speculations on the great questions respecting the best possible order capable of being given to society, that they are, in this country at least, wholly unknown, except in the character of political economists; though their political economy formed only a small and subordinate branch of their entire system; and, what is indeed extraordinary, we know not a book in the English language in which an account of that system is to be found.

This article is intended to contain, 1*st*, the history of the sect; 2*dly*, an account of their system; and, 3*dly*, some observations, pointing out the principal errors into which they have fallen.

I. M. de Gournay appears to have been the first man in France who had formed any systematic notions on the real principles of trade. It is true, indeed, that Fenelon had recommended, on the direct suggestion of good sense, detached from theory, the practice of freedom of trade. The Marquis d'Argenson was celebrated for the sound and important maxim, *Pas trop gouverner;* and the memorable advice of the merchants to the meddling Colbert was well known, *Laissez-nous faire.* Another of the more peculiar doctrines of the economists was expressed in the famous maxim of the great Duc de Sully, *Que le labourage et le pâturage sont les mammelles de l'état;* and Montesquieu had brightly but superficially run over several of the questions relative to trade.

For such lights as M. de Gournay did not derive from his own reflections, he seems to have been chiefly indebted to the writers of England; but there appears some reason to conclude that the best of these had not fallen in his way. We do not perceive, for example, any sign of acquaintance with the writings of Locke.

Jean-Claude-Maria Vincent, Seigneur de Gournay, was an extraordinary man for the age and country in which he was produced. He was born at St Malo, in the month of May 1712, the son of Claude Vincent, one of the most considerable merchants of the place. Destined to commerce by his parents, he was sent to Cadiz when scarcely seventeen years of age. His vigilant attention to business did not hinder him from finding time, well husbanded and diligently applied, not only for storing his mind with general knowledge, but for unravelling the combinations of commerce, and ascertaining its elementary principles. After he had raised himself to great eminence as a merchant, and to a high reputation for knowledge of the principles of commerce, the ministers of France conceived the design of turning his knowledge to advantage in the office of intendant of commerce, as they call it, to which he was raised in 1751.

No sooner was M. de Gournay invested with his office, than he began to wage war with the established system of regulations and restrictions, which the experience of twenty years of mercantile practice the most varied and the most extensive, discussions with the most intelligent merchants of Holland and of England, the perusal of the best writers on the subject, and the impartial application of his own philosophical thoughts, had all conspired to make him regard as a source, not of national advantage, but of continual vexation and hardship to individuals, and of poverty to the state. "He was astonished," says M. Turgot, "to find that a citizen could neither make nor sell a commodity, without having purchased a privilege, by getting himself made, at a great expense, a member of some corporation; that if he made a piece of cloth, for example, of any quantity and quality different from those commanded in certain regulations, instead of being allowed to sell it to those purchasers whom such quantity and quality suited the best, he should be condemned to see it cut in pieces, and to pay a fine heavy enough to reduce a whole family to beggary. He could not conceive how, in a country where the succession to titles, to estates, and even to the crown itself, rested upon custom, and where the application of even the punishment of death was rarely guided by any written definitions, the government should have thought proper to fix by written laws the length and breadth of each piece of cloth, and the number of threads which it ought to contain. He was not less astonished to see the government take in hand to regulate the supply of commodities; proscribe one sort of industry in order to make another flourish; shackle with peculiar restrictions the sale of the most necessary articles of subsistence; prohibit the storing of commodities, of which the quantity produced varies greatly from year to year, while the quantity required for consumption is pretty nearly the same; restrain the export and import of a commodity subject to the greatest fluctuation of price; and dream of insuring the plentiful supply of corn by rendering the condition of the labourer more uncertain and more wretched than that of any other part of the community." (*Œuvres* de M. Turgot, iii. 333.)

It may easily be imagined that M. de Gournay would find himself encountered by opposition the moment he endeavoured to introduce his beneficial views into practice. The grand instruments of this opposition were certain words and phrases, which have been used to screen misrule in every country in which the voice of reform has begun to be raised. "M. de Gournay," says Turgot, "was opposed, under the names of an 'innovator' and a 'theorist,' for endeavouring to develop the principles which experience had taught him, and which he found universally recognised by the most enlightened merchants of every part of the world among whom he had lived. The principles marked out for reprobation, under the title of the 'new system,' appeared to him to be exactly the principles of plain good sense. The whole of this system was founded upon the certain maxim, that, in general, each man is a better judge of his own interest, than another man to whom it is a matter of indifference. From this M. de Gournay concluded, that, when the interest of individuals is precisely the same with the general interest, the best thing to be done is, to leave every man at liberty to do what he likes. Now he held it as impossible, that in commerce, fairly left to itself, the interest of the individual should not coincide with the interest of the community." The proof which M. Turgot gives of the fundamental proposition, that the interest of the individual and of the community in a free commerce are the same, we need not repeat; because it can neither be rendered more clear nor more cogent than it is already in works with which every person is familiar, who is at all conversant with political science.

"From this principle M. de Gournay concluded, that the sole duties of government with regard to commerce are: 1. To render to all the branches of industry that precious liberty, of which the prejudices of barbarous times, the proneness of governments to lend themselves to the gratification of individual interests, and the pursuit of a mistaken good, have conspired to deprive them: 2. To facilitate the exercise of industry and ingenuity to every member of the community, exciting thereby the greatest competition among sellers, and ensuring the greatest perfection and cheapness of the commodities sold: 3. To admit the greatest competition among buyers, by opening to the seller every possible market; the sole means of encouraging reproduction, which hence derives its only reward: 4. To remove every obstacle by which the progress of industry is retarded, by depriving it of its natural reward."

It is to M. de Gournay, therefore, that Turgot ascribes the origin of political economy in France. "It is to the ardour," says he, "with which M. de Gournay endeavoured to direct to the study of commerce and of political economy, all the talent which he was able to discover, and to the facility with which he communicated the lights which he himself had acquired, that we ought to ascribe the happy fermentation which for some years has been excited on these important subjects; a fermentation which arose two or three years after M. de Gournay was intendant of commerce, and has since that time procured us several works calculated to wipe off from our nation that reproach of frivolity, which, by its indifference for the more useful studies, it had but too justly incurred."

Francis Quesnay was born in the village of Ecqueville in the year 1694. According to M. Dupont de Nemours, the editor and commentator of the works of Turgot, and a zealous economist, he was the son of a small proprietor, who cultivated his own little property; and he was eminently indebted to his mother for the fashion of his mind. Though he was educated as a physician, and rose to such eminence in his profession as to be first physician to the king, the early occupation of his mind on the business of agriculture had given the current of his thoughts a permanent direction; and when he was summoned to reflect on the sources of wealth, by the discussions probably to which the speculations of M. de Gournay had given birth, agriculture was the object on which his attention was more particularly fixed. He produced several works on different points of the science and practice of medicine; and it was only at a late period of life that his works on political economy appeared. His chief production on this subject, *Physiocratie, ou du Gouvernement le plus avantageux au genre humain*, was first published in 1768. Not only had the speculations which he broached, and which he propagated with much fervour and diligence, considerable success in the world, but he had the fortune to gain a considerable number of proselytes, who exerted themselves with an ardour for the diffusion of his doctrine, and with a devotion to the opinions of their master, which more resembled the enthusiasm of the votaries of a new religion, or that of the followers of some of the ancient philosophers, than the indifference with which new speculations in philosophy have on all other occasions been received in modern Europe; and which gave to the economists more of the character of a sect or a school, than has appeared to belong to those who have in recent times concurred in any other system of philosophical opinion.

There was, in truth, in the system of M. Quesnay and the other economists, many things well calculated to attract attention and excite enthusiasm. From a few simple principles, they deduced, as they imagined, by a chain of very close and imposing arguments, a system of changes which would easily be introduced, without the smallest interruption to the tranquillity and happiness of the existing generation, calculated to remove from society all the deformities by which it was overspread, and to communicate to the mass of human beings a fulness of happiness hitherto altogether unknown. At this point, therefore, we may close the historical part of this article; for the success of the great work of Dr Adam Smith, in a short time, superseded the *political economy* of the sect; and after the political economy was discredited, the rest of their doctrines met with little regard. The memory of them, however, is well worthy of being preserved; and this task we shall now, in as few words as possible, endeavour to perform.

II. The economists proceeded upon no Utopian plan, which supposes society to be composed of beings different from those with whom we are already acquainted. They took man as he is, a being having wants, and governed by the desire of avoiding pain and obtaining pleasure.

Man must have subsistence. Upon this ground they first took their stand. This being allowed, it followed, of course, that whatever was the best means of obtaining subsistence, would command the operations of men as soon as ever it was sufficiently known.

Of these means, the first and fundamental is the establishment of property. This they proved by convincing arguments. We cannot exist without consuming. The nature of man leads to a rapid multiplication of human beings, and the earth yields a spontaneous nourishment for only a few. To make food keep pace with population, labour must be employed upon the ground. Men would be born for no other purpose than that of destroying one another, if there were not means of increasing the quantity of food in proportion to those that were born. Labour, then, is one of the physical necessities of nature. But if labour be necessary, so is property, because, without property, there can be no labour.

The proof of this proposition is short and irresistible. Nobody would labour under an assurance that he would derive no advantage from his labour. Nobody would labour without a certain probability that he should enjoy the fruits of his labour. Now, this is property. The only question, then, which remains is, what is the degree of assurance with respect to the fruits of a man's labour; in other words, what are the laws of property which tend most to secure the benefits which human beings derive from their labour? This, said the economists, is the object and the end of our researches.

They proceeded in their inquiry by the following steps. As a means to this labour, on which every thing depends, a man must be free to use his natural faculties of labour —his muscular powers. This freedom they called *the property of his person.* As another means to the same end, he must be free to use exclusively, and to preserve, what he acquires by his labour. This they call his *moveable property.*

Here we see the origin of that to which men have assigned the names of *rights* and *duties.* The exclusive powers assigned to the man over his person, and over the fruits of his labour, are called his *rights.* To allow these exclusive powers, by abstaining from every act which would impair them, is called the *duties* of all other men. Here we see, also, that *rights* and *duties* are reciprocal; that they imply one another, that they are created together, and that the one cannot exist without the other. Destroy the *rights* of property in the man, you destroy, by the same act, the *duties* of other men to exclude themselves from what was called his property. Destroy, in the same manner, the *duties* of other men to exclude themselves from what was called his property, and you destroy, at the same time, his *right* to that exclusion. *Rights* and *duties* are, in fact, but different names given to the same thing, according as it is regarded under one or another of two points of view.

Another important concatenation is here also to be seen. *Rights* are advantages; things to be enjoyed. *Duties* are burthens, abstracted from things to be enjoyed. Why should men accept these burthens, submit to these duties? Why, but because they find their advantage in doing so. It is plain how they find their advantage in doing so, and there is, there can be, no other reason. Men submit to the *duties* of respecting other men's *rights,* that they may have *rights* themselves. It is good for them to have *rights;* there can be no rights without *duties.* It is better to have the *rights* submitting to the *duties,* than, by renouncing the *duties,* to have no *rights.* The *duties* are then the price which is paid for the *rights.* The *duties* which one man yields to other men, are the price which he pays for having *rights* of his own. *Duties,* then, are in themselves *evils;* and they never ought to exist, except when they are compensated by a greater good. Nobody ought to be subjected to a burthen, which is not, either to himself, or to the community in which he has clubbed his private interests, attended with a good sufficiently great to overbalance the evil which he is made to endure. *Utility,* then, is the exclusive foundation of *duty.*

Having laid this foundation, the economists proceed.

On the necessity of subsistence rests the necessity of property, and on the necessity of property rests the necessity of a certain inequality in the conditions of men. This inequality exists, because a good is obtained through it, which can in no other way be obtained; and that good the parent of every thing else to which the name of good is applied. "Those who complain of it," says Mercier de la Riviere, one of the chief expositors of the doctrines of the sect, "see not that it is a link in the chain by which the human species must drag from the abyss of non-production every thing which they enjoy. As soon as I have acquired the *exclusive* property of a thing, another man cannot have the property of it at the same time. The law of property is the same for all men; each man, however, acquires in proportion to his faculties of acquiring: but the measure of these is different in different men. And besides this fundamental law, there is, in the whirlpool of accidents, a continual succession of combinations, some more, some less fortunate, which increase the causes of that inequality of acquisition, without which the motives to acquisition cannot exist......................I admit, however," he in conclusion adds, "that in any given community, these differences in the possessions of different men may become the source of great disorders, and which augment again these same differences beyond their natural and necessary degree. But what follows from this? That men ought to establish an equality of conditions? Certainly not; for to that end, it would be necessary to destroy all property, and, by consequence, all society: it only follows that they should correct those disorders which make that which is an instrument of good become an instrument of evil; which alters in such a manner the distribution of things, that *force* places all the rights on one side and all the duties on the other."

We have seen that the necessity of labour to procure the means of life and the means of enjoyment, produced a necessity of *property personal* and *property moveable,* as the two sorts were named by the economists. The necessity of raising food, as well as the first material of most of the other articles of human enjoyment, by labour upon the *land,* produces a like necessity of creating a *property in the soil.* The proof of this proposition is not less short and convincing than that which regards the other species of property. To make the land yield a produce useful to man, it must be cleared of many incumbrances, and prepared with much labour and expense. No adequate return can be obtained for this labour to the man who would bestow it, without a perpetuity of possession. It is essential for the well-being of the species that the labour should be yielded, and in the greatest degree of perfection. It cannot be yielded perhaps at all, certainly in no tolerable degree of perfection, without that exclusive possession which constitutes property. Property in land is, therefore, essential to the well-being of the human species.

We see in this manner what are the *rights* and what are the *duties* which the supply of the first wants of human nature renders it necessary to constitute; but as all mankind are not disposed to respect *rights* and *duties,* it is necessary, in order to obtain the advantages which they are destined to produce, that measures should be taken to protect them.

The measures taken to protect them are generally comprehended under one name, that is, *government*. The protection of the rights, or, which means the same thing, the insuring of the duties, is the *end*, the government is the *means;* and the question is, what combination of means is best adapted to the purpose?

This assuredly is the most important question to which the human faculties can be directed; and the economists have never yet received the credit which is their due, for the ability and success with which they laboured to resolve it. No speculations can be conceived of more importance than those in which they engaged, nor has it yet become easy to throw upon them a greater portion of light.

The grand classes of means by the skilful combination of which they conceived that the end might be obtained, were either more direct or more indirect. The more indirect were liberty and evidence; the more direct were laws exactly adapted to the end, magistrates exactly adapted to the execution of these laws, and a supreme, or, as they called it, "*tutelary power*." We shall endeavour to communicate their leading ideas on each of these particulars.

1. *Liberty*. We have seen that the end which is aimed at through property, as a means, is the greatest possible abundance of the things adapted for human enjoyment, and that property is a means altogether indispensable for that end. It is now to be proved that liberty is absolutely necessary to enable property to answer the purpose of a means to that end, and that, without liberty, the existence of property is deprived of almost all its advantages. In fact, the right which a man has not the liberty to enjoy is not a right. The right of property in a man's person, in his moveables, in his land, is the right of enjoying; but the *right* of enjoying and the *liberty* of enjoying are the same thing. Liberty, therefore, cannot be hurt without damaging the right of property, and the right of property cannot be hurt without damaging liberty. "It is," says Mercier de la Rivière, "so inseparably connected with the right of property, that it is confounded with it, and that the one cannot exist without the other. Deprive a man," he cries, "of all the rights of property, and I defy you to find in him a vestige of liberty. On the other hand, suppose him deprived of every portion of liberty, and I defy you to show that he truly retains every right of property."

It is now pretty clear that liberty is necessary to produce that abundance of production which is the end aimed at by the constitution of all *rights* and *duties*. Man is excited to labour only in proportion as he is stimulated by the desire of enjoying; but the desire of enjoying can only be a motive of action in so far as it is not disjoined from the liberty of enjoying. You cannot have productions in abundance, without the greatest possible inducement to labour; you cannot have the greatest possible inducement to labour, without the greatest possible liberty of enjoyment. The chain of evidence is therefore complete.

"Let us not," say the economists, "seek in men beings which are not men. Nature has destined them to know only two springs of action, or moving powers; the appetite of pleasure and the aversion to pain. It is in the purpose of nature, therefore, that they should not be deprived of the liberty of enjoying, since, without that liberty, the first of those two powers would lose the whole of its force. *Desire of enjoying, liberty of enjoying;* these are the soul of the social movements, these are the fruitful seed of abundance, because that precious combination is the principle of all the efforts made by human beings to procure it."

2. *Evidence*. Property, and by consequence liberty and security of enjoying, being proved to constitute the essence of what they called the natural and essential order of society, it was seen to be in reality a chain of *physical* consequences, involving nothing arbitrary, nothing changeable; evident, on the other hand, simple, and resting on no other ground than that of being the most advantageous possible to the whole body of the community, and to every one of its members.

"The best possible order of society, however," they observed, "cannot be established where it is not sufficiently known; but for that very reason, that it is the best order, the establishment of it, as soon as it is known, must become the common ambition of men; it must then introduce itself by *necessity*, and, once established, it must by *necessity* continue for ever." These were bold promises, but the proof was correspondent. "The best possible order of society must introduce itself as soon as known, and preserve itself for ever as soon as introduced, because the appetite of pleasure, and the aversion to pain, the only moving powers within us, lead naturally and constantly toward the greatest possible augmentation of enjoyments; and the desire of enjoying implies by necessity that of the means by which enjoyment is procured. It is, then," said the economists, "impossible that men should know their best possible condition without a consequent union of all wills and all power to procure and to preserve it. Imagine not," they cried, "that for the establishment of this essential order it is necessary to change the nature of men, and divest them of their passions; their passions, on the other hand, become auxiliaries in this establishment, and, for the most complete success, it is only necessary to place them in a condition to see with *evidence* that it is in this order alone they can find the greatest possible sum of enjoyments and of happiness."

These philosophers made some admirable observations upon the nature of evidence, and the important purposes to which it is subservient. They made a distinction between those propositions which a man receives without evidence, and those which he only receives upon the strength of evidence. The first they denoted by the word *opinion*, the second they marked by the names of *knowledge* and *certainty*. "As error," they said, "is every thing which is not truth, in like manner, what is not *evidence* is only *opinion;* and whatsoever is only opinion is arbitrary, and liable to change. It is evident, therefore, that these opinions are not a sufficient foundation for the natural and essential order of societies. A solid edifice cannot be erected on a basis of sand; and that into which nothing arbitrary can enter, which is and must be unchangeable as the ends to which it is directed, can never be founded on a principle so arbitrary and various as opinion; opinion which, however just and true it may accidentally be, so long as it is not founded on evidence, is but opinion still, and liable every moment to be subverted and expelled by any other opinion, however extravagant and absurd."

Evidence is the knowledge, clearly attained and possessed by ourselves, of all that is necessary to see the truth or falsehood of an object of belief. This excludes all doubt, all uncertainty, every thing arbitrary, all exercise of will. A man can no more help believing that which he actually holds in his mind evidence sufficient to prove, than he can help seeing the object which is painted on his retina.

From this irresistible power of evidence the economists deduced the most important consequences. "Not only is it," they said, "the essential characteristic of evidence to stand the test of the most severe examination, but the most severe examination can have no other effect than that of displaying it to more advantage; that of giving to it a power more predominating and supreme; while, on the other hand, sufficient examination destroys prepossession and prejudice, and establishes in their place, either evidence, or at least suspension of judgment, where evidence on which to found a judgment is out of our reach."

On the first of these propositions, that "evidence can stand the test of the most severe examination," they said, "that all attempt at proof was surely unnecessary,—it was self-evident; and hence," they said, "was evidently deduced this most important consequence, 'that the liberty of examining, of criticising, and of contradicting evidence, is always and necessarily without inconvenience.'"

"That a sufficient examination destroys prepossession and prejudice," they regarded as a proposition equally indisputable; and from this it followed, as an irresistible consequence, "that the most unbounded liberty of examination and contradiction is of primary and essential importance; for no examination can be *sufficient* till all the reasons of doubt are exhausted."

"That a sufficient examination establishes evidence in the place of error in the case of all questions where evidence is within our reach," was a truth, they said, resting on the same immoveable basis; and from this it followed, as an evident consequence, "that liberty of inquiry will lead by necessity to the clear and public knowledge of what is the best possible order of human society; for on this subject evidence is undeniably within our reach."

"We may thus regard evidence as a sort of beneficent divinity, whose pleasure consists in spreading peace on earth. Never do you behold mathematicians at war with mathematicians on account of the truths which they have established on evidence; if they enter into a momentary dispute, it is only while they are yet in the avenue of inquiry, and have investigation solely in view; but as soon as evidence has pronounced either on the one side or the other, every man lays down his arms, and only thinks of enjoying in peace the good which is thus acquired in common."

"Pass now," say the economists, "from the evidence of *mathematical* to that of *social* truths; to the evidence of that order of human affairs in society which would produce to men the greatest possible amount of happiness. From the known effects of evidence in the first of these cases, try to conceive what would be the effects of it in the second; what would of *necessity* be the internal condition of a society governed by that evidence; what would of *necessity* be the political and respective situation of all nations if they were illuminated by its divine effulgence; consider if men, rallied under the standard of that evidence, would have any division among them; if any motive for war would be sufficiently powerful to make them sacrifice to it their best, and to themselves *evidently* best possible condition: penetrate still deeper, and see if the pictures which that medium presents to you do not excite in you sensations, or rather transports, which elevate you above yourself, and appear to indicate that, by means of evidence, we communicate with the divinity.

"But to increase your sensibility to the impressions which those pictures will make upon your understanding and your heart, place in opposition all the inconveniences which, in a state of ignorance, arise from the force of *opinion*.

"A certain thing is forbidden under the sanction of punishments capable of inspiring the greatest terror. What power can such prohibition and punishments have against an opinion which tends to despise them? None; we have too many examples to prove it.

"A man is placed by his birth in a situation in which he might effect the happiness of a great number of other men, if he made a beneficent use of his advantages; what is it the man performs when his *opinion* is wrong? He sacrifices his advantages to the disorder of his opinion, lives and dies unhappy.

"One man unarmed commands an hundred thousand with arms in their hands, of whom the weakest is stronger than he. What constitutes his power? Their opinion; they obey him in obeying it; they follow their leader because they have an opinion that they ought to follow him.

"Do you wish to see other effects which characterize the force of opinion? Consider the effects of honour; of that sort of enthusiasm which prefers toil and fatigue to repose, poverty and privation to riches, and death to life, on which it finds the secret of shedding a lustre.

"*Opinion*, of one sort or another, governs the world. Even when it is but a prejudice, an error, there is no power in the moral world comparable to its power. Fruitful in phantoms, it borrows all the colours of reality, in order to deceive. Source inexhaustible of good and of evil, it is through it alone that we see, by it alone that we will and we act. According as it borders upon truth or falsehood, it produces virtues or vices, the great man or the villain. No danger stops it; difficulties render it more intense; at one time it founds empires, at another destroys them.

"Every man is therefore a little kingdom upon the earth, governed despotically by opinion. He will burn the temple of Ephesus, if it is his opinion that he should burn it; in the midst of the flames he will brave his enemies, if his opinion is that he ought to brave them. Our physical powers themselves are so completely subordinate to the power of opinion, that, to have the command of our physical powers, it is necessary to begin by having the command of our opinion; but how is it possible to have the command of opinion, while it is the sport of ignorance, and its nature arbitrary? How is it possible to fix and to unite the opinions of men, but by the agency of evidence? Is it not visible that the Author of nature has appointed no other means for chaining our arbitrary will?

"We ought to look, therefore, upon ignorance as the necessary principle of all the evils which have afflicted society; and upon the knowledge, that is, the evidence of the best possible order of society, as the natural source of all the good which is destined for the inhabitants of the earth.

"But as all the physical forces in the world cannot render that evident which is not so, and as evidence can spring from nothing but *adequate examination*, from the necessity of that evidence clearly follows the *necessity of examination*, from the necessity of examination clearly follows the necessity of the *greatest possible liberty of contradiction*, and, in addition to that liberty, the existence of all those political institutions which are required to give to evidence its greatest possible *publicity*."

The *publicity of evidence* was a subject on which the economists dwelt with peculiar emphasis, and which they branched out into a number of the most important consequences. "The necessity of it," they said, "was apparent from this, that the proper order of society cannot be solidly established, but in proportion as it is sufficiently known. In any society, if some men only had knowledge and evidence of this order, while the multitude rested in other opinions, it would be impossible for this order to govern; it would in vain command; it would not be obeyed. This state would be that of a perpetual intestine war of one part of the nation with another. By *intestine war* they did not, however, mean," they said, "only that which is performed with arms in the hands, and by open force; they more peculiarly referred to those disguised and clandestine ravages and oppressions, exercised under forms of law; to those dark and predatory practices, which sacrifice all the victims which artifice is able to bring within their power; to all those disorders, in a word, which tend to make all particular interests enemies of one another, and thus to uphold, among the members of the same political body, an habitual war of clashing interests, the contending effects of which tear in sunder all the bonds of society. This situation is so much the more dreadful, in as much as, excepting the superior and governing force of evidence, there is no power in nature equal to that of opinion; as in its aberrations opinion is tremendous, and as no means exist by which we can make sure of retaining it always within proper limits, when it is once given up to its own inconstancy, and to seduction.

"From the *publicity*, which is an indispensable condition to possession of evidence respecting what is best in the social order, we are conducted to the necessity of *public instruction.* Though faith," said the economists, "be the gift of God, a peculiar grace, which cannot be the work of men alone; nevertheless it is held that the preaching of the gospel is peculiarly necessary to the propagation of the faith. Why, then, should not every one have the same opinion with regard to the publication of the social order, more especially as that publication has no need of being aided by grace and supernatural light? This order is instituted for men, and all men are born to live under it; it is then required by this order that men should know it, and accordingly they have all a sufficient portion of natural faculties, to be able to elevate themselves to that knowledge. For the same reasons that knowledge is required, instruction is required, by which alone certain kinds of knowledge can be attained."

The economists did not enter into details respecting establishments necessary for instruction. They, however, affirmed, that such establishments "constituted a part of the essential form of a society, and that they could hardly be too numerous, because instruction can never be too common." They affirmed, also, that "verbal instructions did not suffice; that it was necessary to have doctrinal books, suited to the purpose, and in every body's hand. This help," they said, "was so much the more important, as it was clear of all inconvenience, for error cannot stand in the presence of evidence; and contradiction is not less advantageous to evidence than it is fatal to error, which has nothing to fear so much as examination."

What they affirmed with respect to the necessity of those which they called doctrinal books, and of the liberty which ought to reign with regard to them, "was founded," they said, "upon the very nature of that order which is due to society, and of the evidence which belongs to it. That order," they observed, "is either perfectly and evidently known, or it is not. In the first case, its evidence and simplicity render the formation of heresies on the subject of it altogether impossible. In the second case, men cannot arrive at knowledge or evidence, but through the conflict of opinions. It is certain that an opinion can be established only upon the ruins of those which are opposed to it; it is further certain, that every opinion which is not founded upon evidence will be contradicted, until it is either destroyed, or recognized on evidence for a truth, in which case it ceases to be a bare opinion, and becomes an evident principle. And thus, in the pursuit of truths, capable of being established on evidence, the conflict of opinions leads, of necessity, to evidence, because it is by evidence alone it is capable of being terminated."

This doctrine is of such infinite importance, that we are willing to prolong it, by adding the illustration which the economists were accustomed to adduce. "If a man should be actuated by any motives to write a book endeavouring to persuade his countrymen that they might live without subsistence, that they ought to make commodities without the materials, that they multiply themselves by change of place, or any other extravagant opinion, it would be highly useless for the public authority to give itself any concern or labour to prevent such a book from making an impression upon the public mind; and, far from feeling any alarm, every body would rest securely upon the evidence of the contrary truths, assured that this evidence would always be sufficient for itself, and would quietly triumph over all the ridiculous efforts which would be made to oppose it.

"So absolutely necessary is it to leave to the whole body of society the greatest possible freedom of examination and contradiction; so absolutely necessary is it to abandon evidence to its own strength, that there is no other power which can supply its place; physical power, of what magnitude soever, can command actions alone, never opinions. The experience of every day affords to this truth the evidence of the senses. So little have our physical powers any influence over our opinions, that our opinions, on the contrary, exercise an uncontrollable dominion over our physical powers. Our physical powers are put in motion, and guided by our opinions alone. The common or social, called the *public force*, is formed by the union of the physical powers of many individuals. This supposes, necessarily and invariably, a correspondent union of evils; and this can never exist but in consequence of an union of opinions, good or bad. It is, therefore, to reverse the order of things, and take the effect for the cause, to desire to give the public force a power over opinion, while it is from the union of opinions that public force holds its own existence, and while, by consequence, it can have no stability but in proportion to that which reigns in the opinion on which it is founded, that is to say, in proportion as bare opinions, stripped of evidence, are replaced by opinions fixed and invariable, because founded upon evidence which cannot deceive."

3. *Laws.* Having established as incontrovertible truths, that property is necessary to the production of the means of human life and enjoyment, that the system of human rights and duties spring from it as natural consequences, and that the natural and essential order of societies is nothing in reality but the chain or connected order of these same rights and duties, the economists laid down the following definition: "That the essential form of a society is the continuation of all those social institutions which are necessary to consolidate the right of property, and secure to it all the liberty which essentially belongs to it."

Among these instrumental establishments, an important place is held by laws, of which they communicated the following very striking and original idea.

"A multitude of men assembled without acknowledging any respective rights, any reciprocal duties, would not form a society. That does not consist in the meeting of a number of men in a particular place. It may subsist among men very remote in respect of place, and not subsist among men very near in respect of place. *That which really constitutes the union, are the conditions of the union.* These conditions are the systems of rights and duties, in other words, the conventions entered into for their common interest by the members of the associated body. The laws, then, are precisely those conventions, by operation of which, the reciprocal rights and duties are established in such a manner that the members of the society are no longer permitted arbitrarily to depart from them.

"Of these conventions, some are of such a nature as cannot be defined very exactly, or at least cannot be enforced by artificial sanction, but must be left to the natural coercion of the approbation and disapprobation of mankind. Such are the common duties of morality; gratitude, veracity, charity, and the like. But the next class of these conventions are those which are capable of being defined exactly, and enforced by artificial sanctions; as, that murder shall not be committed, property shall not be stolen. This last class of conventions are those which are properly called *laws.*

" The first property necessary to give those laws their best possible *form* (for, in regard to their substance, it is always supposed that they are strictly conformed to that utility from which the whole system of rights and duties takes its origin) is, that they be definitive; to distinguish, by an incontrovertible line, what each of them does, from what it does not, comprehend. This is implied in the very notion of a law, which is to render something *positive,* which would otherwise be *arbitrary.*

" The second property necessary to give laws their best possible form is, that they be written. This is indeed implied in the first property; because no combination of ideas can be rendered *positive* and *unvarying,* of which the *expression* is not *positive* and *unvarying.* But nothing can render an expression positive and unvarying but a permanent sign; and, of permanent signs, none is equal to writing.

" The third property necessary to give to laws their best possible form is, that the reason of each be annexed to it. The distinction is very important between the *letter* of the law, and the *reason* of the law. The *letter* of the law is its textical composition; the *reason* of the law is the motive by which it was dictated. *The man who is guilty of murder shall receive a certain punishment.* This is the *letter* of the law. The *reason* is, that *if murder were common, and not restrained by adequate motives, the happiness of human beings, if not the species, would soon be destroyed.* Having thus acquired a knowledge of the reason of the law, I possess the *evidence* of its *utility.* And of this I should not have been possessed, had I seen in the law nothing more than the *letter.* Let us suppose two laws, which equally assign the punishment of death; the one for homicide, the other for walking at certain hours in the day. Is it not clear that they would be viewed with different eyes; that the one would appear to be just, the other tyrannical; that we should feel within ourselves a natural disposition to submit to the one, a disposition to avail ourselves of every thing which might serve as a means to deliver us from the hateful yoke of the other? This difference arises from the different judgment we form of the *reason* of these bad laws. The first carries with it the *evidence* of its *utility;* and that *evidence* overcomes and binds without resistance the understanding and the will. The other carries with it, instead of the evidence of utility, the evidence of nothing but a disproportional rigour, of a manifest evil, to which our understanding, and consequently our will, can never submit.

" It is not, therefore, in the *letter,* but in the *reason* of the laws, that we must seek for the first principle of a constant submission and obedience to the laws; for that principle can be nothing but the dominion exercised over our minds by the *evidence* of the justice of necessity, that is, the *utility* of the laws; now this evidence is not in the *letter* of the laws; to establish that submission, therefore, generally and invariably, two conditions are requisite; one is, that the reason of the laws contain conclusive *evidence* of their *utility,* commonly called their justice and necessity; the other is, that the publication of this evidence be so complete, in respect both of clearness and diffusion, as to lodge it in the mind of a majority of all classes of the people. Men, persuaded that their laws were bad laws, might indeed for a time be constrained to observe them; but such a submission, contrary as it is to nature, could not be durable, nor escape daily breaches on the part of those who regarded themselves as suffering by the injustice of the laws. *Submission to the laws is always, and necessarily, proportional to the idea which we hold of their justice and necessity;* that is, their indispensable use in procuring good and eschewing evil.

" If laws," said the economists, " are any thing but the results of the natural order of society, or of that system of duties and rights which are rightly founded upon the interest of all; if the legislature of any country sets up rights and duties of another sort, these new rights and duties are contrary to the first; and hence, of necessity, the laws which prescribe them are in a state of perpetual opposition with our understandings and wills." This contrariety they proved in the following manner: " All the rights which a reasonable being can desire are summed up in that of property; because from the right of property results the liberty of enjoying; a liberty which ought to have no bounds but those which are assigned to it by the similar rights of property belonging to other men. As the essential order of society thus determines the measure of liberty belonging to each of its members, and as that measure is the greatest which can be, without disturbing that essential order itself, it is impossible that any thing should be added to the liberty, that is, to the rights of one set of men, without taking from the liberty, and by consequence from the property, of other men; and this is an injustice and disorder, the tendency of which is destructive to the society."

It is destructive to the society, because it throws it into a state of violence. " My neighbour," says Mercier de la Rivière, " will be content that he is not allowed to reap or to injure my crop; but for the same reason he will not be content that I should be allowed to reap or to injure his. On the view of such an injury permitted in regard to any other man, he will take the alarm, his fears will be excited for himself, and this anxiety will be a state of torment, from which his reason will perpetually urge him to seek relief. A law which violates the principle of utility, is a law therefore resisted by that evidence which governs beyond control the human will. To make such a law, is to put the society into a state of violence, because it is to put the minds of men into a state hostile to one another, and more or less hostile to the laws.

4. *Magistrates.* By this term the economists understood judges, and, in a word, all the leading functionaries employed in giving execution to the laws. Agreeably to the doctrines already exhibited, they conceived that the first service of the magistrates is that of shedding the light of *evidence* upon the particular cases which have been too obscure for the parties. But as there are some minds with which you cannot be sure of being able in every case to bring evidence, as it were, in contact, the magistrate needs to be armed with a coercive power; and all that is necessary is, that he affords to the rest of the community *evidence* that in such cases the power has been used agreeably to the principle of general good.

From these premises, the chief consequence which they deduced was, that the legislative and judicial powers are never to be united in the same hand, without destroying among the people all certainty of the justice and necessity of their laws, that is, the very essence of the laws themselves.

" The essential form of positive laws," they said, " in that which makes them to be what they ought to be, is, that they consist of certain visible signs, which show, that in the institution of them, that order has been followed which is necessary, 1*st,* to ensure their justice and necessity, that is, their adaptation to the ends of obtaining good and avoiding evil; 2*dly,* to render their adaptation to those ends evident or certain to the individuals whom they concern. Now it is clear that these conditions could not be fulfilled if the legislative power was to engross the judicial functions. The legislator and judge being the same person, neither could the legislator find any resource against his own mistakes in the close review and experience of the judge; nor, on the other side, could the arbitrary will of the judge find any bridle or chain in the authority of the legislator; but the laws, however good in themselves, would be rendered evil by a variable and corrupt administration.

"If the legislator were judge also, his business would be to consummate and to crown all the mistakes which he incurred, or the abuses which he committed, in the formation of the laws. If the judge were legislator also, the laws existing only in conformity to his will, he would be under no necessity to consult the laws in passing his judgment, and would always ordain as law-maker, what he should have to determine as law-interpreter. Thus the *reason* of the positive laws would be found to consist in nothing but the will of the legislator, as he would be guided in making them by nothing but its arbitrary impulses; and, in the same manner, the *reason* of the judicial decisions would be found to consist in nothing but the mere will of the judge, whose independence would enable him to make them whatever he pleased. This double malady abundantly proves that those laws would be stript of the essential characteristics of law, the evidence of their justice and necessity, and an absolute exemption from every thing arbitrary."

The duties of the judge they deduced in the following order: As the laws are in themselves mute, and the magistrate is the organ through which they speak, he is particularly charged with the *guardianship* of the laws. It is of importance to know what is implied in the term guardianship of the laws. It relates either to the laws which *are* made, or to those which are *to be* made. The natural strength of the laws consists in the evidence of their goodness. Their weakness consists in the strength of the hands which dispose of the physical power. As the laws are mute in themselves, they cannot wield that evidence in which their strength consists. The magistrates, who are the mouth of the laws, ought therefore to wield it for them, and to resist the hands in which the physical power is deposited, when they attempt the infringement of the laws, with all the force which evidence can be made to exercise over the minds of the community.

The same principles demonstrate what are the duties incumbent on the depositaries of the judicial power with regard to laws *to be* made. As laws ought all to be founded on that concatenation of the causes of human good which the economists denominated "the primary and essential reason of all laws, the *evidence* of that primary and essential reason was," they said, "a deposit, so to speak, in the hands of the judicial instruments, of which they owed an account to the legislature, to the nation, and to God himself, of whose supreme will that evidence is the decisive token. It was their first duty, therefore, to have a perfect *knowledge* of that primary and essential reason." Their next duty was, on all occasions, as far as their utmost efforts could extend, to impart that evidence to the governing power, and to make it as clear as it can be made, what laws, not yet proposed, that evidence shows that the society requires.

The economists further affirmed, "that no man can, without rendering himself criminal towards earth and heaven, undertake to perform the office of judge, according to laws that are *evidently* unjust. He would in that case cease to be a minister of justice, in order to become a minister of iniquity. If any law, for example, ordained that a man should be condemned to the ultimate punishment, on the mere denunciation of another man, and without any inquiry into the truth of the allegation, is it not evident that such a law would be a law of murder? And is it not equally evident, that the barbarian who should pronounce a judgment agreeably to that law, would be the voluntary instrument of murder? It is necessary, however, either to go the full length of saying that a man can, without guilt, become the instrument of such a law, or allow that no minister of the law ought to lend his ministry to the execution of a law evidently unjust; for if he may for one such law, so he may for all, however atrocious; no outrage to humanity, no excess of evil, presents any limiting point."

5. The *tutelary authority*. "The union of wills to form that of individual powers; the union of individual powers to form a common or public force; the deposit of that force in the hands of a chief, by whose ministry it may command, and make itself obeyed,—these," said the economists, "are the component parts of the tutelary authority. The tutelary authority is nothing more than a physical force resulting from an union of wills; and, by necessary consequence, it is impossible for it to be either powerful or secure, unless the intuitive and determining force of evidence be the principle of that union.

"In one sense, it may be affirmed that the right of commanding belongs to evidence alone; for, in the order of nature, evidence is the only rule of conduct bestowed upon us by the Author of nature. But all men are not equally capable of seizing evidence; and even if they were, the interest of the moment often operates upon them with such vehemence, that the appetite of enjoyment will not, in a state of disorder, be restrained by the evidence of duty. Among human beings, therefore, it is necessary that the natural authority of evidence be armed with a physical force; and that the legislative power, though it commands in the name of evidence, have the disposal of the public force to ensure obedience to its injunctions."

From the analysis of what is necessary to constitute the tutelary authority, the key-stone, as it were, of the arch of human society, that which gives to the whole its binding force, and retains the parts in their order, the economists deduced a variety of most important conclusions, of which we can only present the more striking as a sample.

The first is, that the legislative and executive powers are essentially inseparable, and that all the fine-looking theories, which have solicited and obtained so much of the admiration of a superficial world about the virtues of their separation, are phantoms in the air, the mere visions of imagination. "To dictate laws is to command; and as our passions render it impossible that commands should be more than useless sounds without the physical power of making them obeyed, the right of prescribing laws can have no existence without the physical power of enforcing them. The depositary of the power is, therefore, and necessarily, the master of the right; and the executive power is always and certainly the legislative power. Let the enemies of this conclusion turn and torture the subject which way they please, they never can escape from it. Suppose, in order to form two powers, that the legislative right is confided to one organ, the public force to another, when opposition arises, which of the two is to be obeyed? As it is impossible that two contradictory commands can be obeyed at the same time, it must be absolutely decided which of the two is in preference to be obeyed. Now, this decision is, by the very fact, the destruction of the other power, and the establishment of that one. These two powers, therefore, unavoidably run into one; the legislative power necessarily becomes the executive power, or the executive becomes the legislative.

The second is, that the legislative never has, never can have, a right to make *bad* laws. A right to make bad laws, they said, is a contradiction in terms. A right supposes a *compact;* it is the offspring of an agreement, tacit or express; the idea of it can no more exist without that of a mutual convention, than a debt without the contract of debtor or creditor. The compact upon which all rights are founded is that of mutual advantage; it is the union of all wills, freely determined by a great interest, of which the *evidence* is visible to all. How can that union which only exists for the sake of a good continue to exist if it is seen to produce evil? The hope cannot be framed of maintaining it by force, because force is its effect; force can exist only subsequent to union, and in consequence of union. The horrid prerogative of being able to make bad laws supposes necessarily a state of ignorance, a state in which the vices of the laws are not illuminated by evidence; for it is impossible that a community should consent to uphold that which visibly hurts them. The power exists in this hateful situation, but the right as little there as anywhere else.

The economists come next to the important question, What is *the security for the right use of the legislative power?* On this subject their anxiety to secure to their opinions the benefit of publicity, and the favour of those in whose hands the governing powers were actually deposited, led them to use the veil of expressions too general, and into some positive mistakes. "The security," they said, "for the right use of the legislative power, is the interest of that same power, which can, in the general order alone, find its own best possible state. The irresistible force which evidence acquires by publicity is also that security. This evidence exists in its greatest force in the body of the magistrates, who cannot, without ceasing to be ministers of justice, lend their ministry to the execution of laws evidently unjust; or forbear, without being criminal, their utmost endeavours to make the *evidence* of that injustice as clear as possible both to the legislature and to the nation."

The grand question followed, *What are the hands in which the legislative power ought to be deposited?* Having demonstrated that the legislative and executive powers cannot by possibility exist in any but the same hands, and that they form together what they denominated the *tutelary authority*, they proceeded to inquire what was implied in the idea of authority. "Unite," said they, "upon one object a multitude of opinions and of wills; from that union will arise naturally and necessarily an union of physical forces for the accomplishment of those wills; and from the whole together will result an authority, or, in other words, *a right of commanding, founded upon a physical power of procuring obedience to what is thus commanded.* If these opinions and wills should disunite, and form, for example, two parties, the forces will for that reason be divided; there will be two forces, two authorities, and, by consequence, two societies. That two authorities cannot exist in the same society, they maintained by the following proof. Such authorities must be either equal or not equal. If equal, each of them taken separately is null. If unequal, the superior is the real and only authority. That, in the first case, each taken separately would be strictly and literally null, arose, they said, from the very nature of equality, which rendered it absolutely impossible that the one could do any thing without the other. Neither of them, therefore, could procure a single act of obedience, except by their union; but, at the very moment of their union, they cease to be two authorities, and form both together only one authority made out of the union of both. Unity is, then, a part of the very essence of authority; to divide it is to reduce it to an incapacity of acting, that is, to extinguish it; for authority is not authority but in so far as it can act to procure the execution of its will."

From the necessary unity of the tutelary authority it followed, they said, by necessary consequence, that the organ of that authority must be one man. That the physical force which is one of its component parts can be directed only by one will, is above the need of proof. But it is said that one will may be formed out of the union of several wills, and that the public force is not subject to the separate wills till the union takes place.

To this the economists made answer, that if the opposition of one will can suspend the effect of all the others, it reduces authority to inaction, and for that reason destroys it. The reason why physical force is necessary is, that you cannot count upon the union of all wills. If, to avoid this objection, you have recourse, they said, to plurality of suffrage, you build no longer on the basis of evidence. That which divides opinions is not yet evident. As nothing in government ought to be arbitrary, and every thing that is not arbitrary is founded on reasons, that is, *evidence*, there cannot be diversity of opinions on matters of government, except from the effect of ignorance, or of bad design on the part of the deliberants. But it cannot be determined by a few voices less or more, on which side the ground of evil lies. Experience shows that an accredited error may long unite partizans in much greater number than the truth by which it is opposed. The number of those who concur in an opinion cannot render that evident which is not evident; their opinion is only opinion still, which is of course subject to change; for nothing but evidence is unalterable. And with respect to bad design, as that results from particular interests, it can never be determined whether the number of those whom such interests command is the greatest or the least. On both accounts, then, plurality of suffrage is not security.

But the greatest evil, they said, of the mode of determining, by majority of votes, the question respecting the social order, was, that it set individual interest in opposition to public; in which case the public interests are sure to be sacrificed. "How great soever the differences among men, they have within them, nevertheless, two grand moving powers common to all, and which are the source of all their actions—the appetite of pleasure and the aversion to pain. To suppose that men can move in opposition to those powers, is to suppose that the cause can depend upon the effect. But the desire of enjoyment, and opinion by which it is modified, cannot act naturally and constantly in the direction of the public interest, when authority is divided among several persons who are liable to have interests opposite to one another. For it may be laid down as a truth which will not admit of contestation, that the public interest cannot be considered as generally safe when it is in opposition to the private interests of those who are entrusted with it. If one or more of the public administrators behold any great advantage to themselves in a sacrifice which has been made, or which may be made, of the public interest, we ask, said the economists, What can prevent the sacrifice from being made? Not the two springs of action which nature has placed within us to be the cause of all we do; for they are in this case put in opposition to the public interest. Not any other authority in opposition to that of the public administrator, since by the supposition they themselves engross the whole of the governing power."

The remaining evil which the economists ascribe to this expedient was, that it attached to the number of votes a despotical authority, which can safely and usefully belong to *evidence* alone. "Under this system it is not evidence," they said, "which governs; it is opinion, or the will of a certain number of men actuated by the same opinion.

The mischief apt to result cannot be estimated; it is without bounds. Suppose, in fact, that the vote of the majority is dictated by private interests, and that *evidence* is on the side of the minority, is it not monstrous that the former should command, and that the form of the government should lend to bad design a title to triumph over evidence itself? This excess of disorder is nevertheless inevitable under so defective a plan of government; and the nation remains absolutely without protection against the scourges with which, under private interest set in opposition to public, it may be lacerated, especially if these private interests are the interests of men who, by their riches or otherwise, are in possession of power.

"We forget not," they said, "that the mischievous tendency of private interest would find a counterpoise in the *knowledge of the nation.* It is very true, that in a nation really enlightened, a nation that had from *evidence* the knowledge of its own true interests, the body of rulers could not abuse their authority. But why? because the evidence of the abuse would in that case annihilate the authority. But the idea of a nation governed by plurality of suffrage, and by evidence at the same time, involves an absurdity. Again, a nation sufficiently instructed to know all the links in the chain of social good and evil, would never sanction a form of government which places the common interest in opposition to the private interests of those to whom it is entrusted. Besides, it would be ridiculous to suppose a nation sufficiently instructed to have the wills of all united under the evidence of what is best in the social order, and to suppose its rulers at the very same time so ignorant as to be divided on those subjects, and reduced for a ground of decision to plurality of suffrage.

"So long, on the other hand, as a nation is not thus instructed, the people properly so called, sunk in ignorance and prejudices, see no farther than the nearest objects by which they are surrounded; each canton thinks the interest of the state is all summed up in the interest of that canton; each profession in the interest of that profession; the knowledge of relations and dependencies is absolutely wanting. Such men cannot ascend from effects to causes, much less enumerate the links in the chain of causes and effects. It becomes, therefore, morally impossible for them to act by principle and by rule. Ever credulous, and prone to prepossession, they must be gained in order to be persuaded; the same artifices must be practised upon them which are used to seduce them. The resolutions of men, the sport of momentary impressions, must have all the inconstancy of these impressions. Divided into rich and poor, the rich look upon the poor as made for them, and upon every power which they wish to possess as naturally their due. The poor, justly discontented with the treatment they receive, and mistaking the cause, are tempted to envy the condition of the rich, and to regard as injustice the inequality of the partition which is made between them. It is evidently, therefore, unsafe to choose the body of administration exclusively from either of these two classes. Nor would much be gained if one half were chosen from the one and the other from the other. If the separate portions continued to be governed by the prejudices and views of the classes to which they belonged, they would do nothing but contend; and there is only one way in which they could receive a motive to cease,—*if collusion would enable them to serve their own private interests by sacrificing the interests with which they were entrusted.*"

The economists come then to their grand conclusion with respect to the artificial or physical security of the social order. To the question, what is the best form of government, they answered, the government of a single individual, uniting in his own person the whole of the legislative and executive powers; in other words, absolute. "All men," they said, "would confess that the best form of government was that which was so perfectly conformable to the natural and essential order of societies, that no abuse could result from it; that form, in short, which renders it impossible to make gain out of misrule—which subjects him who governs to the absolute necessity of having no greater interest than that of governing well." This advantage would be found, they affirmed, in the government of an hereditary sovereign, and it would be found in no other.

The reason was, that in no other could the interests of governor and governed be rendered absolutely the same. As the hereditary sovereign is the hereditary proprietor of the sovereignty, the interest of the sovereignty is his interest. The interest of the sovereignty means the most perfect possible state of the governing authority; that is, the most perfect possible assurance of obedience to its command. But obedience to command can only arise out of the union of wills. And there can be no perfect assurance of the union of wills to obey but from one cause; the evidence that what is commanded is for the benefit of those who are to obey. The interest of the hereditary sovereign, therefore, and the interest of the community, is one and the same.

With regard to the famous idea of the *balance* of a constitution, that fancied arrangement of things in which the power and will of one part of the instruments of government finds a counterpoise in the power and will of another; this pretended counterpoise the economists treated as a perfect chimera, a mere imposition of the imagination, a sort of day-dream.

The nation, they said, is either instructed or not instructed. Let us examine the supposition of the balance in both cases. If it is instructed, or, in other words, possesses the evidence of the causes of good and evil in society, there is no balance of forces; there is only one force, because force follows will, and here wills are united. They carry the development of this idea to a great length, to which our limits will not permit us to follow them.

If the nation is not instructed, or, in other words, does not possess the evidence of the causes of good and evil in society, the establishment of counter-forces is impracticable. To ignorance there can be only one salutary counteracting force, and that is evidence. The effect of ignorance in the sovereign is dreaded; and to remove the dread, another man's ignorance is provided. This is what people call making counter-forces. It must be confessed that they are not of the very best sort of materials. How could it ever be imagined that confidence for any thing stable could be laid on any thing so unaccountable as the results of ignorance?

Let us adopt this chimera for a moment, and ask if it be possible to assure ourselves that each force will be the same to-morrow which it appears to be to-day. It is evidently impossible; nay, what each appears to-day may be a *false* appearance; for, resting only on opinion, detached from evidence, it rests on what can never be exactly known.

The idea of a balance is the idea of two powers, one tending by its own force in one direction, another urging it by an equal force in an opposite direction. The effect is rest. To balance the power of the sovereign acting in one direction, you provide another power acting in an opposite direction. If the powers are equal, they destroy one another, and there is no action. If they are unequal, there are not two powers, but only one power; for the greater swallows up the less.

The theory of a constitutional balance is founded on a metaphor, a contrivance of language; and moral forces are supposed to be subject to the laws of material forces. Material forces acting on a body in different directions, make it assume a certain determinable duration between the two. But it has not been considered, that in physics the direction given does not depend upon the opinion of the things which act. In morals, on the other hand, the things which are depended upon for counteraction change their duration according to their opinion. A theory which supposes that to be uniform and constant which is known to be the reverse, is evidently absurd.

Suppose every thing which the theory needs to be supposed. Conceive an assembly, or assemblies, provided to counteract the sovereign, and so constituted, as to form the most perfect counteraction possible; that the sovereign can ordain nothing but with the consent of the assemblies, and the assemblies nothing but with the consent of the sovereign. In this case, it is not a government of one, but a government of many; each member of the assemblies shares in the sovereignty; they are so many partners, therefore, with a particular partner at their head. The question is, what are the interests of the partnership? Those of the nation or not? The interests of the partnership doubtless are, to make it as profitable to the members as possible; for it would be absurd to suppose them not governed by their private interests. Suppose, then, that there is originally a tendency to counteraction between the sovereign and the assemblies. It is very obvious that they will put an end to this counteraction, as far as they discover that the suspension of it is conducive to their private interests. This is a law of nature, and may be taken for granted. As far, then, as the serving of the private interests of the members is concerned, there is no balance of opposite forces; the forces combine instead of opposing, and so far the balance is lost. The loss of the balance to this extent may be a loss engrossing the whole of the protection to the common interest which it was expected to yield, or it may be a loss not extending so far. If it goes to the whole extent of that protection, there is to the purpose in question no balance at all. If it does not go to the whole extent, there will still be some balance, more or less. What then is the case? The case is, that the loss goes to the whole, and that the balance does not exist. The balance does not exist, as far as the private interests of those who share among them the governing powers are concerned. But it is only from the private interests of those who govern that the nation has any thing to fear; it is only against these interests that the balance is provided. As far, however, as these private interests are concerned, the balance does not exist. As far, therefore, as the balance is even *supposed* to be of any service, the balance is excluded by the law of nature. It follows as a corollary, that in a country where the people depend upon what is called *a balance* as the whole of their security for good government, they have no security at all.

Such is the analysis which the economists present of the causes of good and evil in human society, and of that order of things which best insures the presence of the one and the absence of the other. That part of their doctrine which alone is yet known to the mere English reader, their *Political Economy*, is introduced as only an auxiliary exposition. It is part of the development by which they endeavoured to prove the identity which they supposed between the interests of the sovereign and the interests of the people. But, as a very distinct account of this part of their system has been given by Dr Adam Smith and other writers, and as our object rather was the exhibition of those doctrines of the sect which nobody has yet presented to our countrymen in their own language, we shall content ourselves with only marking the place which their political economy held in their general system.

As the society has public expenses, it is necessary that it also have a public revenue. To reconcile the formation of a public revenue with the idea of social order, it ought to be formed, if possible, without infringing the property of individuals, for the sake of which the order of society itself is established. It ought, therefore, if possible, to be formed without diminishing the revenue of individuals. When the real origin of revenue, the source from which it all is drawn, is sufficiently understood, the mode of forming a revenue for the sovereign, without diminishing that of individuals, would be immediately apparent. *The source of all riches is the land; because the land alone, of all the sources of production, yields a produce greater than the cost of the production.* The surplus produce of the land, therefore, constitutes a fund, which is over and above the remuneration to the agents of production, and out of which the revenue of the sovereign may be taken, without diminishing the motive to production; that is, without retarding the natural progress of the state in wealth, population, and felicity.

To lay the foundation for this plan of a public revenue, it was necessary to prove that the land is the only source of production; and that manufactures and commerce, though they alter the form of things, never add any thing to the amount or value of production. In the development of these views, one of the most remarkable results at which the economists arrived was the necessity of perfect freedom to all the proceedings which lead to production; as giving to produce that form which is most agreeable to those who are to make use of it. Till the time of the economists, the necessity of holding those proceedings in chains, and binding them to the will of governments, was the universal doctrine of governments, and, to a great degree, of speculators themselves. The general principles of the economists respecting the *freedom* of property necessary to constitute the foundation of social order, led them to infer the evil of those abridgments of freedom; but they examined the inference in detail, and showed that the meddling officiousness of governments to compel industry to one thing, and exclude it from another, not only failed to effect any good purposes, but of necessity created obstructions of the greatest magnitude to production in general, and tended powerfully to keep down the wealth, population, and prosperity of the state. The light which they diffused on this subject, and which soon produced a grand effect on the minds of men, was a good, the magnitude of which is beyond calculation.

Another of their conclusions is, that the revenue of the sovereign, taken, as they said it ought to be, wholly from the net produce of the land, ought to be a fixed and unalterable proportion of that produce. The reason appeared to them conclusive. If the proportion was variable, and depended upon the will of the owners of the land, they might be induced to break upon the public revenue, and deprive the state of those benefits which the public revenue is necessary to produce. If it depended upon the sovereign, the property of the land might be detached from that of its produce; nobody would have a motive to become a proprietor in land, and all the advantages which depend on the existence of that property would be lost the production of subsistence would fail, and the community could not exist.

This proportion being once fixed, there is no longer any contrariety between the interest of the sovereign and the interest of any portion of his people; and the proprietors of land are as completely and securely exempt from contributing to the expense of the state, as any other class of the community. The sovereign derives no part of his revenue from the subject; and this deplorable source of the conflict of interests is wholly cut off. The proportion being settled for ever between the sovereign and the land-owners, that alone is the property of the landowner which is the proportion remaining to him. The rest is, with regard to him, as if it did not exist. The sovereign they denominated, therefore, *co-proprietor* of the land; and between him and the landowner, commonly so called, a perfect community of interests is fixed. It is the interest of the sovereign that the produce of the land should increase, because, with every increase in the produce of the land, his revenue increases. It is also the interest of the landowner that the produce of the land should increase, because it is from the same cause that his revenue increases. See the article POLITICAL ECONOMY.

III. In the remarks which we have to offer on the doctrines of this sect, we must content ourselves with a few general strictures on one or two leading points.

The most important slips which the economists made in tracing the laws of the social order, are found in their deductions respecting the *tutelary authority*. Many steps, nevertheless, in that doctrine they have established. That the legislative and executive power are essentially the same, and cannot be separated except in *appearance*, they seem to us to have placed beyond the reach of dispute. That no security for good government can be found in an organization of counter-forces, or a *balance* in the constitution, they have proved in a manner equally satisfactory. But we think they have not proved that a security for good government can ever be found in the personal interests of a sovereign who unites in himself the whole of the legislative and executive power. And we think they have not proved that this security, if it cannot be found in the interests of such a sovereign, can be found in nothing else.

1. That the economists do not reason correctly from their own principles, when they regard the interests of the sovereign as an adequate security for good government, may be made apparent, we should hope, by an argument of a very few steps.

In a perfect state of the social order, they say that the interest of the sovereign would be the same with that of the community; and the evidence of this identity would be so clear to the sovereign, that the effect of it would be irresistible on his mind. But in a perfect state of the social order, they say also, that the interest of *every* man would consist in the most exact conformity to all the rules of that order, and that the evidence of this truth would be so apparent as to be sure of its effect. In the only state, therefore, in which the interest of the individual entrusted with the tutelary authority could be relied on as a security, the tutelary authority itself would not be required; for in a state in which every man would, of his own accord, do what is best, an authority to compel him to do so would be worse than useless.

The moment when you suppose a tutelary authority to be necessary, the moment at which you suppose there is any man in the community who can regard his private interest as consisting in any degree in what is hurtful to the community, how can you be sure that the depositary of the legislative and executive powers will not be that man? It can be easily shown that no man is acted upon by stronger forces to impel him in that direction.

In order to prove that the legislative power cannot be exercised by the community at large, the economists declare expressly, "that if we study the nature of each man in particular, we shall find in general that he would if possible have nothing but rights on his own side, nothing but obligations on the side of other men. The legislative power can be exercised with safety only by those who possess in perfection the evidence of the justice and necessity of the original and pervading laws of social order. It cannot, therefore, be exercised in safety by a body of men, among whom unequal rights exist, and must exist; and who at the same time are all separately desirous that the inequality should be in their favour."

Admit this—admit that all men in general desire to have nothing but rights on their own side, obligations on the side of other men; to have the inequality all in their own favour; to possess advantages, in short, over their fellows in the community; and it is surely absurd to talk of security in the interest of the sovereign.

It is a part of their doctrine, that he who is entrusted with the legislative power cannot be entrusted with the judicial power; because in that case the same party, both legislators and judges, would destroy law, by the exercise of arbitrary will. This is a direct admission, or rather an unlimited affirmation, that the interest of the sovereign is not a security such as good government requires. Again, it is said by the economists, "that under a government conformable to the principles of order, the positive laws would be of a justice and necessity *publicly evident;* and that in order to apply these laws, the judges would unite two sorts of knowledge, both of its meaning and of its reason; and, secondly, a knowledge of the facts which constitute the case in which they are required to decide." No men, according to them, are more urgently called upon, none can be more reasonably expected to be in full possession of the evidence of that interest which every man has in the preservation of the social order. Yet so far are the economists from saying that the interest of these men, and the evidence they could possess of that interest, would be a sufficient security for the right administration of their trust, that they declare them liable to the greatest malversations, and that the ultimate security would lie in the sovereign, who would check them. It is surely matter of wonder how the economists could fail to perceive, that the very same motives which they rejected as security for the right use of authority in the judges, they trusted to as complete security in the sovereign; though likely to operate on the judges with greater force than upon him.

2. We think it may also be made apparent, that the economists do not reason correctly from their own principles, when they conclude, that if security for good government cannot be found in the interests of one man entrusted with the whole of the legislative and executive powers, it can be found in nothing else.

They expressly state, that "the first, the real depositary and general guardian of the laws, is the nation itself, at the head of which is the sovereign. Accurately speaking, the deposit and guardianship of the laws *can* belong to those alone who are armed with the superiority of the physical force, to procure to that deposit its necessary superiority. This being evident, it is the nation as a body which naturally and necessarily is the depositary and guardian of its own laws; because there is in the nation no power comparable to that which results from the combination of its powers." Again,

In contending that the legislative and executive powers must always be exercised by the same hands, they affirm that those powers could only be exercised by those who had in their hands the superiority of the physical force. Observe, now, the legitimate conclusion:

The people alone have the physical force necessary to constitute them guardians of the laws. The same force is necessary for the makers and the executors of the laws. No body, therefore, but the people ever can, accurately speaking, have either the legislative or the executive powers. In a state of ignorance they may be led by fraud to lend their powers to their own destruction. But it is a part also of the doctrine of the economists, that in a state of knowledge, in which they may be easily placed, it is not possible they should make any but a good use of their power.

"A nation," they said, "governed according to the natural and essential order of society, has *necessarily* the perfect evidence and knowledge of it, and therefore sees with certainty that it enjoys its best possible situation. This perception, of necessity, unites all the wills and all the forces in the nation for the support of that order, and, by consequence, for the creation and preservation of all the institutions which are best adapted to that support." The people, therefore, may be safely trusted.

In a nation governed badly, governed not according to "the natural and essential order," but according to what the economists call the "*political* order," "it is always," they said, "one part of the nation which governs the rest; the weaker which governs the stronger. In this case, too, the power of him who commands consists in nothing but the powers united of those who obey him. And this union of their forces supposes, of necessity, the union of their wills; which can be founded only upon the persuasion that this obedience procures them their best possible condition. The powers of the nation in this vicious order are less at the disposal of the sovereign than at the disposal of those who hire to him their agency, and, by consequence, sell to him the means of procuring obedience from the nation; his situation is therefore at bottom a real dependence; his situation is precarious, uncertain, changeable; he is put in chains, which he dares not attempt to break." In every situation, therefore, it is the will of the people, either of the whole of the people united, or of a part of the people united against the rest, which is in reality both the legislative and the executive power. Estimate, therefore, as high as you please, exaggerate to any excess, the inconvenience of being governed by the people, you have that inconvenience still; you are bound to it by the inexorable law of nature; it is not within the range of possibility that you should escape from it.

We have already seen that the economists declare that "every man wishes to have all the rights on his own side, all the duties on the side of other men; that every man likes inequality, in short, when the inequality is in his own power." From this they infer, that the community cannot safely govern; but from this it may with much more justness be retorted upon them, that nothing else can safely govern. The interest of the community, say the economists, is easily known; the evidence of it is within the reach of all descriptions of the people, and so cogent as to be irresistible. The union of wills, according to their doctrine, follows as a matter of course. Here, therefore, it should seem we have a much better security than can be found in the interest of any *individual*, sovereign or subordinate.

It is remarkable enough that the economists have wholly overlooked, in their criticism on the plans opposed to their own, *the representative system;* and yet it is pretty evident that it is by means of the representative system that the grand problem of government must finally be resolved. The speculations connected with this subject will, however, find a more fitting place under the article GOVERNMENT. (A. A. A.)

ECONOMY, POLITICAL. See POLITICAL ECONOMY.

ECSTACY. See EXTASY.

ECSTATICI, Εκστατικοι, from εξιστημι, *I am entranced,* in *Antiquity,* a kind of diviners who were cast into trances or ecstacies, in which they lay like dead men, or persons asleep, deprived of all sense and motion, but who, after some time, recovering their senses, gave strange relations of what they had seen or heard.

ECTHESIS, in *Ecclesiastical History,* a confession of faith, in the form of an edict, published in the year 639 by the Emperor Heraclius, with a view to allay the troubles occasioned by the Eutychian heresy in the eastern church. However, the same prince revoked it, on being informed that Pope Severinus had condemned it, as favouring the Monothelites; declaring at the same time that Sergius, patriarch of Constantinople, was its author.

ECTHLIPSIS, among Latin grammarians, a figure of prosody, by which the *m* at the end of a word, when the following word begins with a vowel, is elided, or cut off, together with the vowel preceding it, for the sake of the measure of the verse. Thus they read *mult' ille,* for *multum ille.*

EDAM, a small and woody island on the coast of Java, about two miles in circuit, whither criminals are banished. It is nine miles north-north-east from Batavia.

EDAMBAVANUM, a town in the north of India, province of the Carnatic, situated on the western shore of the bay of Bengal. Long. 75. 55. E. Lat. 10. 27. N.

EDDA, a system of the ancient Icelandic or Runic mythology, containing many curious particulars of the theology, philosophy, and manners of the northern nations of Europe; or of the Scandinavians who had migrated from Asia, and from whom our Saxon ancestors were descended. Mr Mallet apprehends that it was originally compiled, soon after the Pagan religion was abolished, as a course of poetical lectures, for the use of such young Icelanders as devoted themselves to the profession of scald or poet. It consists of two principal parts; the first containing a brief system of mythology, properly called the *Edda;* and the second being a kind of art of poetry, and called *Scalda* or *poetics.* The most ancient Edda was compiled by Soemund Sigfusson, surnamed the Learned, who was born in Iceland about the year 1057. This was abridged, and rendered more easy and intelligible, about one hundred and twenty years afterwards, by Snorro Sturleson, who was supreme judge of Iceland in the years 1215 and 1222; and it was published in the form of a dialogue. The latter added also the second part in the form of a dialogue, being a detail of different events transacted amongst the divinities. The only three pieces which are known to remain of the more ancient Edda of Soemund are, the Volupsa, the Havamaal, and the Runic chapter. The Volupsa, or prophecy of Vola, or Fola, appears to be the text on which the Edda is the comment. It contains, in two or three hundred lines, the whole system of mythology disclosed in the Edda, and may be compared to the Sibylline verses, on account of its laconic yet bold style, and its imagery and obscurity. It is professedly a revelation of the decrees of the father of nature, and the actions and operations of the gods. It describes the chaos, the formation of the world with its various inhabitants, the functions of the gods, their most signal adventures, their quarrels with Loke their great adversary, and the vengeance that ensued; and it concludes with a long description of the final state of the universe, its dissolution and conflagration, the battle of the inferior deities and the evil beings, the renovation of the world, the happy lot of the good, and the punishment of the wicked. The Havamaal, or Sublime Discourse, is attributed to the god Odin, or Woden, who is supposed to have given these precepts of wisdom to mankind; it is comprised in about a hundred and twenty stanzas, and resembles the book of Proverbs. Mr Mallet has given several extracts of this treatise on the Scandinavian ethics. The Runic chapter contains a short system of ancient magic, especially of the enchantments wrought by the operation of Runic characters, of which a specimen is also given. A manuscript copy of the Edda of Snorro is preserved in the library of the university of Upsal; the first part of it was published with a Swedish and Latin version by M. Goranson. The Latin version is printed as a supplement to Mallet's Northern Antiquities. The first edition of the Edda was published by Resenius, professor at Copenhagen, in the year 1665, in a large quarto volume, containing the text of the Edda, a Latin translation by an Icelandic priest, a Danish version, and various readings from different manuscripts. Mallet has also given an English translation of the first part, accompanied with remarks; from which we learn, that the Edda teaches the doctrine of the Supreme, called the Universal Father, and Odin, who lives for ever, governs all his kingdom, and directs the great things as well as the small; who formed the heaven, earth, and air; who made man, and gave him a spirit or soul, which will live after the body shall have mouldered away: then all the just shall dwell with him in a place called Gimle or Vingolf, the palace of friendship; but wicked men shall go to Hela, or death, and thence to Niflheim, or the abode of the wicked, which is below in the ninth world. It inculcates also the belief of several inferior gods and goddesses, the chief of whom is Frigga or Frea, that is, *lady*, meaning thereby the earth, who was the spouse of Odin or the Supreme God; and hence we may infer that, according to the opinion of these ancient philosophers, this Odin was the active principle or soul of the world, which uniting itself with matter, had thereby put it in a condition to produce the intelligences or inferior gods, and men, with all other creatures. The Edda likewise teaches the existence of an evil being called Loke, the calumniator of the gods, and the artificer of fraud, who surpasses all other beings in cunning and perfidy. It teaches the creation of all things out of an abyss or chaos; the final destruction of the world by fire; the absorption of the inferior divinities, both good and bad, into the bosom of the grand divinity, from whom all things proceeded, as emanations of his essence, and who will survive all things; and, lastly, the renovation of the earth in an improved state.

EDDREDSI, an island in the Red Sea, six miles from the coast of Arabia. Long. 41. 33. E. Lat. 17. 10. N.

EDEGHERRY, a town of Hindustan, in the Carnatic, 144 miles north-west from Madras. Long. 79. 42. E. Lat. 14. 51. N.

EDEN, the name of a country, with a garden, in which the progenitors of mankind were settled by God himself. The term denotes pleasure or delight. It would be endless to recount the several opinions which have been entertained concerning its situation, some of them very wild and extravagant. The garden was also called Paradise; a term of Persic original, denoting a garden. See PARADISE.

EDER, a town of Hindustan, possessed by independent chiefs, in the province of Gujerat, fifty-three miles north-north-east from Ahmedabad. Long. 73. 3. E. Lat. 23. 35. N.

EDESSA, also called ÆGÆ, a city of Macedonia, in the district of Emathia, twenty-eight miles west of Pella, which is celebrated in the ancient history of this kingdom as being the point from which the powerful family of the Temenidæ commenced their career of conquest, and from which they did not desist till they had subdued the whole of the neighbouring country. (Herodot. viii. 137, 138; Justin. vii. 1.) It continued long the royal residence; and even after it had ceased to be so, it still remained the burial place of the race of Temenus, and, as Diodorus says, the *hearth* of their empire. Here were interred Philip and Eurydice, king and queen of Macedonia; and it was intended that the body of Alexander, which was interred at Memphis in Egypt, should be placed in these vaults. (Diodor. xix. 52; Pausan. i. 6.) It was here that Philip was assassinated by Pausanias, at the marriage of his daughter Cleopatra with Alexander king of Epirus. (Diodor. xvi. 92.)

It is supposed to be the modern city of Vodina, on the river Vistritza, where Dr Clarke says there are sepulchres cut in the rock, which the superstitious inhabitants have never plundered, because they are afraid to go near them.

EDGWARE, a town of the county of Middlesex, partly in the parish of that name, and partly in the parish of Whitchurch or Little Stanmore, nine miles from London. Its chief importance is derived from being on the great road to St Albans and to Buckingham, a road constructed by the Romans, called the Watling Street. It formerly was remarkable for the splendid palace of the Duke of Chandos, which was one of the most highly finished and decorated of any of the noble edifices in England. This building has, however, been pulled down, and one of the wings converted into a dwelling for a family of respectability. The population of the parish amounted in 1801 to 412, in 1811 to 543, in 1821 to 551, and in 1831 to 591; but the parish does not include the western part of the town.

EDHILING, EDHILINGUS, an ancient appellation of the nobility among the Anglo-Saxons. Instead of *edhiling*, we sometimes meet with *atheling*, or *ætheling*; which appellation was likewise given to the king's son, and the presumptive heir of the crown.

EDICT, in matters of polity, an order or instrument, signed and sealed by a prince, to serve as a law to his subjects. We find frequent mention of the edicts of the prætor, or the ordinances of that officer, expounding the principles on which he was to administer the law.

EDINBURGH.

Situation.

EDINBURGH, a city, the capital of Scotland, and chief town of Mid-Lothian, or Edinburghshire, is situated within two miles of the south shore of the Frith of Forth, at the distance of about 392 miles north from London, in 55. 57. 20. north latitude, and 3. 10. 30. west longitude. The situation of this ancient city is exceedingly romantic. It occupies a congeries of hills and elevated grounds, rising gradually from the shore of the Forth, and attaining in some parts to a considerable height above the level of the sea. The central elevation, which has been compared to nothing so aptly as a wedge lying flat upon the ground, is terminated at its highest or western extremity by a mass of rock, seven acres in superficies at top, and about two hundred and fifty feet above the surrounding country; on which stands Edinburgh Castle, the nucleus of the city. From the castle, along the descending slope towards the east, and for a mile in length, the original, or, as it is now called, Old Town, was built in the shape of a spacious street. In latter times, the city, by means of bridges, was extended to the grounds on the south and north.

Origin and name.

The etymology of the name Edinburgh is obscurely but certainly found in the history of its origin. Subsequently to the year 449, or the era of Anglo-Saxon dominion in Lothian, the Castle became the occasional residence of the chiefs of the Northumbrian dynasty; and from Edwin, the potent king of the territory, the appellation *Edwin's burgh* was introduced. At a period coeval with or preceding the era of Edwin, the name applied to the fort was *Mai-din* in British, or *Magh-dun* in Gaelic, which may either signify the fortified mount in the plain, or the good fort; but when the English language came into use, some busy fancies conceived that *Mai-din* was the same as *Maiden*, and hence arose the title which it obtains in old writings, of *Castrum Puellarum*, the castle of maidens, and the fable that it had been the residence of the daughters of the British kings. The origin of Edinburgh can now with tolerable accuracy be traced to the beginning of the seventh century, or the era of Edwin, from which period it gradually though slowly increased in size. In the year 856 it is described as a considerable village; and, with the castle, it was often the object of contest in the wars which took place between its Anglo-Saxon possessors and the natives of Scotland. From the period of the cession of Lothian to the Scots, in 1020, the Castle continued to be the frequent residence of their monarchs; and here the widowed consort of Malcolm Ceanmore, the pious and worthy Margaret, died in the year 1093. In the reign of David I. the Castle continued a royal residence, and the town increased so much as to be considered one of the four chief burghs in the kingdom. Soon after his accession the munificent David founded the Abbey of Holyrood, on the plain at the eastern extremity of the rising ground on which Edinburgh was built. On the canons of this abbey he conferred the privilege of building a suburb westward from their church, along the ridge, in order to meet the burgh; and the new town thus reared by the monks received from them the name of *Canonsburgh*, or popularly *Canongate*, which title the eastern part of the old city still retains. For a considerable period after the reign of David, the houses of Edinburgh were all thatched with straw; but it nevertheless rose into importance, and in the twelfth century it was constituted a royal burgh by William I. surnamed the Lion.

The death of Alexander, king of Scotland, proved fatal to Edinburgh. In June 1291 the town and castle were surrendered to Edward I.; but in 1313 they were recovered by assault, under the conduct of Randolph earl of Moray, and the castle was destroyed. The English again took and repaired the castle under Edward III., who resided there and placed a strong garrison in it. In 1337 the castle, still in the custody of the English, was besieged by Sir Andrew Moray, the guardian of Scotland, though without success; and it was only by an ingenious stratagem, employed by Sir William Douglas, in 1361, that the fortress was secured by the Scottish patriots.

From the era of the murder of James I. at Perth, in 1436–37, the origin of Edinburgh as a national capital may be dated. Neither Perth nor Scone, Stirling nor Dunfermline, being able to secure royalty against the designs of the nobility, Edinburgh and its castle were therefore selected as the only places of safety for the royal household and the functionaries of government. The infant sovereign was crowned in the chapel of Holyrood, in which sat the first parliament of his reign. James II. was particularly attached to Edinburgh, and bestowed on it a variety of grants as to the holding of fairs and markets, the levying of customs, and also rights to property. Besides, in 1450, he conferred upon the city the pre-eminent privilege of erecting walls and bulwarks for its defence. Throughout the turbulent reign of James III. Edinburgh was the seat of the court and regular parliament; and this king conferred additional immunities upon the city, especially one assigning sites for certain markets, which to the present day partly continue in the places thus fixed upon. On account of the loyalty of the people in assisting him against Edward IV. he moreover granted the inhabitants a banner, with power to display the same in defence of their king, their country, and their own rights. This flag, which is still esteemed a sort of palladium of the city, is called from its colour the *Blue Blanket*, and remains in the custody of the convener of the trades. In 1497 Edinburgh being visited by a loathsome distemper, imported from abroad, the king by a proclamation ordered the magistracy to put out of the town all infected persons, who, in order to free the city, were transported by boats to the island of Inchkeith in the Frith of Forth, which thus served as a lazar-house for the time. James III., in his latter years, made Edinburgh Castle the repository of his treasure, valuable effects, and ordnance. In 1488, when this prince was murdered near Stirling, the whole fell into the hands of his rebellious subjects.

The first parliament of James IV. was held at Edinburgh; and in 1503, on the marriage of this prince with Margaret, the eldest daughter of Henry VII. of England, it was the scene of a gorgeous royal pageant, which is fully recounted by the historians of the time. In 1508 the king empowered the town to let the grounds of the Boroughmuir on the south; but the citizens were no sooner in possession of this grant, than they set about clearing the ground of its wood, and so many trees were cut down that they could not be disposed of; wherefore the magistrates enacted, that whosoever should buy as much as would form a new front to a house, might extend the same seven feet farther into the street. In consequence of this preposterous edict, Edinburgh was in a short time filled with houses of wood instead of stone, and the principal street was reduced fourteen feet in breadth. The year 1513 was the epoch of a dreadful plague, and also of the great national calamity, the defeat at Flodden. With James perished the magistrates and many of the burgesses; the privy council removed to Stirling for safety; the walls of the city were greatly extended to the south, and better fortified; and at the same time, 1514, the corporation of the burgh raised the civic military corps called the town guard, which remained in force till the year 1817.

Throughout the minority of James V. the capital was the constant scene of tumults, especially one between the Hamiltons or Arran's party, and the Douglasses or party of Angus, which is known in history by the name of *Clear the Causeway*. May 1532 is the era of the greatest event in the annals of the Scottish metropolis. This was the establishment of the College of Justice, or series of supreme courts and their functionaries. The city now became a place of resort from all parts of the kingdom; and the magistrates for the first time had the High Street repaired and paved, and gave orders to the citizens to light it. In 1538 the town was the scene of rejoicings, on the entrance into the city of James, with his wife Mary of Guise.

In 1544 the regency having refused to ally the young Queen Mary to the son of Henry VIII., an English fleet and army were sent to ravage Scotland; and in prosecution of this object the Earl of Hertford landed with a force near Leith, and set fire to the city in several places. In 1548 Edinburgh was garrisoned by French troops under D'Esse, who prevented the English from committing any further serious damage.

Disturbances consequent on the change of religion in Scotland broke out in 1556, at which time a concourse of people assembled to protect John Knox from the violence of the ecclesiastical judicatory. During the struggle which ensued in effecting the reformation, Edinburgh formed the chief position of the reformers, as Leith was of the French and Catholic party. By the assistance of a Protestant army sent by Queen Elizabeth, the reformers were finally triumphant, and the first assembly of the reformed kirk met at Edinburgh on the 15th of January 1560.

A new object of excitement soon appeared in the person of Mary, the young queen of Scots, who on the 9th of August 1561 arrived at Leith from France. On the 1st of September she made her public entry into the city. Darnley was proclaimed king at the market-cross in July 1565, and next morning was married to the queen in the chapel of Holyrood. In June following the queen was delivered of a son, afterwards James VI.; and in February 1567 Darnley was blown up by gunpowder in a house at the Kirk of the Field, on the site of which the college now stands. Mary's marriage with Bothwell occasioned fresh disturbances in Edinburgh; and during the period of the irregular warfare which ensued between the king's and queen's parties, the city suffered very severely. At length the young king himself entered upon public life, and on the 17th of October 1579 arrived in the metropolis with a cavalcade of two thousand horse, and held his first parliament in person. In the year following, the Earl of Morton was beheaded in Edinburgh, by an instrument called the *Maiden*, which he had himself introduced, and which is now preserved in the Museum of the Society of Antiquaries. The character of the city was about this period greatly improved by the erection of the college, which was commenced in 1581, and its first professor appointed in 1583. The infant institution was warmly patronized by King James, who, on the occasion of a temporary visit which he made to Scotland in 1617, desired that it should thenceforth be called King James' College. In 1585–86 the city was visited by the plague, and suffered severely from that affliction. In 1591 the city was alarmed by an attempt of the Earl of Bothwell to seize upon the person of the king in Holyrood Palace. The attempt, however, was defeated by the promptitude and vigour of the citizens. Bothwell himself escaped, but eight of his followers were taken and put to death on the following day. In 1596 the clergy and citizens united in tumultuary resistance to an attempt made by the king to control the language of the pulpit. Unable to subdue or restrain the insurrectionary spirit which he had excited, James withdrew from the town, and ordered all the public courts to be removed from it. A reconciliation, however, soon afterwards took place, and the offended monarch returned peaceably to his capital. In 1599 the first regular dramatists appeared in Edinburgh. They were from England, and there is some reason to suppose that the immortal Shakspeare was amongst the number.

Three years after this the regal dignity of Scotland became extinct, or rather merged in that of England. On the 24th of March 1603, James was called to the throne of the sister kingdom. Two days before his departure, he addressed the citizens in St Giles' Church, promising them a continuation of his countenance, and expressing the regret which he felt at leaving them. Amongst the marks of royal favour with which James visited Scotland after his accession to the throne of England, was his empowering the magistrates of Edinburgh, in 1609, to have a sword of state carried before them, and to wear gowns; this, it is believed, being the earliest appearance of magisterial robes in Scotland. In 1617 James paid a long-promised visit to his native country. He entered Edinburgh by the West Port, and was conducted through the city with great pomp, and every demonstration of rejoicing. On the 28th of June he convened his twenty-second parliament at Edinburgh. In this assembly there were several remarkable acts passed, and amongst these one for the restitution of archbishops, bishops, and chapters. Four years after this, namely, in 1621, an act of the estates and town council was passed for coping houses with lead, slates, or tiles, instead of thatch, which had hitherto been the covering commonly employed. In the same year water was introduced by pipes into the city; and three new bells were imported from Campvere in Holland, two for St Giles' Church, and one for the Netherbow Port.

Edinburgh seems to have enjoyed uninterrupted tranquillity during the remaining period of King James's reign. When he died, in 1625, the ministers of the city eulogised him as the "most religious and peaceable prince that ever was in this unworthy world." After the accession of Charles to the throne, which was proclaimed at the cross by the officers of state, a convention was held; and the town council, in consequence of certain ships of war being wanted, and forts for securing the coasts, not only agreed to advance the assessment when called upon, but also to contribute towards the maintenance of 10,000 men. Some time afterwards, a subsidy for four years having, at the king's desire, been granted by parliament, the inhabitants of Edinburgh generously advanced at once their quota, amounting to L.40,000 Scots. For these acts of kindness his majesty expressed his gratitude, by sending a sword and gown to be worn by the provost in the manner appointed by his father. Like his father, too, Charles resolved to visit his native country, and though prevented for some years from fulfilling his design, he at last accomplished it in 1633. He was received by the inhabitants with much pomp, and the celebrated Drummond of Hawthornden was appointed to address him on his arrival, which he did with all the characteristic poetical embellishment peculiar to the times. On the 18th of June, Charles was crowned in the Abbey Church of Holyrood, and on the 20th he assembled his first Scottish parliament in the Tolbooth. During his residence in the city on this occasion, Charles erected the bishopric of Edinburgh, a measure which was by no means popular, and gave rise throughout the country to a series of civil disturbances, the principal focus of which seems to have been Edinburgh. During the civil war in 1640, the magistrates fortified the town against the castle, and disciplined the citizens. The governor, on perceiving these demonstrations of hostility, fired upon the city; but being soon afterwards invested by General Leslie, he was compelled to surrender from want of provisions.

Charles visited the city a second time in 1641, and was received and entertained by the magistrates with the utmost deference and respect. A parliament met on the 15th of July, the result of whose proceedings was an entire change in the government, Charles retaining only the name of king, and the kingdom the appearance only of a monarchy. He agreed to an act of oblivion, by which his opponents were pardoned at the expense of his friends; and after a residence of four months in the northern metropolis, he returned to London, having entrusted his Scottish affairs to a committee of the estates. Two years after this, in the month of July, the Solemn League and Covenant for the extirpation of prelacy was signed in the High Church; and shortly afterwards the city raised and supported a regiment of twelve hundred men, to assist the English parliamentary forces against Charles, at a cost of L.60,000 Scottish money. For this and several other acts of hostility to the king, the town was in 1645 threatened with a visit from the Marquis of Montrose; but it was saved from this disaster by the presence of another. This was the plague, which committed great ravages amongst its population. It was, however, the last visit which this dreadful scourge paid to the metropolis. Shortly after this (such were the changes of these eventful times), the city borrowed L.40,000 Scots to raise troops for the national engagement in favour of Charles. This debt they afterwards refused to pay, on the plea that it was contracted in an unlawful cause. The impartial justice of Cromwell, however, subsequently compelled them in 1652 to refund the money. In May 1650 the Marquis of Montrose was conveyed a prisoner into Edinburgh. Three days afterwards he was brought to trial, condemned to death, and suffered on a gallows erected at the cross. Two months subsequently Charles II. was proclaimed on the same spot; and in the end of September following, the town was in the possession of Cromwell. On this occasion the magistrates fled to Stirling, then the head-quarters of the king's forces. The town was thus left without any other civic rulers than that of a body of thirty citizens, chosen by the inhabitants to discharge in part the functions of the magistracy, who absented themselves from the 2d of September to the 5th of December 1651. About this period the town council granted liberty to one Adam Woodcock to establish a stage-coach between Edinburgh and Leith; which is amongst the first notices of a public conveyance of the kind in Scotland, and on that account sufficiently remarkable.

On the 11th of May 1660, the magistrates sent the town-clerk to Charles, who was at Breda, expressing their concurrence in his meditated restoration, already agreed to by both houses of parliament in England, and their joy at the prospect of such an event. Their messenger "had a most gracious acceptance;" and, in the name of the burgh, presented "a poor myte of L.1000, which he did graciously accept, as though it had been a greater business." The feelings of delight which the arrival of the king in England excited in Edinburgh, were expressed in the customary mode of costly feasting, a sumptuous banquet having been served up by the town council at the cross. This attachment on the part of the citizens was ill requited by Charles, who, in settling the affairs of the kingdom, re-established episcopacy in Scotland, in opposition to the oath and obligation of honour by which he was bound. It is not surprising, therefore, that the Scottish people, so attached to presbyterianism, should have expressed their indignation at his conduct in the most open manner. But when the liberty of the press, and freedom in matters of religion, were in consequence also speedily infringed upon, the whole country rose in arms, particularly the western counties. The attempt, however, which was made upon the life of Archbishop Sharp in the streets of Edinburgh led that prelate to advise those milder measures which were soon afterwards adopted by government. In 1679, James, then duke of York, came to reside in Edinburgh, and took up his abode in the Palace of Holyrood, where he remained till May 1682. During this period he rendered himself extremely odious by his opposition to the Covenanters, and by his attempting the revival of the drama, and encouraging other amusements to which the people were exceedingly averse.

Two years after this, the magistrates set up for the first time a regular state carriage; and were so much pleased with the accommodation and conveniency of this novelty, that they ordered two coaches from London for their own especial use, with the addition of four horses. On the demise of Charles II. in 1685, the town council erected an equestrian statue to him in the Parliament Square, as a proof of their gratitude to and affection for that monarch. Soon after James' accession, the unfortunate Earl of Argyll was brought a prisoner into Edinburgh; and after being ignominiously paraded through the streets, his head was struck off by the Maiden, this being the last time, it is believed, that the instrument was employed. After a series of disturbances and tumultuary proceedings, occasioned by the attempts of James VII. to restore the Roman Catholic religion, a convention of estates was held at Edinburgh, in which it was declared that James had forfeited the crown; a resolution which was followed in March 1689 by an offer thereof to William and Mary.

The next epoch in the history of Edinburgh is formed by the celebrated Darien expedition in 1696. The intervening period is not without interest, but it exhibits no event of any importance in relation to the city. The occurrences during that time were wholly of a national character, and are therefore more properly to be looked for in the history of the kingdom. In the famous bubble alluded to, Edinburgh was deeply interested, and was full of the high anticipations which this speculation had diffused throughout Scotland. About L.400,000 sterling were subscribed in the country. Six ships of considerable force and burthen, and laden with various commodities, sailed from the Frith of Forth; and in 1699, when intelligence arrived of the settlement being formed, the rejoicings in Edinburgh were unbounded. On the other hand, the disappointment excited on learning in the following year of its failure, filled the streets for several days with tumult and riot; and the city altogether presented such a scene of lawless anarchy, that the commissioner and officers of state deemed it necessary, for their personal safety, to retire until the popular fury had somewhat abated.

In 1702 a similar commotion was excited, from an apprehension on the part of the populace that one Captain Green, and his accomplices, four in number, who had been condemned for piracy and murder on the high seas, were, through the connivance of the authorities, to be permitted to escape the consummation of their sentence. The Lord Chancellor, in passing from the privy council in his coach, was attacked at the Tron Church, the glasses were broken, and he himself was dragged from the carriage. He was rescued by some of his friends; but it was found necessary to sacrifice the seamen to the resentment of the populace. The following year was distinguished by its presenting the last exhibition of the ancient Scottish national pageant called the Riding of the Parliament. This parting show took place on the 6th of May 1703. In 1704 the inhabitants of Edinburgh were gratified by a ceremony quite in accordance with the spirit of the age. By an act of the privy council, a large quantity of vestments, beads, chalices, crucifixes, and other appurtenances of Catholic worship, were brought to the cross, and there publicly burnt before the eyes of a delighted populace.

The tumults to which the city had been so frequently subject were revived in 1707, on the occasion of the proposed union of the kingdoms. This, as is well known, was at first an exceedingly unpopular measure in Scotland; and the consequence was a series of the most violent and outrageous proceedings on the part of the mob, in order to intimidate those members of the Scottish parliament who were favourable to the obnoxious project. The deed, however, was finally accomplished, though not without great danger to the lives of its most active promoters. A small summer house in the Regent Murray's garden is still pointed out as the place where the last signatures were attached to the document which terminated the independence of Scotland as a separate kingdom.

In the civil war of 1715 Edinburgh was little further involved than from the circumstance of an unsuccessful attempt made by the Jacobites to surprise the Castle. About this period the provost received a regular salary of L.300 per annum in order to defray his expenses; and in 1718 the scheme which had for some time been framed of extending the pier and building docks at Leith was in part executed; the town's debts, which even then amounted to L.25,000, being thereby, in the space of five years, nearly doubled.

The next occurrence of any importance in the annals of the city, was the celebrated tumult designated the Porteous Mob, which took place in September 1736. The accounts of this remarkable affair are so numerous, so easily accessible, and withal in general so full, that it is deemed unnecessary to give more than a mere outline in this place. Porteous, whose name distinguishes the transaction, was captain of the city guard. At the execution of a criminal of the name of Wilson, whose fate had excited an extraordinary sympathy, Porteous, dreading a rescue by the mob, who suddenly became tumultuary, ordered the guard to fire on them. Six people were killed by the discharge, and eleven wounded. For this Porteous was tried and condemned to death; but he was afterwards reprieved by Queen Caroline, then regent. Resolved however that he should not thus escape the fate which they conceived he merited, the mob, on the evening of the day previous to that on which he was to have been executed, broke into the jail in which he was confined, and having dragged him out, led him to the Grassmarket, the usual place of execution at that period, and there hanged him by torch light on a dyer's pole.

On the 17th September 1745 Edinburgh was taken possession of by the rebels under Prince Charles Edward. A party of the Highlanders secured the Netherbow port, and thus made themselves masters of the city. The main body of the rebel army arrived shortly afterwards at the King's Park, headed by the Chevalier in person, who took up his residence in Holyrood, where he held open court, and was visited by great numbers of the inhabitants. The city remained on this occasion in the hands of the rebels till the 31st of October, when, finding it impossible to reduce the castle, they proceeded on their march towards England.

The public transactions of an historical nature which occurred in the metropolis after these events, are not, except in a few instances, such as to require a particular description. On the 2d of February 1779, an infuriated mob, under the influence of religious fanaticism, burnt one Roman Catholic chapel and plundered another. Twelve years later, on the outbreaking of the revolution in France, a considerable body of the inhabitants manifested their admiration of the new political principles which were then brought so prominently forward, by forming themselves into associations for supporting the cause of political regeneration. These societies, the members of which received the appellation of Friends of the People, at length drew down upon them the notice and vengeance of government. Several persons accused of having been concerned in spreading sedition, and engaged in treasonable practices, were arrested and brought to trial. One of them named Watt, was condemned and beheaded, whilst others were transported. Subsequently, during the war with France, the citizens showed great zeal in support of the government, by forming themselves into regiments of volunteers, consisting of yeomanry, artillery, and several corps of infantry. On the last night of the year 1812, being the season devoted to innocent festivity, the streets of Edinburgh were disgraced by a series of riots, outrages, and robberies, hitherto unparalleled. During almost the whole night, after eleven o'clock, a gang, principally composed of young men, armed with bludgeons and other weapons, infested some of the principal streets of the metropolis, and knocked down, robbed, and otherwise wantonly maltreated almost every person who had the misfortune to fall in their way. In the dreadful tumult and scuffles which ensued, one officer of police was killed and many persons dangerously wounded, some of whom died in consequence, whilst a great number received severe contusions. Several rioters were seized, and being brought to trial, three were condemned and hanged, whilst some others were transported. This fearful outbreaking of juvenile delinquency led to the adoption of several beneficial plans for the better instruction of the lower classes, the benefits of which still continue to be felt.

The most remarkable event in which Edinburgh was more particularly concerned since that period was the visit of George IV. to Scotland in 1822, when he spent upwards of a fortnight in the metropolis, inspecting its public institutions, and receiving the congratulations of his Scottish subjects. Being the first crowned head that had entered Edinburgh since Charles II. in the year 1650, his late majesty's visit caused the greatest excitement throughout the country, and produced such an influx of people from the surrounding counties, particularly from the west and north, as never before perhaps took place in Edinburgh. His majesty arrived in Leith Roads on the 14th of August, and landed on the 15th, on which occasion he made a grand progress from Leith through several of the streets of the New Town to the Palace of Holyrood, and thence drove to the Duke of Buccleuch's house at Dalkeith, where he resided during his stay in Scotland. On the 17th he held a levee in Holyrood Palace, and on the 19th received the addresses of the commission of the General Assembly of the Church of Scotland. Next day he held a drawing-room, and on the 22d he went in procession from Holyrood House to the Castle. On the 23d he reviewed a body of cavalry on Portobello Sands, and on the same evening attended a ball given in honour of the royal visit by the peers of Scotland. On the 24th his majesty presided at a banquet given by the civic authorities, and on this occasion conferred on Sir William Arbuthnot, then Lord Provost, the honour of baronetcy. On the 26th his majesty attended a ball given by the Caledonian Hunt; on the evening of the 27th he appeared at the theatre; and on the 29th, after a visit at Hopetoun House, he embarked at Port Edgar, near Queensferry, on his return to England.

In 1824 the city suffered from a series of conflagrations of a most destructive and appalling description. The first of these commenced on the 24th of June, when some of the private dwellings in the Parliament Square, with a part of the High Street, and several closes, were consumed. The second and the most extensive began on the evening of the 15th November, and continued for three days, destroying an immense number of houses, chiefly between the High Street and Cowgate, also several fronting the High Street at the Cross, another portion of the Parliament Square, and likewise the spire of the Tron church, which had accidentally caught fire from the flying brands.

In no part of the united kingdom was the passing of the reform bill more strenuously insisted upon, or received, when framed into a law, with more heartfelt demonstrations of joy, than it was by the citizens of Edinburgh. The first election of members of parliament under that act took place at the cross on the 21st of December 1832; and never, except perhaps during the visit of George IV. was such a multitude of people collected upon its streets.

Edinburgh is surrounded on all sides, excepting on the north, where the ground slopes gently towards the Frith of Forth, by lofty hills. On the east, in the immediate vicinity of the city, are the abrupt and rocky elevations of Arthur's Seat, Salisbury Crags, and the Calton Hill, the first of which rises to the height of 800 feet above the level of the sea. On the south are the Braid and Pentland Hills, and on the west the hill of Corstorphine. Salisbury Crags form a continued range of naked and perpendicular cliffs, which rise like a mural crown from the summit of the hill, and at a distance have a singularly wild and romantic appearance, the interest of which is heightened by the contrast of the splendid city over which they tower majestically. The town stands on high and uneven ground, being built on three eminences, which run parallel to one another from east to west. The most elevated of these, on which the city was originally built, is terminated abruptly on the west by a precipitous rock surmounted by the Castle, whilst to the east it gradually inclines to the plain from which rises the lofty elevation of Arthur's Seat. The valley to the north of this ridge, which was formerly filled with water, has been of late years drained, and is now laid out in public gardens. It still retains, however, its original name of the North Loch.

Rise and progress of the city.

Till the middle of the eighteenth century, Edinburgh continued to occupy little more than the same space of ground which it had covered in the reigns of James III. and James IV.; namely, the ridge between the Castle on the west and Holyrood House on the east, with the hollow called the Cowgate on the south, and part of the rising ground beyond. In a great proportion of this Old Town the buildings are crowded and irregular, and the houses in some parts rise to the unusual height of eleven stories. The principal, or High Street, which is somewhat more than a mile in length, and is in some parts ninety feet in breadth, occupies the centre of the ridge, and extends, under different designations, nearly in a straight line from the Castle on the western extremity to the Palace of Holyrood on the eastern. Both sides of the ridge occupied by this street are covered with buildings crowded together in the closest array, and descending from the High Street, chiefly in narrow lanes, or closes as they are termed, which are seldom broader than six feet, and which, consisting of high houses on either side, are inhabited by numerous families, with little regard either to health or cleanliness. A proposal in the reign of Charles II. to extend the town over the lands to the north, beyond the hollow called the North Loch, having been frustrated, nothing was done till 1751, when an old building having fallen, by which one person was killed, a strong feeling regarding the inconvenience and decayed condition of the houses began to be expressed. The first decided step towards extending the city was taken by Provost Drummond, on the 21st of October 1763, when he laid the foundation-stone of what is now styled the North Bridge, in order to connect the town with the properties on the north. This edifice consists of three great central arches, each seventy-two feet in width and sixty-eight in height, with small side arches, making the total length 310 feet. In 1767, whilst this work was proceeding, an act for extending the *royalty* was obtained; and a plan for the New Town being then formed by Mr Craig, architect, the foundation of the first house was laid on the 20th of October the same year. By this plan the chief streets of the New Town of Edinburgh were disposed in three parallel lines from east to west; that on the south side, formed like a terrace, and facing the Old Town, being called Princes Street; a similar street facing the north, called Queen Street; and the third, which was named George Street, running up the centre. An elegant square at the west end of George Street, styled Charlotte Square, corresponded to another at its eastern extremity, designated St Andrew Square. Between Princes Street and George Street a narrow street of inferior houses runs along the whole length, and a street of nearly the same appearance is situated between Queen Street and George Street. Seven cross streets, namely, St Andrew, St David, Hanover, Frederick, Castle, Charlotte, and Hope Streets, intersecting these parallel thoroughfares at right angles from south to north, completed the plan. Coeval with the erection of these splendid streets and squares, a lofty street was opened from the extremity of the North Bridge and Princes Street, towards Leith Walk, or main road to Leith, opening an excellent communication with that sea-port. The whole of the new edifices according to Mr Craig's plan were completed about the year 1815, but the greater part much earlier. Only one serious error was committed by the local authorities in connection with the building of the New Town. This was the formation of a huge mass of earth called the Earthen Mound, which was laid down in the valley of the North Loch, parallel to the North Bridge, and calculated to serve the purpose of a second bridge. It was begun about 1781, out of the accumulation of the rubbish from the excavations of the New Town, and has been recently completed. It is computed to contain upwards of two millions of cart loads, and now serves as a thoroughfare from Hanover Street to the upper part of the Old Town.

Such was the success attending the building of the New Town, that in time a second extension of the same nature was projected, still farther towards the north, beyond an open area in front of Queen Street. The design of this second town intimately resembled that of its predecessor, consisting of a terrace in front and rear, a large central street, with two intermediate narrow ones, and cross streets in continuation of those in the former New Town. This vast and splendid addition to Edinburgh was commenced in 1801, and was nearly finished in the year 1826. Its central street is entitled Great King Street, and, as in the case of George Street, it is terminated by large open areas: one of these, of an oblong form, is styled Drummond Place; whilst the other, of a circular shape, is called the Royal Circus. Since this portion of the New Town was completed, another extension, still farther towards the north, has been projected, and is now partially built; and between the new streets in this quarter and the sea, a distance of about a mile and a half, are now built a number of isolated villas and ranges of houses, of a similarly elegant style of architecture.

About the time when the second New Town approached its completion, a series of superb edifices began to be erected on its north-western confines, between Charlotte Square and the Water of Leith, on the property of the Earl of Moray. This magnificent part of Edinburgh was erected during the years 1823, 1824, and 1825. An open space called Moray Place forms the chief cluster of buildings, and is considered as the most superb part of the modern extension of the metropolis. To the westward of Charlotte Square and Princes Street another series of beautiful streets and crescents have been erected, chiefly on the lands of Coates. As it is by a road through these new streets that persons from the west of Scotland enter the town, the appearance of so many structures on a scale of uniform splendour almost unrivalled in Britain, seldom fails to excite feelings of delight and admiration. This quarter of the town has latterly been considerably improved by the erection of a magnificent bridge of four arches, stretching across the deep dell or ravine at the bottom of which flows the Water of Leith. This bridge was completed in 1832, and will henceforth serve as the principal entrance to Edinburgh from the north.

The extension of the New Town to the north and west absorbed public attention till about the year 1813, when the idea was started of opening an entrance from the east. The foundation-stone of a bridge to form a connection with the Calton Hill, styled Regent Bridge, was laid in September 1815, and the work was completed in 1819. The arch of this structure is fifty feet wide, by about the same in height. On the top of the ledges of the bridge are arches and ornamental pillars of the Corinthian order, which on either side are connected with the houses in the line of street formed at the same time. The street, or

Waterloo Place as it has been designated, is composed of very superb houses of four stories, and each is terminated at Princes Street by a pediment and pillars above the lower story. From Waterloo Place, the new road by which most of the vehicles and passengers from the east enter the city, proceeds by a sweep round the southern face of the Calton Hill. The entrance by this thoroughfare is not less commanding and beautiful than that by the west; and the semicircular range of houses forming the Royal and Regent Terraces, lately erected on the slope of the hill, have a very striking effect. From the northern and eastern base of the hill towards Leith, the rudiments of another New Town were simultaneously formed. At present (1833) only a few streets in this quarter have been completed, but these are on a scale not surpassed by many of the modern structures.

Some years prior to the foundation of the New Town, certain private proprietors began to build lines of houses, of a good style of architecture, on the grounds to the south of the Old Town, and in this way George Square, Argyle Square, and Brown Square were opened for the reception of the higher class of citizens. The erection of these and other edifices soon suggested the necessity of a proper communication between them and the High Street, on the plan of the North Bridge; and on the 1st of August 1785, the foundation-stone of a bridge crossing the Cowgate, styled the South Bridge, was laid, and the thoroughfare opened for passengers in March 1788. The South Bridge consists of twenty-two arches, all of which are concealed by the buildings along its sides, with the exception of one at the centre spanning the Cowgate. In later times the city has spread very considerably towards the south; and beyond the outskirts of the streets in this direction there have been erected towards Newington a variety of neat and beautiful villas, which form the residences generally of the more respectable mercantile classes. From the period of the erection of the South Bridge in the year 1788, no further improvements took place in this direction, till after the opening of the Union Canal. The formation of this canal, to serve as a water communication with Glasgow, by joining the Forth and Clyde Canal, took place in virtue of an act of parliament procured in 1817 by a joint-stock company. Its eastern termination is about half a mile south-west from the Castle. Here the place of shipment, called Port Hopetoun, has been greatly improved by the erection of various new streets, one of which communicates directly with the west end of Princes Street or the New Town. In order to form an equally direct line of communication with the Old Town, and, generally speaking, that the High Street might be more thrown open to an approach from the southern districts, an act of parliament was procured by the inhabitants in 1827, vesting powers in certain individuals called Commissioners of Improvements, to open two lines of approach to the Old Town, one proceeding from the neighbourhood of Port Hopetoun on the south-west, and the other from the district on the south, adjacent to George Square and the open grounds or Meadow Walks in its vicinity. Both lines were calculated to render the destruction of many houses on the Castle Hill and in the Lawnmarket absolutely necessary, as well as to require bridges of an expensive nature; and the outlay for the whole was ordained by the same and by a subsequent act of parliament to be defrayed by assessments upon the inhabitants. These improvements are now (1833) in progress, and when finished will do much to renovate the more ancient part of the capital, as well as to form useful thoroughfares through the town.

At the present day the city extends about two miles in length and the same in breadth, and presents, when viewed from the Calton Hill, one of the most extraordinary panoramic scenes which can be conceived. On the right are the splendid lines of streets of the New Town, constructed of white sandstone, gradually spread out with a moderate descent towards the flat ornamental grounds adjacent to the sea. In front we have the vista of Princes Street, nearly a mile in length; and on the opposite side of the ravine of the North Loch, now disposed as pleasure-grounds, the huge unbroken line of tall structures forming the Old Town, terminated by the towers of the Castle. Beyond and towards the south, the town is seen to spread out in lines of streets and detached houses, till arrested by the fields and inclosures towards the Braid Hills, or on the east by the precipitous heights called Arthur's Seat and Salisbury Crags. The view from the Calton Hill in a northerly direction is also remarkably fine, comprehending a prospect of the whole Frith of Forth, and the hills of Fifeshire on its opposite shore.

We now proceed to notice Edinburgh in detail, commencing with a description of its more remarkable public edifices.

Public buildings and institutions.

The Castle, as has already been stated, owes its origin as a regular place of defence to the Anglo-Saxon dynasty, near the end of the fifth century; but its fortifications appear to be of comparatively modern date. The rock on which the fortress is situated rises to a height of three hundred feet, and is precipitous on all sides except the east, on which it is connected with the town by an open glacis or esplanade. The surface of the rock measures about seven acres, and is surmounted by battlements, lofty barracks, and other buildings. Amongst the buildings crowning the summit is that erected by Queen Mary as a palace, in a small apartment on the ground floor of which that princess was delivered of her son, James VI., on the 19th of June 1566. In the same part of the edifice is situated the crown room, where the regalia of Scotland were lodged in 1707, and found in 1818, after being lost sight of for upwards of one hundred years. These regalia consist of a crown, sceptre, sword of state, and lord treasurer's rod; the former is supposed to be even more ancient than the time of Robert Bruce, though it has undergone several changes since that period; the sword was a present from Pope Julius II. to James IV. The arsenal or storehouse of the Castle is capable of containing 30,000 stand of arms, and the whole buildings about 2000 men. In March 1829 an addition was made to the curiosities of the castle by the restoration of an ancient piece of ordnance called Mons Meg, which had been removed from the fortress and carried into England in 1754. This immense cannon, for it is of an unusual size, was fabricated in the year 1498, and is curious from its structure, being formed of bars bound together with rings. It was employed at the siege of Norham Castle, but was rent in 1682, when firing a salute in honour of James duke of York.

The charter of foundation of the Abbey of Holyrood is dated 1128. It was largely endowed by the founder David I., and was considered as one of the wealthiest ecclesiastical establishments in Scotland. In 1544 it was sacked, and in part destroyed, by the Earl of Hertford when he invaded Scotland; and again in 1547. The chapel attached to it was desecrated and dismantled by the mob in 1688; and in 1768 the roof fell in, and thus left it in the ruined condition in which it now stands. Within this chapel were interred, amongst other illustrious remains, those of Queen Magdalen and Darnley. The royal palace is contiguous. It is not known at what time a palace was first erected on this spot. The more ancient parts of that which is now in existence were built by James V.; but it has since undergone many changes, and little if any of the original building remains. In the time of Cromwell it was burnt by the soldiers of that usurper, and was rebuilt after the Restoration by Charles II. The architect on this occasion was Sir William Bruce, and the builder who carried his designs into execution was Robert Mylne. The edifice is of a quadrangular figure, with an open court in the centre, surrounded with piazzas. Amongst the curiosities exhibited in the Palace of Holyrood is the chamber of Queen Mary, in which may still be seen, though in a decayed state, the bed of that unfortunate princess. In a hall or gallery a hundred and fifty feet in length, twenty-seven and a half in breadth, and eighteen in height, and which is adorned with the portraits of a hundred and six Scottish monarchs, takes place the election of representative peers for Scotland. The most remarkable circumstance connected with Holyrood House is its privilege of affording a sanctuary to debtors. The limit of this privileged territory is marked in the direction of the town by a strand or gutter at the foot of the Canongate, and at the distance of about a hundred yards from the palace. Altogether the sanctuary describes a circle of about five miles, including Salisbury Crags and Arthur's Seat. The immunities of the sanctuary have existed since the date of the monastery. Considerable improvements were made on the exterior walls of the palace during 1832, and some years previously, at the expense of his majesty.

Edinburgh is now chiefly distinguished as a capital by being the seat of the Scottish supreme courts or College of Justice, which, as has already been mentioned, was constituted in 1532 by James V. This body consists of persons intimately connected with the various supreme courts, and comprehends the judges or senators, the faculty of advocates, writers to the signet, solicitors in the supreme courts, advocates' first clerks, clerks to the judges, extractors, keepers of the different departments, and, in a general sense, may be said to include the principal professional gentlemen in Edinburgh. This influential body at one time possessed some valuable privileges, the chief of which now remaining are exemptions from certain local taxes, and non-liability to be sued before any inferior civil court of record.

The principal court connected with the College of Justice is the Court of Session, or supreme civil court. This judicature possesses all those peculiar powers exercised in England by the Courts of Chancery, King's Bench, Common Pleas, Admiralty, and others, being a court both of law and of equity. The constitution of the court, during its continuance of three hundred years, has undergone many alterations, and is now established upon an improved plan, introduced by an act of parliament passed in 1830. There are thirteen judges, who are separated into the first and second divisions. In the former there are six lords, and in the latter seven. The presiding judge in the first division is the Lord President, and in the second division the Lord Justice Clerk, a title which he derives from being co-ordinately the presiding judge of the High Court of Justiciary. The two divisions form distinct courts, which, excepting on particular occasions, have no connection with each other. Popularly, they are each denominated the Inner House, from their meetings being held in inner apartments leading from the Outer House, or hall of the Parliament House. From the first division are detached two judges with the title of Lords Ordinary, and from the second there are detached three. Before one or other of these ordinaries all causes are brought in the first instance; and, in case of dissatisfaction with their judgments, the suits can be removed by appeal into the Inner House, but always to that division before whose ordinary the case was primarily brought. The office of Lord Ordinary on the Bills, which is successively discharged by the judges, is of great importance in a national sense, as, besides other duties, it includes that of supreme civil magistrate of the kingdom. Cases may be removed by appeal from the Court of Session to the House of Lords. The court has a winter term of four, and a summer term of two months.

Agreeably to certain acts of parliament, a civil jurisdiction, with the title of Jury Court, was instituted in Scotland, and subsisted under various modifications, between the years 1816 and 1830, when it ceased as a separate court. By the act 1 William IV. cap. 69, passed 23d July 1830, the benefit of jury trial in civil causes was united with the ordinary jurisdiction of the Court of Session. In virtue of this act, the lords president of the two divisions respectively try by jury all issues arising out of causes in these divisions, and otherwise discharge all duties previously assigned to the Lord Chief Commissioner of the Jury Court. In certain circumstances, the ordinary lords of session may also discharge the same duties, and the Lord Chief Commissioner is still qualified to act as a judge in such causes. The juries who are impannelled under this branch of the jurisdiction of the Court of Session are twelve in number, as in England, and must be unanimous in their verdicts or findings.

Every alternate Wednesday during terms, the Teind Court of Scotland, instituted in 1707, is held in Edinburgh, in the apartment of one of the divisions. The judges of the Court of Session are, by commission, judges also in this. It is the peculiar duty of the Teind Court to regulate the stipends of the clergy of the established church of Scotland, and other secular matters touching ecclesiastical polity. Nine judges form a quorum.

The High Court of Justiciary was instituted in 1672. It is composed of a president, styled the Lord Justice Clerk, and five other judges, who are at the same time lords of session. This supreme criminal court sits every Monday during term, and in the vacations of the Court of Session, the commissioners of justiciary proceed, in small detachments, upon appointed circuits.

The Commissary or Consistorial Court, the duties of which comprehended pleas relative to declarators of marriage and legitimacy, to divorce, adherence, and the like, was in 1830 amalgamated with the Court of Session. The head consistorial court of Scotland was thus almost entirely abolished. A certain number of commissaries, however, yet remain, whose duty consists in granting confirmation of testaments of persons dying abroad and leaving personal property in Scotland. They have also a special jurisdiction in the county of Edinburgh, the same as sheriffs in other counties.

The Dean of Guild Court consists of the Dean of Guild, Old Dean of Guild, and six guild councillors. The powers of this court were formerly far more extensive than they are at present, having relation to causes between merchant and mariner, as well as to those between merchant and merchant. The institution, however, of the Admiralty Court, by the act 1681, cap. 16, superseded its interference with maritime affairs. Even yet, the functions of the individual who is at the head of it do not seem to be very distinctly defined; but he is independent of the burgh or bailie court. The Dean of Guild is chosen yearly, and with his council has power to regulate the buildings within burgh, agreeably to law. He alone is competent to grant authority, by his warrants, or jedges as they are called, for pulling down or erecting houses; and he gives directions as to keeping buildings and streets in proper repair. The provost and bailies have no power to review the decrees of the Dean of Guild, redress being only competent in the Court of Session, as in the case of judgments by the bailie court. For more specific information, see GUILD.

The Court of Exchequer is now abolished as a separate judicature, its functions being included in those of the Court of Session. The only remaining branch of the Scottish Exchequer establishment now consists of a variety of officers for conducting the business connected with the different descriptions of revenue drawn from the country, which pass through this channel. Amongst these is an officer of the crown, with the title of King's Remembrancer for Scotland, whose duty it is to secure all fines payable to the king, all treasure found, and property falling to the crown as *ultimus hæres.*

The Lyon Court is now nearly extinct. The duties of the Lord Lyon, so named from the circumstance of the lion forming the armorial bearing of the kings of Scotland, are performed by two deputies. These duties consist in the ordering of proclamations, conferring armorial bearings, and superintending the management of state ceremonials and processions. He has besides a control over a large body of messengers at arms, and other officials, amongst whom are six heralds, and the same number of pursuivants. The fees payable at the lyon office for patents of arms are, for arms without supporters L.52. 10s., and with supporters L.84; but if the patent be granted as a *favour,* the price is L.115. 10s. The Lord Lyon receives a share of the fees to the amount of L.700 a year. Altogether his office is worth about L.1300 annually. It is enjoyed by the Earl of Kinnoull.

The Faculty of Advocates is an association of barristers entitled to plead before the supreme or any other courts of record. It consists at present of four hundred and thirty members, who are presided over by a Dean. All candidates for admission into this society must undergo an examination on the Roman and Scotch law, and every member on entering pays a fee of nearly L.300, one half of which goes to support the library belonging to the Faculty. The appointment of judges of the Court of Session, and the thirty-three sheriffships of Scotland, together with several other government offices and dignities, are filled up exclusively from this body. The Faculty, however, possesses no charter of incorporation.

The Society of Writers to the Signet is also an unincorporated body, consisting at present of nearly seven hundred members, qualified to conduct causes before the supreme courts, and possessing the sole right of passing papers or warrants under the signet or seal of his majesty, from which circumstance their professional name is derived. The principal and most lucrative branch of their professional employment is that of conveyancing. In order to promote the study of this important department of legal practice, they, many years ago, founded a lectureship, which was, in 1825, erected into a professorship in the University. In order to gain admission into this Society, an apprenticeship of five years is necessary. At entering into his indentures, the apprentice must show that he has attended a university for two years; and, during the course of his apprenticeship, he must attend the law classes in the University. A thorough examination on the principles of the law of Scotland, and the practice of conveyancing, takes place previously to admission into the Society. Its affairs are administered at stated meetings. It possesses an extensive and very valuable library; and most of the members are associated in supporting a fund for widows, which, by act of parliament, must amount to L.20,000 for every hundred members.

The Solicitors before the Supreme Courts form a body of attorneys incorporated in 1797. Its members amount to between one and two hundred. With the exception of the power of passing papers under the seal of his majesty, their privileges are nearly the same with those of the Writers to the Signet. They have also office-bearers, a hall of meeting, and a library.

Of the class of practitioners denominated Advocates' First Clerks, there are not a great number. They are entitled to act as attorneys in the Supreme Courts on undergoing the usual examinations, and paying certain fees. Every advocate has the privilege of appointing a clerk.

The edifice which has been appropriated since the Union as the place of meeting of the supreme courts, is the old Parliament House of Scotland, situated in the centre of the Old Town, and separated from the High Street by the cathedral of St Giles. This structure was erected between the years 1632 and 1640, at an expense of L.11,600 sterling to the civic corporation. In recent times, however, with the exception of the great hall, it has been almost totally renewed. It stands on the southern and western sides of the inclosure called the Parliament Square, a place formerly surrounded with the shops of tradesmen, but entirely remodelled since the destructive fires of 1824, and now exhibiting on the south and west sides splendid erections in the Grecian style of architecture, with piazzas underneath. These improvements, which extend over the front of the old parliament-house, or present court-house, have been executed chiefly by government, at a great expense. The entrance to the courts is at the south-west angle of the square; the great hall is 122 feet by 49, and has a lofty roof of carved oak, arched and disposed in the same style as that of Westminster Hall. In this hall or outer house generally sit two of the Lords Ordinary, and the floor during session is the daily resort of all persons connected with the courts. On a pedestal near the south end of the hall is a statue in white marble, of the late Lord Viscount Melville, executed in 1818 by Chantrey.

Adjoining the Parliament House are certain spacious apartments fitted up as libraries for the Faculty of Advocates and the Writers to the Signet. The Library of the former body was founded in 1682, at the instance of Sir George Mackenzie, then Dean of Faculty. The collection is now the largest and most valuable in Scotland, and is in every sense one of the noblest national libraries. By an act of parliament passed in the reign of Queen Anne, it is entitled to a copy of every work printed in Britain; and, with the sums annually disbursed in the purchase of useful and rare books, it is rapidly increasing. The library is under the charge of six curators, a librarian, and assistants. At present the collection is on the eve of removal to a large new building erected for its reception on the west side of the Parliament House, and facing the new approach from the south.

The Library of the Society of Writers to the Signet occupies a splendid modern erection of two stories, in the Grecian style of architecture, extending westward from the north-west corner of the Parliament House, and having a front to the Lawnmarket. This edifice contains two large and beautiful apartments, decorated in front of the book-presses with rows of columns, which produce a fine effect. These noble apartments have cost the society L.25,000. The library, like that of the Advocates, is under the charge of curators, a librarian, and assistants.

The Scottish Supreme Courts possess accommodations for their records, and the functionaries connected therewith, in a building styled the General Register House of Scotland, one of the most remarkable national edifices in the metropolis. It stands at the eastern extremity of Princes Street, fronting the thoroughfare of the North Bridge. The foundation was laid on the 17th of June 1776, and L.1200 were given by George III. out of the money arising from the sale of the forfeited estates, to assist in its erection. It was fully completed in 1822, at a very great expense, which has been defrayed by government. The building, which was planned by Mr Robert Adam, forms a square, with a quadrangular court in the centre, containing a circular edifice or dome fifty feet in diameter, which joins the sides of the court, leaving spaces at the angles for the admission of light. Viewed from the street, it presents a compact building of 200 feet in length, by a breadth of 120. Each of the corners is surmounted by a small turret, and the central tower is crowned with a dome. The interior consists principally of small fire-proof chambers, in which are deposited state papers, copies or records of all the title-deeds of property, and of all legal contracts, mortgages, &c.; also records of all suits at law from an early period.

The Post-Office establishment for Scotland is conducted in Edinburgh, and occupies a handsome new edifice of four stories in Waterloo Place. The duties of this well-regulated establishment are executed by a numerous body of individuals, amongst whom are a secretary, cashier, clerks, and letter-carriers. The produce of the Scottish posts is now upwards of L.207,000 annually, and the expense of management about L.55,000.

The Stamp Office for Scotland is also situated in Waterloo Place, a short way westward of the Post-Office, to which it bears a very considerable resemblance in point of architectural design. This establishment, which is under the superintendence of a comptroller, is subject to the Board of Stamps in London.

In looking along the noble line of Princes Street, the eye is arrested by a structure of modern date, occupying a situation at the northern extremity of the Earthen Mound, or that end adjoining the New Town. This edifice, which fronts the opening of Hanover Street, is entitled the Royal Institution Buildings, and is appropriated for the accommodation of a variety of institutions. It was founded in the year 1823, on a substructure of piles and cross bearers, rendered necessary by the nature of the ground, which consists of forced earth. The building is from a Grecian model, executed by Mr Playfair, and has a range of Doric columns on each side, and another range surmounted with a pediment in front. Owing to the opposition of the Princes Street proprietors, the structure is not sufficiently elevated. The interior accommodations consist of one large central hall for exhibitions, and an upper and lower range of smaller apartments on each side. Additions are at present making to the building by an extension in the direction of the Mound, which will very much improve its appearance. The Royal Institution, under whose auspices this edifice was founded, was incorporated by royal charter in the year 1827, for the purpose of encouraging the fine arts in Scotland. The primary object of the institution is the annual exhibition of pictures of modern artists, and the purchase of those which are deemed of sufficient merit to entitle them to a place in a regular gallery of paintings. The institution also occasionally offers exhibitions of paintings by the old masters. A separate establishment was founded in Edinburgh in 1826, by a body of artists, with similar objects in view, entitled the Scottish Academy of Painting, Sculpture, and Architecture, which has now also regular exhibitions.

The Royal Society of Edinburgh was incorporated by royal charter in 1783, for the purpose of encouraging philosophical inquiry, and discussing matters connected with nature and art. Its meetings, which are very numerously attended, take place twice a month during winter and spring, and it has published twelve volumes of transactions. It is governed by a president, several vice-presidents, and twelve counsellors. It possesses very splendid apartments, an extensive library, and a small museum, in the Royal Institution Buildings.

The Society of Antiquaries of Scotland originated in 1780, and was incorporated by letters under the great seal in 1783. The society is governed by a president, three vice-presidents, and a council of nine members, with a treasurer, two curators, a general secretary, and a secretary for foreign correspondence. The king is patron. The fee of admission is three guineas, and two guineas annually, or a life premium of twenty guineas. Its meetings are held every alternate Monday during winter and spring. The society possesses a museum, in which there is a considerable collection of antiquities, principally Scottish. Its apartments are situated in the Royal Institution Buildings.

The Board of Trustees, which was instituted for encouraging trade and manufactures in Scotland, was erected by letters patent in the year 1727. On its erection it was endowed with the sum of L.3800, and an annuity of L.2000 from government. It has since then received various accessions of revenue, chiefly from the forfeited estates, which now amounts altogether to L.7961. 13s. 8d. annually. The management of this capital is vested in twenty-eight trustees, consisting of peers, judges of the supreme courts, the lord advocate, bankers, and gentlemen of property, all of whom give their services gratis. Vacancies are filled up by the crown; five members form a quorum; and meetings are held periodically throughout the year. The chief object of this institution has hitherto been the encouragement of the manufacture of particular kinds of linen and woollen cloths; but it now extends its patronage to other branches, and pays, besides, L.500 per annum to the Royal Institution of Scotland for the Encouragement of the Fine Arts. It has an academy for instruction in drawing, and possesses a noble gallery of casts from the ancient sculptures. It has apartments in the Royal Institution Buildings.

The Highland Society of Scotland originated in the year 1784. In 1787 it was incorporated by royal charter, and assisted by a grant of L.3000 from the forfeited estates. In 1789 it received a further and annual grant of L.800 from the treasury. Its members exceed seventeen hundred, and are admitted by ballot at public meetings, each paying a life subscription of L.12. 12s. or an annual fee of L.1. 3s. 6d. The society is under the management of a president, four vice-presidents, a treasurer and secretary, two deputy-secretaries and collectors, and a body of thirty ordinary and ten extraordinary directors. The object of this institution was originally confined to improving the condition of the Highlands; but its patronage is now extended over the whole kingdom, and embraces every species of improvement in agriculture, management of cattle, and general country produce. It annually awards premiums in money and medals to the amount of L.1200, for the best specimens of live stock, shows of which are every season made in some particular district. The society has a handsome hall, model-room, and other apartments in Albyn Place, at the west end of Queen Street.

The Caledonian Horticultural Society, the object of which is the promotion of improvement in the cultivation of the best kinds of fruits, flowers, kitchen vegetables, and the like, was established in the year 1809. It is supported by the sale of shares of twenty guineas in value, or annual fees of two guineas. Its affairs are managed by a president, four vice-presidents, a secretary, a treasurer, an auditor, an artist, a council of twelve, a committee of prizes, and a garden committee. The society has an excellent experimental garden in the grounds of Inverleith.

The object of the Society of Arts, instituted in 1821, is to encourage the invention of machines calculated to improve manufactures, the discovery of chemical preparations of utility in the arts, and the exposition of facts tending to improve the natural products of the soil. The king is patron. The society has honorary, associate, and ordinary members. The latter pay L.1. 1s. annually, or a life premium of L.10. 10s. It distributes about L.80 every year in premiums for models, essays, and the like.

Nelson's Monument occupies the summit of a rocky eminence on the Calton Hill, and is one of the most prominent, though at the same time most unsightly objects in Edinburgh. It was begun by subscription soon after the death of Lord Nelson, whose actions it was intended to commemorate, but it was not finished till 1815. It consists of a lofty circular turret, with a stair inside, and is battlemented on the top. Round the base is a low structure in the same style of architecture, divided into apartments.

The National Monument occupies a prominent situation on the Calton Hill. It was begun by a body of subscribers in 1822, and was intended to be an exact model of the Parthenon at Athens. Its object was to commemorate those Scotchmen who had fallen in the different engagements by sea and land during the wars consequent on the French revolution; but it has been arrested in its progress for want of funds, and only twelve massive pillars of exquisite workmanship have as yet been completed.

A monument of a singularly elegant description, designed by Mr Playfair, and which is a reproduction, with some variations, of the choragic monument of Lysicrates, was erected in 1830–31 on a prominent situation on the Calton Hill. It is commemorative of the late Mr Dugald Stewart, professor of moral philosophy in the university of Edinburgh. A monumental erection, commemorative of Professor Playfair, is also placed on the Calton Hill, at the corner of the enclosure of the Royal Observatory; and more recently another to the memory of Robert Burns has been raised on an isolated eminence fronting the new High School. David Hume's Monument, within the old Calton Hill burying-ground, is also conspicuous.

Lord Melville's Monument, an elegant fluted column, in the centre of St Andrew Square, was finished in 1828. It was raised by subscriptions chiefly among gentlemen connected with the royal navy. On the summit is a colossal figure of the above nobleman, cut in freestone. This beautiful column rises to the height of 136 feet, is modelled after Trajan's pillar at Rome, and forms altogether a very prominent and striking object.

In George Street, at the crossing of Hanover Street, stands a pedestal, surmounted with a figure in bronze of George IV., erected in 1832, in commemoration of the visit of his majesty to Scotland in 1822. A similar pedestal and figure of Mr Pitt were erected in George Street, at the crossing of Frederick Street, in 1833. Both statues are by Chantrey.

During the reign of episcopacy in Scotland, Edinburgh was the seat of a bishop. It is now the place of meeting of the General Assembly of the church, and the seat of a synod and presbytery. Ecclesiastically, the ancient and extended royalty comprehend thirteen parochial divisions, eight of which have one clergyman each, and five are double or collegiate charges. That portion of the town which is not within these divisions belongs either to the parish of Canongate, or to that of St Cuthbert's. Originally the city consisted of only one parish, of which the ancient church of St Giles was the place of public worship. This venerable fabric, which occupies a prominent situation in the centre of the Old Town, on the south side of the High Street, is of unknown origin and date. It has been presumed, however, that a church existed on its site as early as the year 854; but the first certain intelligence regarding it occurs in 1359, when a charter was granted by David II. bestowing some land on a chaplain who officiated at one of its altars. The building, previously to certain alterations which were made upon it, was cruciform, and of Gothic architecture, but rather substantial than elegant. From the centre of the whole there rises a square tower, the top of which is encircled with open figured stone work, whilst from each corner of the tower springs an arch, and the four meeting together produce the appearance of an imperial crown. These arches are highly ornamented with small pinnacles, and from the apex rises an equally ornamented short spire. This elegant object is prominent above the whole of the town; and being 161 feet in height, it may be seen at a great distance. After the Reformation, the church was divided by internal walls into separate places of worship. By these and other subsequent alterations, the choir or eastern division formed the High Church; the one occupying the centre of the building, was styled the Old Church; another entering from the south-west corner, the Tolbooth Church; and one at the north-west corner was named the New North Church. Between the years 1829–33 this extensive edifice was remodelled, and greatly improved in external appearance, by an entire casing of new walls. It now forms two churches; and contains also a spacious hall intended as a place of meeting for the General Assembly. The design of the remodelled church does great credit to its architect, Mr William Burn.

Trinity College Church, which is next in point of antiquity to St Giles, is situated on the low ground east from the North Bridge. It was founded in 1462, by Mary of Gueldres, widow of James II.; and in 1502 James IV. invested it with some additional revenues. At the period of the Reformation it shared the fate of the other ecclesiastical establishments of the kingdom. Its revenues were in 1567 given to Sir Simon Preston, provost of Edinburgh, who again presented them to the town council as a common fund. In 1587 the magistrates restored an hospital which had formerly belonged to the establishment, and which still exists. The body of its royal foundress lies interred in an aisle on the north side of the church, and within its walls are likewise the remains of many persons celebrated in Scottish history.

The Old Grayfriars Church was built in 1612, but it was not constituted a parish church till 1722. Previously to this, in May 1718, its spire was blown up by gunpowder, which had been lodged in it by the town authorities for security. The New Grayfriars Church was built in 1721. Both of these buildings, which are separated only by a wall, were erected on what was formerly the garden ground of the monastery of Grayfriars, in the south part of the town, and which, on the demolition of the friary in 1559, was conferred by Queen Mary on the town, to be used as a public cemetery. The Old Grayfriars Church is remarkable for being the place where the National Covenant was begun to be signed in 1638, and for having had the historian of Charles V. as its minister.

The Tron Church, which stands in the High Street, was begun in the year 1627, and opened for public worship in 1647. Its appellation is acquired from the circumstance of a tron or weighing beam having formerly stood upon the spot. Its steeple, formed of wood and covered with lead, was destroyed during the great fires of 1824, but has since been replaced by an elegant stone spire of 160 feet in height.

Lady Yester's Church was founded in 1647, by Dame Margaret Ker, Lady Yester. This pious lady gave the magistrates fifteen thousand merks for the erection of the building, and made a bequest of a thousand merks per annum for the stipend of a minister. The original edifice having become ruinous, it was rebuilt in 1803. It is situated in Infirmary Street, and has no spire.

St Andrew's Church was erected in the year 1781. The body of the building is of an oval form, with an exceedingly handsome spire in front, partly resting on four Corinthian pillars, and rising to a height of 168 feet.

St George's Church, which is situated on the west side of Charlotte Square, was founded in the year 1811, and opened in 1814. It is a huge square fabric, in a plain Grecian style, and is capable of accommodating about 1600 persons. From the centre rises a tower surmounted with a dome, 150 feet in height, somewhat in imitation of St Paul's. The building cost L.33,000.

St Mary's Church stands in Bellevue Crescent, and was opened in the year 1824. It is of an oblong figure, with a front of considerable elegance, consisting of a portico with a range of pillars of the Corinthian order, supporting a pediment, from which rises a spire.

St Stephen's Church, situated at the northern extremity of St Vincent Street, was opened in 1828, and cost L.25,000. It is ornamented with a square tower of solid proportions, 162½ feet in height, terminated at the top with a balustrade. The church can accommodate 1600 persons.

The foregoing churches are all under the patronage of the civic corporation. The clergy, eighteen in number, are supported by an assessment, called annuity-tax, levied within the ancient and extended royalty on all houses and shops, with the exception of the dwelling-houses of the members of the college of justice. The following table, drawn up from official documents, exhibits the nature and amount of the funds belonging to the church establishment. It is for the year 1830.

Assessment, or annuity-tax.........	L.8581	0	0
Seat rents of the churches............	7240	0	0
Impost, a small assessment............	1329	0	0
Proportion of shore-dues at Leith...	3616	0	0
Dues or customs of the pack, Leith,	21	0	0
Proportion of ale and beer duty......	137	17	8
Lady Yester's bequest.................	13	17	9
Dues at Port-Hopetoun..............	24	8	0
	L.20,963	3	5

Exclusively of the seat-rents, which are appropriated to ordinary purposes, the foregoing sums, when properly collected, afford a stipend to each minister averaging L.611.

St Cuthbert's Church is situated in the low ground between the western extremity of Princes Street and the castle. There formerly stood on the same spot an ancient edifice, one of the earliest places of Christian worship in this part of Scotland. The modern church is a large plain building, with a spire at the western extremity; it is of date 1789, and stands in the midst of an extensive burying-ground. In modern times it has been popularly named the West Kirk, from its situation to the west of the metropolis. The populous parish of St Cuthbert's has likewise at present (1833) five chapels of ease, one of which, in Clerk Street, erected in 1823, is a handsome building.

The church of the parish and subordinate burgh of Canongate is of date 1688, and was erected at an expense of L.24,000 sterling. It is situated in the midst of a burying-ground, on the north side of the Canongate, but having no spire, it is not conspicuous as a place of worship.

Lady Glenorchy's Chapel, a simple square edifice, situated near the College Church, was founded and endowed by the pious lady whose name it bears, in the year 1772, and was opened in 1776. It is under the government of the established ecclesiastical courts.

The Gaelic Chapel, the only one in Edinburgh in which the service is conducted in the Celtic tongue, is situated in North College Street. It was erected in the year 1815, and is under the jurisdiction of the established church courts.

There are five chapels in Edinburgh belonging to the communion of the Scottish Episcopal church, to which a considerable number of the higher classes are attached. The most elegant of these perhaps is St John's, situated at the west end of Princes Street. This edifice was founded in 1816, and finished in two years, at an expense of L.15,000. It is of the florid Gothic style, from a design by Mr Burn, measures 113 feet in length by sixty-two in breadth, and is terminated at the western extremity by a beautiful square tower, rising to a height of 120 feet. Another Episcopal chapel, of tasteful Gothic architecture, is that of St Paul's in York Place. It was designed by Mr Elliot, founded in 1816, and finished in 1818 at an expense of about L.12,000. It measures 122 feet by seventy-three, and from each corner there rises a small circular turret. St George's Chapel, a much smaller building, is also situated in York Place, and of date 1794. St James's Chapel is erected in the line of houses in Broughton Place. St Peter's Chapel is a similar plain edifice in Roxburgh Place. St Paul's Chapel, Carrubber's Close, is the oldest episcopal chapel in Edinburgh, having been erected about the end of the seventeenth century.

The Roman Catholic communion has a principal place of public worship, and a subordinate one. The former is a large structure, with a Gothic gable front, situated in Broughton Street, and was built in the years 1813–16, at an expense of about L.8000, raised by subscriptions and collections. The latter is situated in Blackfriars Wynd. Another Roman Catholic chapel is at present in the course of erection in Bristo Street, in the southern part of the town.

Edinburgh possesses a number of places of public worship belonging to the United Secession church, and other presbyterian dissenting bodies. The following are those of most note. Nicolson Street Chapel was founded in 1819, and was raised at an expense of L.6000. It has a broad and lofty Gothic front, with pinnacles rising to the height of ninety feet. Broughton Place chapel is a modern building, with a Grecian front, portico, and range of Doric columns. Rose Street Chapel is a handsome structure of plain Grecian architecture, built in 1830. The Cowgate Chapel, now belonging to the Secession, was formerly occupied by an episcopal congregation, from whom it was purchased; a recess in the interior is decorated by some oil paintings of Runciman. The other chapels are at Stockbridge, Lothian Road, Bristo Street, Potterrow, and the Vennel.

Edinburgh is the seat of one of the presbyteries of the Associate Synod of Original Seceders, and of two congregations. One chapel is situated at the foot of Infirmary Street, and the other in Richmond Street. The former is under the superintendence of the Reverend George Paxton, professor of divinity, and author of the Illustrations of the Holy Scriptures; and the latter under that of the Reverend Dr M'Crie, author of the lives of Knox and of Melville.

There is also a congregation belonging to the Original Burgher Associate Synod, and one to the Cameronian communion, a representative remnant of the old Covenanters.

Edinburgh is likewise the seat of a presbytery of the Relief Synod, and there are in the city five places of worship belonging to that communion. Besides the foregoing churches and chapels in Edinburgh, there are two chapels of Scottish Independents, one of English Independents, four of Baptists, one of Methodists, one of Bereans, one of Unitarians, one of Glassites, one of the New Jerusalem Church or Swedenborgians, one of the Society of Friends, and a Jews' synagogue.

Edinburgh has long derived celebrity from its educa-

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tional establishments, the chief of which is the University. This institution dates its origin about the year 1583, when the first professor was appointed; and under the patronage of James VI. it soon assumed the character of an ordinary college. About the year 1660, by means of benefactions from public bodies and from private individuals, the establishment had attained a respectable rank among similar institutions. As a school of medicine it first rose into repute under Dr Alexander Munro, who became professor of anatomy in 1720; and in this branch of science it afterwards attained a distinguished pre-eminence, from possessing professors remarkable for their abilities and success as teachers. In the other branches of knowledge, its reputation was gradually exalted to the highest pitch by Maclaurin, Black, Fergusson, Stewart, Robertson, and other eminent men. The decay and insufficiency of the old buildings had long been complained of; and at length, in 1789, the foundation was laid of a new and extensive structure, the plan of which had been furnished by Mr Robert Adam. But this plan, after it had been partly carried into execution, was altered and modified; and the building has been finished in conformity with a very skilful and tasteful design furnished by Mr William Playfair. It still (1833), however, wants a dome and other interior finishings, to render it complete. This splendid edifice forms a parallelogram, inclosing a quadrangular court. The sides of this court are occupied with the class-rooms, the museum, and the library. In the middle of the front are three entrances to the court, consisting of lofty porticos penetrating the building.

The number of Professorships is about thirty, and these are divided into four Faculties, viz. Theology, Law, Medicine, and Arts. The latter includes all the chairs devoted to Literature and General Science. The Principal and Professors constitute the Senatus Academicus; and the Lord Provost of the city for the time being assumes the title of Lord Rector.

The magistrates and town council are the patrons of the University, and have the nomination to the greater number of the chairs; the others are under the patronage of the crown, except three, the patronage of which is shared by the faculty of advocates, the writers to the signet, and the town council. The degrees it bestows are the same as in the other Scottish colleges, namely, those of doctor of divinity, doctor of laws, doctor of medicine, and master of arts. The terms of the college are a winter session of about six months, beginning in November, and a summer session of about three months, from May to August. During the latter term the lectures given are confined to botany, natural history, midwifery, medical jurisprudence, and clinical lectures on medicine and surgery. The total number of students who matriculated in the session 1829–30 was 2186.

The College Museum is particularly rich in objects of natural history, amongst which are specimens of upwards of three thousand birds foreign and British. The Museum occupies two large rooms, each ninety feet by thirty, besides minor apartments.

The College Library consists of upwards of 70,000 volumes. It is supported from a fund formed by a contribution exigible from every student who matriculates, five pounds payable by every professor on his admission, and a portion of the fees of graduates both in medicine and arts. It is besides entitled, along with the other libraries belonging to the Scottish universities, to a copy of every work published in Great Britain. There is also an excellent collection of books on theology and church history connected with the class of divinity, and which is supported by certain annual fees paid by the students attending the class. The principal apartment, called the Library Hall, is 198 feet in length by fifty in width, and is certainly one of the most spacious and elegant apartments in the kingdom.

The celebrity of Edinburgh as a place of education has been in some measure derived from the schools of a number of private lecturers of eminence in their several departments of science, particularly in medicine. These lecturers are chiefly members of the Royal College of Surgeons. This body, which was incorporated by charter in 1778, confers the same privileges on medical students as the University does, that of doctor of medicine excepted. The Royal College possesses a beautiful edifice in Nicolson Street, from a design by Mr Playfair. Towards the street it is adorned with a lofty portico, which has a striking effect; and the details, though elaborate, are exquisitely finished, and in admirable harmony with the design. It cost the Royal College L.19,060, and forms several splendid halls for the accommodation of the members and the Pathological Museums. These museums, enriched by the collections of the late Dr Barclay and others, exhibit a valuable repository of preparations and objects calculated to advance the study of surgical science.

The Royal College of Physicians was established in 1681, by a charter of Charles II.; and the number of its fellows, resident and non-resident, is now about a hundred. The meetings of the body take place in the Physicians' Hall, a handsome edifice in George Street, of the Grecian style, and erected in 1775. It contains a good library.

The High School is the chief seminary in Edinburgh for classical education, and has long maintained an eminent place amongst similar establishments. Its origin may be traced to an early period in the sixteenth century; but it has been greatly extended and improved in recent times. It now occupies a splendid structure on the south side of the Calton Hill, facing the road that sweeps round that eminence. The design was furnished by Mr Thomas Hamilton, and the foundation-stone was laid on the 28th of July 1825. The main building extends about two hundred and seventy feet in front, and in the centre of the edifice is a magnificent hexastyle Doric portico. On each side of the portico there is a corridor, the entablature of which is supported by six Doric columns. The apartments, which are entered through a spacious play-ground, consist of a large hall of seventy-five by forty-three feet, and rooms for the accommodation of the various classes taught in the establishment. The cost of this extensive building was about L.30,000, which was partly raised by subscription. The patronage of the High School is vested in the town council of the city. The system of education is conducted by a rector and four classical masters, with teachers of writing, arithmetic, and mathematics. The usual number of pupils is from six to seven hundred.

The Edinburgh Academy is a similar institution with the High School, but its fees are higher. It was begun a few years ago by a society with a capital of L.12,900, which may be augmented to L.16,000, raised by proprietory shares of L.50 each. The superintendence of the establishment is vested in fifteen directors, chosen by the proprietors from their own body. The system of education is nearly the same as that pursued in the High School. There are here also four classical masters and a rector.

Besides the High School and Academy, there are a number of private academies throughout the city, several free schools, and many on moderate scales of charges. There are several sessional schools, which are entirely under the control and patronage of the kirk-sessions of the respective parishes where they are situated. The teacher is allowed a fixed salary from the funds of the church, so that the fees are extremely moderate. The private schools of Edinburgh altogether are computed to amount to about two hundred.

The School of Arts was established in 1821. The students are young men belonging to mechanical and trading professions, and are divided into junior and senior classes. The session is from October to April, during which period there are given every evening lectures on arithmetic, algebra, mathematics, geometry, and other scientific subjects. The students are under the guidance of several regular lecturers, and the institution possesses a library and collection of apparatus and models. It is supported by the sale of tickets of admission, and by voluntary subscriptions.

An institution called the Edinburgh Association for Popular Instruction was established in 1832, for the purpose of affording information by popular lectures, on terms and at hours convenient for the middle classes of both sexes, particularly those who are actively engaged during the day. The association is distinguished from some other institutions for education, by being entirely dependent upon the fees of subscribers, instead of relying for support on gratuitous contributions. It is conducted by directors chosen annually from among the subscribers.

The Scottish Naval and Military Academy was opened on the 8th of November 1825. Its principal object is to afford to young gentlemen intended for the army, navy, or the East India Company's civil or military service, a systematic course of education, in order to qualify them for any of these departments. The institution comprehends classes for fortification, military drawing, surveying, landscape and perspective drawing, arithmetic, algebra and geometry, the higher mathematics, natural philosophy and navigation, elocution, geography, ancient and modern languages, fencing, gymnastics, and military exercises. The establishment is supported by a body of proprietors, holding shares of L.10 each, subscribers who pay one guinea or more per annum, and donors. The management is confided in a body of honorary office-bearers, twenty-seven extraordinary and fourteen ordinary directors, with a chairman and trustees. The king is patron.

The Royal Academy, better known by the name of the Riding School, was established about the year 1760. The members were incorporated by letters-patent in 1764, with the title of the Royal Academy for Teaching Exercises. The directors of this academy are eighteen in number, and are persons amongst the most elevated in rank both in the city and county. The school is superintended by two masters.

The Botanical Garden is about twelve acres in extent. The first ground appropriated to this purpose was in St Ann's Yards, a spot situated near the North Bridge. From this it was in 1767 removed to Leith Walk, and thence to its present situation in the Inverleith grounds, on the road from Edinburgh to Newhaven, in 1822–24.

The new Observatory is situated on the Calton Hill, and belongs to the Astronomical Institution. It is built after a design by Mr Playfair, in the form of a cross, and is sixty-two feet each way. The centre is surmounted with a dome.

The Wernerian Natural History Society is an unincorporated association, formed in 1808 for the promotion of the study of natural history. The name was assumed from Werner, the distinguished mineralogist. It has associate and corresponding members, and holds its meetings in the university buildings.

Besides those already mentioned, there are a number of other societies, namely, the Plinian Society, instituted in 1823; the Diagnostic Society, instituted in 1816; the Medico-Chirurgical Society; the Royal Physical Society; the Royal Medical Society; the Hunterian Medical Society; the Harveian Society, instituted in 1782; the Speculative Society, for improvement in composition and in public speaking; the Select Forensic Society; the Juridical Society, instituted in 1773; the Scotch Law Society, instituted in 1815; the Philalethic Society, instituted in 1792; the Adelpho-Theological Society, instituted in 1758; the Theological Society, instituted in 1776; the Edinburgh Academical Club, instituted in 1828; the Phrenological Society, instituted in 1820; Edinburgh Harmonists' Society; Edinburgh Royal Naval Club; Caledonian United Service Club; the Pitt Club; the Celtic Society, instituted in 1820; the Highland Club of Scotland, instituted in 1825; St Fillan's Highland Society, instituted in 1819; the Six Feet Club, instituted in 1826; the Skaiting Club; the Duddingston Curling Society; the Edinburgh Company of Golfers, instituted in 1744; the Burntsfield Links Golfing Society; the Edinburgh Burgess Golfing Society; the Thistle Golf Club; the Royal Company of Archers, instituted in 1703 by a charter of Queen Anne, and now constituted the king's body guard in Scotland; the Brunswick Cricket Club, established at Edinburgh in 1830; the Edinburgh Chess Club, instituted in 1822; the Edinburgh Quoiting Club; the Edinburgh Shakspearian Club; the Edinburgh Anatomical Society, instituted in 1833; and the Edinburgh Ethical Society, for the study and practical application of phrenology, instituted in the same year. There are various other societies and clubs, which have been established from time to time in the Scottish metropolis, but they are of a character too unimportant to require notice in this place.

In addition to these, there are several associations of a literary nature. The principal is the Edinburgh Subscription Library. This library was instituted in the year 1794, and is the property of a body of subscribers, whose entry-money is twelve guineas, and who pay an annual fee of one guinea. The others are, the Select Subscription Library, instituted in 1800; the Edinburgh Subscription and Circulating Select Library; the Edinburgh Mechanics' Subscription Library, instituted in 1825; the Hope Park Library, instituted in 1816; and the Bakers' Record Office and Library, instituted in 1828.

The chief of the associations for religious purposes is the Society for Propagating Christian Knowledge, instituted in 1701, and incorporated by a charter of Queen Anne in 1709. The others are, The Scottish Bible Society; the Edinburgh Auxiliary Bible Society; the Edinburgh Auxiliary Naval and Military Bible Society; the Scottish Missionary Society; the Edinburgh Auxiliary Church of England Missionary Society; Edinburgh Auxiliary to the London Missionary Society; Baptist Home Missionary Society; Society for Improving the System of Church Patronage in Scotland; Edinburgh Philanthropic Society; Edinburgh Association in Aid of the Moravian Missions; Society for Promoting Christianity among the Jews; Society for Promoting Religious Knowledge among the Poor; Highland Missionary Society; Edinburgh Religious Tract Society; Edinburgh Society in Aid of the Irish Evangelical Society; Edinburgh Society for Promoting the Religious Interests of Scottish Settlers in British North America; and a few others.

Besides these there are several societies who associate the promotion of education in particular places with religious purposes, and a number of branches of different English societies for the accomplishment of similar objects.

Educat-
al hospi-

Heriot's Hospital was founded about the beginning of the seventeenth century. The founder, George Heriot, was born in the parish of Gladsmuir, and in the year 1597 he was appointed goldsmith and jeweller to James VI. He died in London, whither he had removed on the accession of James to the English throne, on the 12th of February 1624, leaving a fortune, it is supposed, of not less than L.50,000.

Of this sum L.23,625. 10s. 3½d. were, by his bequest, appropriated to the founding and endowing of the hospital which bears his name, for the maintenance and education of children, the sons of burgesses of the city "who are not able to maintain them." The magistrates, town council, and ministers of the town, were nominated the governors; and certain trustees were appointed to superintend the execution of the will. The building of the hospital, which is from a design by Inigo Jones, was begun in 1628, and, after some interruptions, completed in 1650, at an expense altogether of L.30,000. It was not however opened for its legitimate purpose till 1659, when thirty boys only were admitted. There are now one hundred and eighty on the establishment, all of whom are comfortably lodged, fed, and clothed, and every pains bestowed upon their education, which comprehends Greek, Latin, English, writing, arithmetic, book-keeping, mathematics, and geography. On leaving the hospital they are furnished with a liberal supply of articles of dress, of their own choosing; and such of them as are apprenticed to trades receive an apprentice fee of L.50, besides an allowance of clothing at the expiration of their indentures. Boys who distinguish themselves by their literary attainments, and who are qualified to enter the university with a view to the learned professions, receive bursaries of L.30 per annum for four years. Ten other bursaries of L.20 each, for the same period, are bestowed upon young men unconnected with the hospital who give proofs of superior talents. Boys are not admitted under seven years of age, and generally leave it at fourteen. The hospital is situated in the southern part of the town, and is one of the most remarkable buildings connected with the city. It is three stories in height in the central parts, and four stories at the corners, with an interior quadrangle or court. In 1832–33, the structure was improved in its external appearance, and a lodge was erected at the principal entrance, which is a beautiful miniature of the hospital.

The founder of George Watson's Hospital died in 1723, leaving the sum of L.12,000 sterling for the erection of an hospital for the maintenance and education of the children and grandchildren of decayed merchants in Edinburgh. The will of the donor, however, was not acted upon till 1738, when the original sum had accumulated to L.20,000. In 1721 twelve boys were admitted; and these have now been increased to eighty. In point of lodging, education, and otherwise, they are upon much the same footing as in Heriot's Hospital. On leaving the house they receive an apprentice fee of L.10 per annum for five years; and on attaining twenty-five years of age, if unmarried and able to show testimonials of good behaviour, they receive a premium of L.50. Boys preferring a college education receive L.20 per annum for six years. The managers are the master and twelve assistants of the Merchant Company, with the treasurer, four old bailies, the old dean of guild, and the two ministers of the Old Kirk parish.

In 1759 John Watson, writer to the signet in Edinburgh, bequeathed the whole of his property to trustees, to be laid out in such pious and charitable purposes within the city as they might think proper. In 1781 this fund amounted to L.4721. 5s. 6d. From that period, by the excellent management of the trustees, it accumulated to upwards of L.90,000. As the donor had not pointed out any particular mode of appropriating his bequest, the trustees originally contemplated the institution of a foundling hospital; but they finally determined on erecting an edifice appropriated "for the maintenance and education of destitute children, and bringing them up to be useful members of society, and also for assisting in their outset in life such of them as may be thought to deserve and require such aid." A splendid and extensive building, in the Grecian style of architecture, after a design by Mr Burn, has accordingly been erected for the purpose, on the Dean grounds, to the westward of the city. Children of both sexes are here maintained and educated; the girls, however, are only instructed in English, writing, and arithmetic.

The Merchant Maiden Hospital originated in 1695, and was incorporated by an act of parliament in 1707. Its objects are the maintenance and education of the daughters of merchant burgesses in the city, who are instructed in English, writing, arithmetic, geography, French, and needle work. It contains nearly a hundred inmates, who are received at from seven to eleven years of age, and who go out at seventeen. On leaving the establishment, each receives the sum of L.9. 6s. 8d. The new hospital is of Grecian architecture, and cost L.12,250. It was founded in 1816, and measures a hundred and eighty feet in length by nearly sixty in breadth, with a portico in front. It is situated near the Meadows.

The Trades' Maiden Hospital, for the maintenance and education of the daughters of decayed tradesmen in Edinburgh, was begun in 1704, and its governors were incorporated in 1707. It was founded and endowed by the trades of the city, and since its institution it has supported about fifty girls.

The Orphan Hospital was incorporated by a charter of George II. granted in 1742. It receives orphans from all parts of the country, and generally maintains and educates about one hundred and fifty children of both sexes. A very elegant building, designed by Mr Hamilton, for this institution, has just been finished (1833), on the property of Dean, near John Watson's Hospital.

James Donaldson, Esq. of Edinburgh, left at his death in 1830, about L.240,000 to six trustees, for the purpose of endowing an hospital for boys, to be called Donaldson's Hospital. An establishment of this kind is therefore about to be commenced.

Hospitals for the indigent, &c.

The Trinity Hospital, the oldest charitable institution in the city, was founded by Mary of Gueldres in the year 1461. The number of persons maintained in the house is at present forty; and there are besides about one hundred out-pensioners. The funds of the institution consist of lands in the county of Edinburgh, heritable property in the city and in the town of Leith, and money in bonds. The magistrates and town council are the governors, and there are regular office-bearers and house-directors.

James Gillespie, the founder of the hospital known by his name, was a shopkeeper in Edinburgh, and, by a will dated 1796, devoted the greater part of his property to endow an hospital for the maintenance of indigent old men and women, and for the elementary education of one hundred poor boys. A house for this purpose was accordingly erected in 1801. The number of its inmates is about forty. Its governors are, the master and twelve assistants of the Merchant Company, four old bailies, the old dean of guild, and the ministers of the Tolbooth and St Stephen's Churches. The name of Gillespie has a preference in admission.

The principal resources for the support of the poor are an assessment, and the collections made at church doors. The amount of money collected for their use in 1833 was L.13,479. 19s. 4d., whereas in 1814 it was only L.6943. 19s. 10d. Edinburgh, as regards the poor, is divided into three districts, the ancient and extended royalty, the parish of St Cuthbert's, and the Canongate, each of which has a house for the reception of paupers, with peculiar funds and a separate board of management. The City Poors-house, which was erected in 1743, supports six hundred persons within doors, affords regular aid to upwards of a thousand, grants to others temporary relief, and maintains about five hundred and thirty children at nurse. The expense incurred for each individual in the establishment is about L.8 per annum.

Besides these public institutions for the relief of the poor, there are several other charitable associations of a private nature. The principal are, the Society for the Suppression of Begging; the Benevolent Strangers' Friend Society, instituted in 1816; a Society for the Relief of the Destitute Sick, instituted in 1785; a Society for the Relief of Indigent Old Men, instituted in 1806; two similar institutions for the Relief of Indigent Old Women, instituted in 1797; the Edinburgh and Leith Seamen's Friend Society, for relieving poor shipwrecked or distressed seamen; and the Orkney and Zetland Society, for relieving such distressed natives of these islands as casually find their way to Edinburgh.

The Royal Infirmary was established in Edinburgh in the year 1736. The building, which is situated in Infirmary Street, consists of a body and two wings, all of four stories, the floors of which are divided into wards fitted up with ranges of beds sufficient to accommodate 230 patients. It also contains a theatre for chirurgical operations, in which 200 students can attend. All classes of persons are admissible into the Infirmary, on a guarantee being given that in case of death their bodies shall be removed. Patients suffering from accidental injuries are admitted without any stipulation. The expense incurred by this institution is liquidated by endowments, private subscriptions, *post-mortem* bequests, and collections at the doors of churches and chapels of all persuasions.

The Lying-in Hospital is adapted to the reception of all poor and unfortunate females requiring aid, and having no home at which they can be attended to. Besides this there are several other institutions of a similar nature, without hospitals, such as the Edinburgh General Dispensary and In-lying Institution; the Maternity Charity; the Edinburgh Lying-in Institution for delivering poor married women at their own houses, instituted in 1824; the Edinburgh New Town Lying-in Institution, instituted in 1825; and the Society for Relief of Poor Married Women of respectable character when in Child-bed, instituted in 1821.

The Public Dispensary, the oldest institution of this kind in the city, was founded in 1776. Besides this there are the following local dispensaries: The New Town Dispensary, instituted in 1815; the Western General Dispensary, instituted in 1830; the Eye Dispensary of Edinburgh; the Edinburgh Western Dispensary for Diseases of the Eye and Ear; and the Institution for Relief of Incurables. All these benevolent establishments afford medicines and advice to the poor gratis.

The Magdalen Asylum, which has for its object the reclaiming of unfortunate females, was founded in the year 1797. From fifty to sixty persons can be accommodated in the asylum, where they are all kept employed at useful occupations. The income of the house for the year ending in 1831 amounted to L.1183. The building is situated in the Canongate.

The Asylum for the Blind, situated in Nicolson Street, was opened in 1793, and is chiefly supported by voluntary subscription. Another for females, the former being confined to males, was established in 1822. The men are constantly employed in making mattresses, cushions, baskets, and other articles; the females in sewing and knitting. The number of inmates in these establishments is about 120, who receive instruction, partly according to the Abbé Sicard's plan, and partly according to methods which have been devised in the institution. See article Blind.

The Deaf and Dumb Institution, occupying a large edifice in the northern part of the New Town, was established in 1810, and contains upwards of seventy boys and girls, who receive the elementary and most useful branches of education. See article Deaf and Dumb.

The Lunatic Asylum, situated at Morningside, was opened for patients in 1813. The expense of its erection was defrayed by private subscriptions, and a grant by government of L.2000 from the forfeited estates. The establishment is managed by a body of directors and two physicians and surgeons. Inmates are received on paying a board regulated in amount by circumstances.

The most prominent of the provident and insurance societies is the Ministers' Widows' Fund, instituted in the year 1744. From this fund the widows of clergymen receive annuities for life, regulated in amount by the annual contribution previously made, and which varies from L.3. 3s. to L.7. 17s. 6d. The management of this fund is entrusted to the presbytery of Edinburgh and the professors of the university. The next in importance is a society formed for the benefit of the sons of the clergy, instituted in 1790. Another has recently been formed for the benefit of the daughters of the clergy. There are, besides, a Friendly Society of the Ministers of the Relief Synod, instituted in 1790; a Friendly Society of Dissenting Ministers, instituted in 1797; a society for the management of the Episcopal Fund, for affording small additions to the stipends of the poorer clergy of the Episcopal communion; a Medical Provident Institution of Scotland, instituted in 1826; and a Society for Relief of the Widows and Children of Burgh and Parochial Schoolmasters, instituted in 1807. There are likewise a variety of humbler associations, on various principles, throughout the city, as well as a large number of insurance companies.

Banki institu tions.

Although not an extensive trading or commercial town, Edinburgh exerts great influence over all branches of commerce in Scotland, by means of its banking associations, which supply capital to almost every seat of industry throughout the country. The oldest institution of this description is

The Bank of Scotland, which was established at Edinburgh in 1695, by charter from William III. and the Scottish parliament. The capital stock of the company was originally L.100,000 sterling, raised by shares differing in amount from L.83. 6s. 8d. to twenty times that sum. The capital has since been raised to a million and a half sterling. Notes were first issued by this bank in 1704. The establishment occupies a large and conspicuous building near the head of the Earthen Mound.

The Royal Bank of Scotland was instituted in 1727, by royal charter. Its original capital was L.111,000 sterling. In 1738 this capital was raised to L.150,000, and subsequently to L.2,000,000. The banking house is situated in St Andrew Square, in the building formerly occupied by the Excise Office.

The British Linen Company's Bank was established in 1746, with a capital of L.100,000. This capital has now increased to L.500,000. The banking house is also situated in St Andrew Square.

All the other banks in Edinburgh belong either to private persons or to joint-stock companies. Of the former there are seven, only two of which issue notes; these are, Sir William Forbes and Co. and Ramsays, Bonars, and Co. The joint-stock banks are, the Commercial Banking Company of Scotland, instituted in 1810; and the National Bank of Scotland, instituted in 1825, which now possesses a charter of incorporation.

Place publi amuse ment.

The present Theatre Royal was built shortly after the commencement of the New Town, in 1768. Previously to this period the theatrical performances of the city were exhibited in the Canongate, where a play-house was erected in 1746, in opposition to a rival establishment in the

Cowgate. The present house, although rather small, and externally of a very plain appearance, is in its internal arrangements one of the neatest and most commodious houses in Britain. The company of actors established here is generally considered as the best to be met with out of London. But, though for many years under able management, the fortunes of the establishment are by no means in a flourishing state. It is situated at the extremity of the North Bridge, adjacent to Princes Street. There is also a Minor or Summer Theatre, called the Adelphi, which is situated at the head of Leith Walk.

Assemblies and balls, under the patronage of ladies of distinction, are held every winter and spring in a large building in George Street, called the Assembly Rooms, erected in 1787. This edifice has a plain external appearance, relieved, however, by a portico and pillars in front. Its principal apartment measures ninety-two feet in length by forty-two in breadth and forty in height, and is occasionally used for concerts, public meetings, and other purposes.

Perhaps the most beautiful feature of Edinburgh in its modern state consists in the highly ornamental pleasure-grounds which occupy the open spaces between the Old and New Town, as well as between the latter and the second New Town. The low grounds to the east and west of the Earthen Mound continued for about fifty years after the commencement of the New Town in a very marshy and unprofitable condition. At length, in 1821, under the authority of an act of parliament, the ground on the west was drained, inclosed, laid out, planted, and highly beautified with walks, and has since been opened to the proprietors or tenants of property in Princes Street, or others, on payment of an annual fee. In 1832–33 the ground on the east was similarly inclosed and beautified. Before the year 1820 the greater part of the ground north of Queen Street was inclosed and laid out in gardens or promenades in the same tasteful and pleasing style.

In the year 1722 a marshy ground, part of the ancient Boroughmuir, in the southern environs of the city, was inclosed, drained, and traversed by extensive broad walks, skirted with trees, for the accommodation of the citizens. These public grounds, which receive the appellation of the Meadows, and bear some resemblance to St James' Park in London, are bordered with extensive open downs, called Burntsfield Links, which are also open to the public, and form a place of agreeable recreation for youth.

I rature.

Edinburgh has for some time been distinguished as a mart of literature, and as a place the inhabitants of which are noted for cultivated tastes and habits. This character, however, is not of much older date than the latter part of the eighteenth century. Previously to that time it seldom produced works of merit. The early editions of the Encyclopædia Britannica were the first large works which issued from the Edinburgh press. But the era of a new system of publishing commenced with the establishment of the Edinburgh Review in the year 1802. The person to whom Edinburgh has latterly been most indebted for an increase of its literary reputation was Sir Walter Scott, whose poetical productions appeared at intervals from 1802 till 1812, and whose novels and tales began to be published in 1814. The principal periodical works now published in Edinburgh are, the Edinburgh Review, the Edinburgh Medical and Surgical Journal, the Journal of Agriculture, and the Edinburgh Philosophical Journal, quarterly; the Presbyterian Review every two months; Blackwood's Edinburgh Magazine, Tait's Edinburgh Magazine, the Christian Instructor, the United Secession Magazine, and the Christian Herald, monthly; and the Edinburgh Almanack annually. There are ten newspapers published in Edinburgh, namely, the Caledonian Mercury, and Edinburgh Evening Courant, on Monday, Thursday, and Saturday; the Gazette, the Observer, and the Advertiser, on Tuesday and Friday; the Scotsman on Wednesday and Saturday; the Weekly Journal on Wednesday; and the Weekly Chronicle, the Saturday Evening Post, and the Edinburgh, Leith, and Glasgow Advertiser, a paper solely devoted to advertisements, and distributed gratis, on Saturday.

Public markets.

The public market-day is Wednesday, when there is a large open market held for the sale of cattle, sheep, corn, and other agricultural produce. The spacious street called the Grassmarket is the chief place to which stock is brought for sale. At its western extremity there is a large granary, the lower part of which is open for the exposure of grain in sacks. This edifice was reared in 1819, and is ornamented with a small spire and clock. Once a year, at the beginning of November, there is a large sheep, cattle, and horse market held in the vicinity of the city, called *All Hallow Fair*, being the feast of *All Saints*.

Edinburgh possesses excellent butcher-meat, fish, and vegetable markets. They are situated in the centre of the town, and consist of a series of descending open areas or terraces, connected by flights of steps from the back of the High Street to the bottom of the valley of the North Loch, below the North Bridge. These markets, all the property of the burgh, are exceedingly well supplied with the various articles of consumption for which they are respectively appropriated. There is another market of a similar nature, though on a more limited scale, in Nicolson Street; and a very spacious one, the property of a private individual, near Stockbridge, at the north-west extremity of the New Town.

Coal.

The metropolis is abundantly supplied with coal, chiefly by means of the Union Canal, from pits in the west of Scotland, and by a railway leading from the pits near Dalkeith to its termination at St Leonards. (See EDINBURGHSHIRE.)

Water.

Edinburgh possesses an abundant supply of water from the Crawley Spring in the Pentland Hills. This was effected by a joint-stock company, incorporated by act of parliament in 1819. The cost of laying new pipes, and other matters connected with the introduction of the new springs, amounted to nearly L.200,000. Families are supplied with small service-pipes, by paying to the company a certain duty on their rental.

Lighting.

Edinburgh is lighted with coal gas, manufactured by a joint-stock company associated in 1817, and incorporated in 1818, with a capital of L.100,000, raised by shares of L.25 each. The streets and shops were first illuminated with this brilliant light in 1818. An oil-gas company, instituted in 1826, not having succeeded in its objects, was, after a short trial, incorporated with the coal-gas company.

Burgal system, police, &c.

The ancient civic establishment of Edinburgh was remodelled in 1833 by the act of parliament for reforming the royal burghs of Scotland. It possesses a town council, consisting of thirty-one members chosen by the qualified voters for members of parliament in their respective wards or districts; of a deacon-convener elected by the incorporated trades; and of a dean of guild, chosen by the incorporation of guildry. The council so composed elects a lord provost and four bailies, who compose the magistracy. The magistrates, in virtue of former privileges, hold certain civil and criminal courts, with the assistance of assessors or legal advisers. In 1833 the funds of the civic incorporation were placed under the control of a body of trustees appointed by act of parliament, for the behoof of creditors. In virtue of the act for reforming the system of parliamentary representation, passed in 1832, Edinburgh and its immediate suburbs return two members to parliament.

The merchants of Edinburgh form a body, called the Merchant Company, incorporated by a charter of Charles II. in 1681. It possesses the management of several charitable institutions, and is active in superintending measures connected with the commercial character of the city. Its business is conducted by a master, treasurer, and twelve assistants, and their hall of meeting is a spacious apartment in Hunter Square.

The High Constables are a body of individuals appointed to support the authority of the magistracy, and to assist in maintaining the public peace of the city. They are generally respectable shopkeepers, and are qualified by being burgesses, and having been in business for three years.

Till the year 1805 the city was protected only by a feeble body of old men in the garb of soldiers, entitled the City Guard, the remains of a civic defensive force originally raised in 1514, after the fatal battle of Flodden. In 1805 a regular police establishment was formed, and the city guard was finally dissolved in 1817. The police establishment was remodelled in 1812, and latterly in 1822 and 1832, by acts of parliament each time. The establishment consists of thirty-two general commissioners elected by the inhabitants of the same number of wards, qualified to vote by paying a certain rent. The body of general commissioners is increased by sixteen *ex officio* members, as the provost and magistrates, the sheriffs, and certain other functionaries. Under this body there is an executive police, with a superintendent; and a criminal court is held daily on the plan of that at Bow Street in London, and in which a town bailie officiates as magistrate or judge, in all cases which occur within the ancient and extended royalty; whilst cases originating in that portion of the city included between the exterior limits of the royalty and the general police boundary fall under the cognisance of the sheriff-substitute. Edinburgh is now in all its parts well watched, lighted, and cleaned; and the expenditure for these and other public purposes amounted in the year ending at Whitsunday 1833, to L.31,038. 6s. 6d. An assessment on the inhabitants, of about 1s. 2d. per pound on the rental, supplies the ordinary revenue of the establishment. The head police-office is a large building within a small court near the Cross.

Since the destruction of the old tolbooth, an extensive building, situated on the Calton Hill, fronting the road which sweeps around that eminence, has been provided as the common town and county jail. It was erected in 1817, and is built in a castellated form, in the Saxon style of architecture, after a plan by Mr Archibald Elliot. It is 196 feet in length by forty feet in breadth, and is four stories in height. The interior exhibits a series of corridors opening upon small cells eight feet by six, and forty-eight in number; there is also a chapel on the second floor. This jail at present affords accommodation for debtors, as well as offenders of every description, who are to a certain extent classified, and furnished with airing grounds. A lock-up house, or jail for the confinement of criminals during short periods, adjoins the County Hall in the High Street.

The Bridewell stands adjacent to the jail on the east. It is an edifice of a semicircular form, within an open court, and was constructed in 1791, upon the panopticon principle, after a plan by Mr Robert Adam. The expenses of the establishment are defrayed partly by assessments, and partly by the work of the inmates.

The Canongate Jail is an old-fashioned plain edifice of the time of James VI. It is appropriated exclusively for the incarceration of debtors, and is under the jurisdiction of the magistracy of Canongate.

The public business connected with the civic establishment or corporation is conducted in the Royal Exchange Buildings. The public business of the county, and the sittings of the sheriff and justices, take place in the County Hall, adjacent to the Parliament House. It was erected in 1819, at an expense of L.15,000, but is shortly to be removed in order to make way for the approach by the bridge leading from the Lawnmarket towards the south.

The superiority of the Canongate jurisdiction, which formerly belonged to the abbot of Holyrood, was purchased by the town of Edinburgh from the Earl of Roxburgh, into whose hands it had fallen, in the year 1636. Since that period the burgh of Canongate has been governed by baron bailies appointed by the town council out of their own body, and by two resident bailies, also appointed by the same authority on the recommendation of the baron bailies. In a similar manner bailies are appointed to the subordinate districts of Easter and Wester Portsburgh. Edinburgh has likewise possessed for a long period a superiority over the port of Leith. See Leith.

Population.

In 1755, shortly before the commencement of the New Town, Edinburgh had a population amounting to 57,195; in 1775 it was computed at 70,430; and in 1791 it had risen to about 80,000. In 1801, by parliamentary census, the amount was 82,560; in 1811 it was 102,987; in 1821 it was 138,235; but in these latter enumerations the population of Leith was included. In 1831 the population was as follows:

Parish of Canongate	10,175
College Church	4,244
Greyfriars, Old	4,345
——— New	4,536
High Church	2,614
Lady Yester's	2,890
New North Church	1,350
Old Church	1,952
St Andrew's	7,339
St George's	7,338
St Mary's	6,587
St Stephen's	5,772
Tolbooth	3,256
Tron Church	3,009
St Cuthbert's	70,887
	136,294
North Leith	7,416
South Leith	18,439
Total of Edinburgh and Leith,	162,156[1]

The gross amount of the rental of dwelling-houses, shops, warehouses, &c. producing above five pounds of rent, within the bounds of police, for the year ending at Whitsunday 1833, was L.406,484. The number of householders paying ten pounds of annual rent and upwards, and qualified to vote for members of parliament for the city, in 1832, was 9382. (M. M. M.)

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[1] There is a slight difference in the amount here stated and the sum of the different parishes added together. It is so in the return.

EDINBURGHSHIRE, or, as it is frequently called, MID LOTHIAN, is the seat of the metropolis of North Britain. It is situated between 55° 39′ and 55° 59′ north latitude, and between 2° 36′ and 3° 33′ longitude west from Greenwich. Its boundaries are the Frith of Forth on the north; Linlithgowshire or West Lothian on the west; the counties of Haddington or East Lothian, Berwick, and Roxburgh on the east; and those of Selkirk, Peebles, and Lanark on the south; the length of the whole line, which is very irregular, and longest on the south, being about ninety miles. The medium length of the county may be taken at twenty-four miles, and the breadth at fifteen; the area thus comprising 360 square miles, or, by the latest computation, 354 square miles, or 226,560 English acres, of which 145,000, or sixty-four acres in a hundred, are in cultivation, and the remainder, or more than a third, hilly, or otherwise comparatively unproductive.

The surface of this county exhibits a great variety of natural scenery, almost everywhere blended and embellished with the labours of taste and opulence. The lower and richer part of it is of a semicircular form, inclining towards the Frith of Forth on the north, and terminating near Mid Calder on the west, and Fala on the south-east, but interrupted by the Pentland Hills, which, rising in the south-west, approach to within five miles of the frith, and thus divide the southern part of this tract into two large plains. These hills cover about forty square miles; and though none of them rise to the height of more than 1700 feet, yet their situation in a flat country, and their bleak and barren aspect, render them very prominent objects in the landscape. On the south-east, where the county terminates almost in a point, between the counties of Roxburgh and Selkirk, and about fifteen miles from the sea, there is another mountainous tract, called the Morefoot Hills, the highest of which rise to upwards of 1800 feet, and extend over fifty square miles. From the rivulet Gala, which flows through it, this is commonly known by the name of the Gala Water district. Fertile valleys are found amongst these hills, and many of the hills themselves have been cultivated. With the exception of these two hilly tracts, Edinburghshire may be considered as a low-lying country, though not level or flat, the surface being varied by ridges and gentle acclivities, and occasionally by detached hills of moderate elevation, amongst which Arthur's Seat, in the vicinity of Edinburgh, and the Corstorphine Hills, are the most considerable. The view from these eminences is singularly rich and beautiful; embracing, besides the city itself, a great many gentlemen's seats, with their pleasure grounds, and elegant villas thickly planted in every direction, with the town and shipping of Leith, and the estuary of the Forth expanding into the ocean on the north and north-east, and the plains and high grounds of Fife beyond; whilst the naked and rugged hills to the south form a striking contrast with the highly-ornamented landscape into which they protrude.

The climate is exceedingly variable, but not subject to extremes. Snow seldom falls before December. From March to June cold east winds often prevail, sometimes attended by great falls of rain. July and August are warm and pleasant. Partly from the nature of the soil, as well as the climate, the corn crops, with a few exceptions, do not come to maturity so soon as in the south of Scotland by three weeks or a month. The fields, in late seasons, are not all cleared, even near the city, till the end of October. According to a register kept in its immediate vicinity for eight years, from 1785 to 1792 inclusive, the average number of rainy days was 175, and the quantity of rain 25·75 inches. The thermometer once in the same period was at 89°, and twice besides above 80°; the lowest point was 11°, and the average of the whole period 46·570.

The streams of this county are so inconsiderable as not to be called rivers, but *waters;* a term which in Scotland is employed to denote a stream somewhat larger than a brook or *burn*, and whose bed is never in ordinary seasons altogether dry. Almond Water, which rises in the borders of Lanarkshire, separates this county from Linlithgowshire for a great part of its course, and falls into the sea near the village of Cramond, where, at high water, it is navigable by sloops for about a quarter of a mile. The Water of Leith has its source in the western extremity of the parish of Currie, on the north side of the Pentland Hills, and falls into the sea at Leith, after a course of about sixteen miles. It flows in a deeper channel than the former; and the banks are, for the most part, beautifully fringed with wood. In no part of the island perhaps is so small a body of water employed with greater effect, there being upwards of seventy mills, the greater number corn mills, on ten miles of its course. The Esk is the most considerable rivulet, and also the most beautiful. It is formed of two others of the same name, called the North Esk and the South Esk. The North Esk rises on the southern side of the Pentland Hills, above Newhall, about fourteen miles from Edinburgh, and flows by Pennicuik, Roslin, Hawthornden, Laswade, and Melville Castle, till it meets with the South Esk below Dalkeith. The South Esk has its source in the Morefoot Hills. On its banks, which are also well wooded and picturesque, stand Arniston, Dalhousie, and Newbattle. Their united streams flow into the sea at Musselburgh. The Tyne, which rises in this county, after a course of five or six miles in a north-east direction, passes into East Lothian; and the Gala, the only rivulet that flows to the south, rising on the north of the Morefoot Hills, leaves this county after it has proceeded about ten miles, and falls into the Tweed below Galashiels. The Esks and the Gala contain trout, and salmon are caught in the Esk at Musselburgh; but the quantity of either is not considerable.

Edinburghshire abounds in coal, limestone, and sandstone, or, as it is popularly called, *freestone.* A continued bed of coal extends across the whole county from Carlops, on the confines of Tweeddale or Peeblesshire, in a direction from south-west to north-east, near fifteen miles in length, and from seven to eight in breadth, on both sides of the North Esk. But it is chiefly towards the lower end of this vale that the coal is wrought, where there are in some places twenty-six seams, from two to ten feet thick. Some of the seams are horizontal, and others almost perpendicular, from which they are distinguished by the names of *flat* seams and *edge* seams; and it has been remarked that the position of the coal corresponds in some degree with the surface of the ground, being level in the valley of the North Esk, and inclined to the horizon on the higher grounds at a distance. Coal has been wrought in the parish of Laswade for upwards of two centuries, where it is still so abundant that the quantity raised is said to be equal to a sixth part of what is obtained from all the coal works of the county. Over nearly the whole coal district it is necessary to keep up powerful steam-engines, for the purpose of freeing the workings from water. A stupendous machine of this description has recently been erected in the parish of Inveresk, by Sir John Hope, Bart. Dikes or veins of stone frequently occur in the coal strata, which, with the expense attending the erection of machinery, and also that incurred in propping the roofs of the pits, forms a very considerable drawback upon the profits realized by the coal-masters. Limestone is found not only in the same tract with the coal, but still farther to the east, and also in the south-west, where coal has not yet been discovered. The great quarry at Gilmerton, in the parish of Libberton, about four miles from Edinburgh, is nearly a mile in length, everywhere open to the light of day, and has the appearance of a long chasm, advancing obliquely to the surface. Like the coal in its neighbourhood, the stone rests in an inclined position, which, when removed, leaves a floor of such a moderate declivity as to be descended by paths among the fragments of rock that have been left. At the bottom there is a pool of water. Overhead is a roof of considerable height, consisting of a bed of solid rock, supported by pillars of limestone. The principal freestone quarries are at Craigleith, in the neighbourhood of the city, from which the six columns in the front of the New College were obtained; and at Hales, in the parish of Colinton, about three miles to the westward. The stone of the former, from its superior whiteness, has been of late most in request for building; but the latter is still unrivalled for flags and for stairs. In the year 1830 a large fossil tree was found in the former quarry, at a considerable depth down in the mass of stone; and another towards the end of October 1833, still deeper. A stone similar to that of Craigleith, but easier wrought, is now got at Redhall, also in the parish of Colinton. Mill-stones have been wrought in the parish of Pennicuik. Copper has been found in the parish of Currie and some other places, but not so rich as to pay for working. Ironstone abounds in the coal district, and also along the shore from Leith westwards; and stones for building and paving are to be found in every parish of the county. A stone similar to the Chinese *Petunse*, used in the manufacture of porcelain, has been found in the Pentland Hills; and clay, fit for being made into crucibles, in the parish of Duddingstone. There are mineral waters in different parts of the county, none of which are of much celebrity, with the exception probably of St Bernard's Well, to the north-west of the city.

The valuation of Edinburghshire, which appears to have been taken in 1649, is L.191,054. 3s. 9d. Scots; and in 1811 the real rent of the lands, according to the returns made under the property-tax, was L.277,827. 19s. 1d. sterling, and of the houses L.400,004. 5s. 6d. In 1795 the landed property was divided into 542 estates, of which twelve belonged to hospitals and other corporate bodies, of the valued rent of L.10,628. 4s. 5d. Scots, or more than an eighteenth part of the whole. Here, as throughout the rest of Scotland, the land is occupied by tenants on leases for a term of years, excepting the comparatively small portion possessed by the proprietors themselves, or let in grass for the season. Within a few miles round the city the cultivation of farms is conducted with a view to the wants of that great market, where potatoes, turnips, and clovers are found more profitable than corn. The price of these crops, sold on the ground, the purchaser taking upon himself all the expense of carrying them to market, or taking them away for his own consumption, may average about L.20 the Scotch acre (about L.16 the English), and very fine crops sometimes bring even more than L.30. Early potatoes, raised within a mile of the city, have been sold, to the extent of several acres on one farm, at L.50 an acre. The manure for raising these crops is amply supplied by the streets and stables of the city. The street soil manure, although the effects of it are not so lasting as those of stable or farm-yard dung, enables the farmers to raise large crops of wheat and other kinds of corn, after the green crops, upon soils that are not naturally very fertile; but the seeds of all sorts with which it abounds are unfavourable to the cleanness of their fields. Their straw, instead of being consumed or converted into manure on their farms, is carried to the city for sale, or given to stablers in exchange for their dung. The rent of farms of from fifty to a hundred acres, within a mile of the city, is in some instances as high as L.8 or L.10 an acre. Lime is very little employed as a manure within the circle to which the town dung extends. Beyond this circle, which has been materially extended by the canal, the system of cultivation is nearly the same as we have already described under other Scotch counties. The extent of the natural wood has been estimated at 3000 acres, and of plantations at about 14,000, being together about one acre in every fourteen.

In 1812, four hundred acres were employed in raising vegetables for the city within a circuit of five miles, and a hundred acres more were under strawberries. Mr Neill, secretary to the Horticultural Society, states the produce of the former at L.45, and the rent from L.8 to L.16 an acre. Between 60,000 and 70,000 Scotch pints of strawberries, or nearly half as many English gallons, are annually sold in Edinburgh, at from 10s. 6d. a pint down to 9d. The produce of an acre is from eight to nine hundred pints, thus yielding a return not very different from the garden grounds. There are also several nurseries in the immediate vicinity of the city, some of them equal to any in the united kingdom for their collection of fruit and forest trees, shrubs, and herbaceous plants, as well as for the arrangement and keeping of the grounds. About a hundred and thirty acres are employed in this way.

The manufactures and commerce of this county, exclusive of Edinburgh, and Leith its sea-port, are inconsiderable. None of the three great branches of industry, the woollen, cotton, or linen manufacture, is carried on here to any extent. Distilleries, paper-mills on both branches of the Esk, iron-works at Cramond, potteries and salt-pans at Inveresk, and gunpowder-works at Stobbs and Roslin, on the South Esk, are the most worthy of notice. The paper-mills of the county have latterly much increased in number, and the article made has become celebrated for its quality. Machinery is employed to a considerable extent in the manufacture of it. From the metropolis of Scotland being situated here, the public roads which pass through it in every direction are kept in the best order, and thus promote its internal trade. A system of railways has lately been constructed between the city and the coal-works to the south-east. By this useful conveyance the metropolis is well supplied with the valuable mineral with which its vicinity abounds. A number of coaches also ply upon the railway, by which a cheap and agreeable conveyance is obtained for ten miles or thereabout to the south-east of the city. A railway between Dalkeith and the port of Leith is in the course of being laid; and it is in contemplation to extend these improvements in land carriage a considerable way farther.

There is a communication between Edinburgh and Glasgow by means of the Union Canal. This work was commenced in 1817, and finished in about five years afterwards. One of the principal objects for which it was projected was to facilitate the conveyance of coal from the coal fields of Falkirk. It has been found of considerable utility in this respect, as also in various others, such as the conveyance of manure from the city into the interior of the country.

Besides the capital itself, there is no town of any note in Edinburghshire, but a great many thriving villages. Of these may be mentioned Mid Calder, Corstorphine, and Cramond, in the north-west; Pennicuik, Dalkeith, which is a burgh of barony, Laswade, Loanhead, and Gilmerton, in the east and south; and Musselburgh, including the villages of Inveresk and Fisherrow, Portobello, and Newhaven, on the Frith of Forth. Portobello is a pleasant village, resembling a portion of the metropolis in elegance, and much resorted to for sea-bathing. Roslin, in the parish of Laswade, is a pleasant village, and much resorted to on account of its castle, a beautiful remnant of antiquity. Dalkeith, the most populous of the places we have mentioned, has been long distinguished for its great weekly markets for meal and grain.

Among the principal seats are, Dalkeith House, Duke of Buccleuch; Newbattle Abbey, Marquis of Lothian; Duddingstone, Marquis of Abercorn; Dalmahoy, Earl of Morton; Dalhousie Castle, Earl of Dalhousie; Melville Castle, Viscount Melville; Calder House, Lord Torphichen; Arniston, Mr Dundas; Pennicuik, Sir George Clerk. To the above may be added the names of some other old families who have long held estates in the county, viz. Borthwick, Craig, Dalrymple, Davidson, Dick, Drummond, Dundas, Forbes, Foulis, Hope, Inglis, Maconochie, Scott, Trotter, Tytler, Watson, and Wauchope.

Edinburghshire sends four members to Parliament, one for the county, two for the city, and one for Leith. The annexed abstract exhibits the state of the population of the county in 1811, 1821, and 1831.

See Robertson's *Survey of Mid Lothian;* the *Statistical Account of Scotland; Beauties of Scotland,* vol. i.; Sir John Sinclair's *General Report of Scotland;* and, for the history and antiquities of the county, Chalmers's *Caledonia,* vol. ii.

YEAR.	HOUSES.			OCCUPATIONS.			PERSONS.		
	Inhabited.	By how many Families occupied.	Uninhabited.	Families chiefly employed in Agriculture.	Families chiefly employed in Trade, Manufactures, or Handicraft.	All other Families not comprised in the two preceding classes.	Males.	Females.	Total of Persons.
1811	15,789	33,043	1167	3594	13,254	16,195	65,004	83,603	148,607
1821	19,077	40,469	1163	4830	18,700	16,939	87,759	103,755	191,514
1831	......	......	......	......	......	......	99,911	119,681	219,592

EDMONTON, a parish in the county of Middlesex, seven miles from London, on the great north-east road. It is situated in the hundred of the same name, and contains many of the residences of the more wealthy citizens of London. The new river is conducted through it. The population amounted in 1801 to 5993, in 1811 to 7824, in 1821 to 7900, and in 1831 to 8192.

EDOM, or IDUMÆA, in *Ancient Geography,* a district of Arabia Petræa. A great part also of the south of Judæa was called *Idumæa,* because it was occupied by the Idumeans, upon the Jewish captivity, as far as Hebron. But the proper Edom or Idumæa appears not to have been very extensive, from the march of the Israelites, in which they compassed it on the south-eastward, till they came to the country of the Moabites. Within this compass lies Mount Hor, where Aaron died, and marching from which the Israelites fought with King Arad the Canaanite, who came down the wilderness against them. This was the extent of the *Idumæa Propria* to the south of the Dead Sea; but in Solomon's time it extended to the Red Sea. (1 Kings, ix. 26.)

EDRENOS, a town of Asiatic Turkey, in Natolia, situated on a river of the same name, twenty miles south of Bursa.

EDRISI, or ALDRISI, the most eminent of the geographers who have written in the Arabic language. There is no individual of equal eminence over whose life there hangs a deeper veil of mystery, the various parts of it affording rather subjects of controversy to the learned than of precise information to the biographer. The place, and even the country in which he was born, compose the first subject of disputation. Sionita and Hezronita, who published a Latin translation of his work at Paris, make him a Nubian, and gave to their work the title of *Geographia Nubiensis,* the Nubian Geography. They proceeded upon the expression there used, namely, "the Nile of Egypt, which cuts *our* land." Hartmann was at once led to suspect the correctness of this inference, by observing that Nubia was one of the countries of which Edrisi gives the most meagre and imperfect account; and his suspicions were confirmed by learning that Ockley, on examining two manuscripts in the Bodleian Library, had found in both "that land," instead of "*our* land." It seems now generally agreed, therefore, that there is no reason to suppose him of Nubian origin. Others have given him an Egyptian one, which seems more probable, yet rests solely upon the erroneous reading above referred to. In 1663, Bochart stated that he had found in a manuscript of Leo Africanus, that Edrisi was born at Mazara, in Sicily, in 1098. Next year, however, the manuscript was edited by Hottinger, in an appendix to his work entitled *Bibliothecarius Quadripartibus,* when it appeared that the person supposed to be Edrisi was there named Esseriff Essachalli. Esseriff, or Scheriff, is indeed an usual appellation of Edrisi, but it is common to many, and is rather a title than a name. The rest of the name, and the date of birth, are materially different, so that there seems very little reason to doubt that Bochart was here mistaken.

The most positive statement on the subject is that of Casiri, who says (*Bibliotheca Arabico-Hispanica,* ii. 9), that if Edrisi, as appeared probable, were the person designated by the Mahommedan writers under the long appellation of Abu Abdallah Mohamad Ben Mohamad Ben Abdallah Ben Edris, he was born at Septa, or Ceuta, on the coast of Morocco, in the year of the Hegira 493 (A. D. 1099). Casiri not only qualifies his statement with this condition, but he does not state the authorities from which it is derived; so that it rests only upon the confidence reposed in his learning and accuracy. Edrisi was long a mighty name in Northern Africa; but in 919 the dynasty was subverted by Mahedi Abdallah, and the proscribed wrecks of the family, according to D'Herbelot, afterwards sought refuge in Sicily. This certainly tends to strengthen the Sicilian origin of our author, though it is not probable that many would seek refuge by concealment in their native country.

If we may trust the information of Casiri, Edrisi pursued his studies at Cordova, then equally famed as a seat of Moorish empire and a seminary of Arabic learning. From the accurate and particular description he has given of Spain, it is probable that he had travelled through a great part of that country. Various circumstances prove that he removed to Sicily, and began to compose his great work under the patronage, and indeed at the express desire, of Roger II. king of that island. It was completed about the year of the Hegira 548, A. D. 1153.

It has been a subject of pretty warm controversy among the learned whether Edrisi was a Mahommedan or a

Christian. Sionita, who adopts the latter opinion, observes that he repeatedly calls our Saviour the Lord Jesus, and on one occasion simply the Lord, a title which is said never to be applied by Mahommedans unless to Mahommed, while they merely say "Jesus, to whom be peace," or "Jesus, to whom be safety." He also speaks with profound respect of the holy Virgin, and of various saints, using in regard to the latter the Italian expression instead of the Arabic. These arguments are strenuously repelled by Hartmann, though not, as appears to us, on very solid grounds. He justly remarks, indeed, that the Mahommedans speak always with the highest respect of every thing connected with the origin of Christianity. But though this may impair the force of Sionita's arguments, there seems nothing of any importance to place in the opposite scale. Hartmann lays much stress on the circumstance that Edrisi, amongst his numerous names, bears that of Mohamad, which he says was never borne by any Christian; but though this may imply that he was a Mahommedan by birth, it does not authorize us to infer that he may not have become a convert to the opposite faith. He evidently wishes to offend persons of neither profession, and thus writes in a style from which no positive inference can be drawn. But considering how high religious differences ran in that age, it does not appear very probable that he could have resided in Sicily, or been in such high favour with Roger, without adopting the religion of the monarch and country.

The only thing relative to the life of this eminent author which remains even a subject of controversy, is the period of its termination. Bochart has fixed it in the year 1122; but this date clearly proves that he had some quite different person in view; since it appears by the preface to Edrisi's own work, that its completion took place in the year 1153. No other notice, nor even conjecture, relative to the time or manner of his death, is to be found in any author.

From these meagre notices respecting the life of Edrisi, we shall proceed to give some account of his work. It has appeared under various titles. The first and fullest appears to have been, *The going out of a Curious Man to explore the Regions of the Globe, its Provinces, Islands, Cities, and their Dimensions and Situation.* This is sometimes abbreviated into *The going out of a Curious Man to explore the Regions of the Globe;* and sometimes merely *The going out of a Curious Man.* Sionita published it under the name of *Relaxation of the Curious Mind;* but the title of *Nubian Geography,* which he and his companion imposed upon it, though it has become general in Europe, is, as already observed, altogether arbitrary.

The work contains a full description of the whole world, as far as it was known to the author, with its countries, cities, and all its features, physical and political. These are arranged, not according to any of the methods to which we are accustomed, but in a manner peculiar to itself. The world is divided into seven *climates*, commencing at the equinoctial line, and extending northwards to the limit at which the earth is supposed to be rendered uninhabitable by cold. Each climate is then divided by perpendicular lines into eleven equal parts, beginning with the western coast of Africa, and ending with the eastern coast of Asia. The whole world is thus formed into seventy-seven equal square compartments, resembling those upon a chess-board, or those formed upon a plane map, by the intersecting lines of latitude and longitude. The geographer begins with the first part of the first climate, including the western part of Central Africa, and proceeds eastward through the different divisions of this climate, till he finds its termination in the Sea of China. He then returns to the first part of the second climate, and so proceeds till he reaches the eleventh part of the seventh climate, which terminates in the north-eastern extremity of Asia. The inconveniences of such an arrangement must be abundantly obvious. Instead of each country, or at least each region of similar physical character, being described by itself, it is severed by these mechanical sections into fragments, which are described in different and distant parts of the work; and no connected view is given of any great country.

The only valuable unpublished manuscripts of Edrisi which now exist in Europe are two which are preserved in the Bodleian Library. The first, which was brought over from Egypt by Greaves, is written in the Arabic character peculiar to Northern Africa. It is illustrated by a map of the known world, and by thirty-three other maps, containing each part of a climate, so that there are maps only for the first three climates. The second manuscript, brought by Pococke from Syria, is written in the Arabic character, as used in that country, and bears the date of 906 of the Hegira, or A. D. 1500. It consists of 320 leaves, and is illustrated by one general and seventy-seven particular maps, the last consequently including all the parts of every climate. The general map has been published by Dr Vincent in his *Periplus of the Erythræan Sea.*

There is a manuscript (Cod. DLXXX) in the Royal Library at Paris, which professes to be the production of Edrisi; but D'Herbelot, it appears, has not made use of it as such; and De Guignes expresses positive disbelief on the subject. Hartmann, however, found it to coincide in many particulars with the geography of Edrisi. A copy of our author's work was contained at one time in the library of the Escurial, but it was destroyed by a great fire in the year 1671.

The geography of Edrisi, in the original Arabic, was printed at Rome in 1592, at the Medicean press, from a manuscript preserved in the grand-ducal library at Florence. Both the paper and printing are exceedingly neat, the latter being made to resemble manuscript. This unfortunately constitutes the whole merit of the edition, which swarms with typographical errors, and forms, besides, only an epitome of the original work. This epitome seems made, indeed, in the oriental style, by the simple omission of those parts which appeared to the editor to be superfluous; but these comprise many essential and important passages. The description of Mecca, for example, which had been unaccountably omitted, is supplied by Pococke from his manuscript. Hartmann gives instances where reference is made to the description of places of which there occurs no other mention. D'Herbelot and Casiri equally remark the imperfections of this edition; and the information obtained by the writer of this article, at Oxford, as to the result of a comparison between it and the manuscripts in that university, tends entirely to confirm their statements. In most bibliographical works, this impression has been characterized as one of the rarest of books; but Adler, in a visit to Florence, found in the palace there 1129 copies, which were publicly exposed to sale at a moderate rate. If, therefore, the book be wanting, even in many extensive public libraries, it is merely because those libraries have not taken the trouble to procure it.

In 1619, two oriental scholars, Gabriel Sionita and John Hezronita, published at Paris a Latin translation of Edrisi's work, bearing the title, as already observed, of *Geographia Nubiensis.* It is not executed with all that care and accuracy which might have been expected from these learned personages. They have been particularly careless as to the proper names, which are given sometimes in Latin, sometimes in Arabic, sometimes in neither, nor in any intelligible language. In consequence of the Arabic original being occasionally appended, it has been supposed to have been reprinted along with it; but this is a mistake, there being no edition ever printed except the Roman one. George Hieronymus Velschius, an eminent German scholar, had prepared a copy of the Arabic original, with a Latin translation, which he intended to have illustrated with notes; but death prevented the execution of this design, and his manuscript remains deposited in the library of the university of Jena. Casiri (*Bibliotheca Arabico-Hispanica*, ii. 13) mentions that, at the request of many friends, he had determined to re-edit this work, but he appears never to have executed this intention. The part relating to Africa, pre-eminent certainly in point of importance, has been very ably edited by Hartmann, professor of oriental languages at Marburg (Edrisi, *Africa*, Göttingen, 1796). Instead of following the awkward division into climates, he has collected together all the notices relating to each particular country, and has annexed the statements of the countrymen and contemporaries of Edrisi, so that his work forms nearly a complete body of Arabian geography, as far as relates to Africa. (E.)

EDUCATION.

The inquiry, what education ought to be, and the description of what it is, in those communities in which it may be considered as having acquired its greatest improvement, are two subjects which in this work it has been deemed convenient to keep separate. The analytical investigation of the end to which education is directed, and of the means which are available for the attainment of it, is that which is attempted in the present article. What is thought necessary to be said with respect to the other connected topics will be given under the titles National Education, Schools, and Universities.

INTRODUCTION.

Extent of the Subject.—The different Questions which it involves.

The end of education is to render the individual, as much as possible, an instrument of happiness, first to himself, and next to other beings.

The properties by which he is fitted to become an instrument to this end are partly those of the body, and partly those of the mind.

Happiness depends upon the condition of the body, either immediately, as where the bodily powers are exerted for the attainment of some good; or mediately through the mind, as where the condition of the body affects the qualities of the mind.

Education, in the sense in which it is usually taken, and in which it shall here be used, denotes the means which may be employed to render the *mind*, as far as possible, an operative cause of happiness. The mode in which the *body* may be rendered the most fit for operating as an instrument of happiness is generally considered as a different species of inquiry, belonging to physicians and others who study the means of perfecting the bodily powers.

Education, then, in the sense in which we are now using the term, may be defined, the best employment of all the means which can be used by man for rendering the human mind to the greatest possible degree the cause of human happiness. Every thing, therefore, which operates, from the first germ of existence to the final extinction of life, in such a manner as to affect those qualities of the mind on which happiness in any degree depends, comes within the scope of the present inquiry. Not to turn every thing to account is here, if anywhere, bad economy, in the most emphatical sense of the phrase.

The field, it will easily be seen, is exceedingly comprehensive. It is everywhere, among enlightened men, a subject of the deepest complaint, that the business of education is ill performed; and that in this, which, it might have been supposed, would have been considered the most interesting of all human concerns, the practice is far from corresponding with the progress of the human mind. It may be remarked, that, notwithstanding all which has been written on the subject, even the *theory* of education has not kept pace with philosophy; and it is unhappily true, that the *practice* remains to a prodigious distance behind the theory. One reason why the theory or the combination of ideas which the present state of knowledge might afford for improving the business of education, remains so imperfect, probably is, that the writers have taken but a partial view of the subject; in other words, the greater number of them have mistaken a part of it for the whole. And another reason of not less importance is, that they have generally contented themselves with vague ideas of the object or end to which education is required as the means. One grand purpose of the present inquiry will be to obviate all those mistakes; and, if not to exhibit that comprehensive view which we think is desirable, but to which our limits are wholly inadequate, at any rate to conduct the reader into that train of thought which will lead him to observe for himself the boundaries of the subject. If a more accurate conception is formed of the end, a better estimate will be made of what is suitable as the means.

1. It has been remarked, that every thing from the first germ of existence to the final extinction of life, which operates in such a manner as to affect those qualities of the mind on which happiness in any degree depends, comes within the scope of the present inquiry. Those circumstances may be all arranged, according to the hackneyed division, under two heads: they are either physical or moral; meaning by physical, those of a material nature, which operate more immediately upon the material part of our frame; by moral, those of a mental nature, which operate more immediately upon the mental part.

2. In order to know in what manner things operate upon the mind, it is necessary to know how the mind is constructed. *Quicquid recipitur, recipitur ad modum recipientis.* This is the old aphorism, and nowhere more applicable than to the present case. If you attempt to act upon the mind in ways not adapted to its nature, the least evil you incur is to lose your labour.

3. As happiness is the end, and the means ought to be nicely adapted to the end, it is necessary to inquire, what are the qualities of mind which chiefly conduce to happiness, the happiness both of the individual himself and of his fellow-creatures?

Each of these divisions branches itself out into a great number of inquiries. And it is manifest that the complete development of any one of them would require a greater space than we can allow for the whole. It is therefore necessary for us, if we aim at a comprehensive view, to confine ourselves to a skeleton.

The first of these inquiries is the most practical, and, therefore, likely to be the most interesting. Under the physical head it investigates the mode in which the qualities of the mind are affected by the health, the aliment, the air, the labour, &c. to which the individual is subject. Under the moral head it includes what may be called, 1. Domestic education, or the mode in which the mind of the individual is liable to be formed by the conduct of the individuals composing the family in which he is born and bred; 2. technical or scholastic education, including all those exercises upon which the individual is put, as means to the acquisition of habits conducive either to intellectual and moral excellence, or even to the practice of the manual arts; 3. social education, or the mode in which the mind of the individual is acted upon by the nature of the political institutions under which he lives.

The two latter divisions comprehend what is more purely theoretical; and the discussion of them offers fewer attractions to that class of readers, unhappily numerous, to whom intellectual exercises have not by habit been rendered delightful. The inquiries, however, which are included under these divisions, are required as a foundation to those included under the first. The fact is, that good practice can in no case have any solid foundation but in sound theory. This proposition is not more important than it is certain. For what is theory? The *whole* of the knowledge which we possess upon any subject put into that order and form in which it is most easy to draw from it good practical rules. Let any one examine this definition, article by article, and show us that it fails in a single particular. To recommend the separation of practice from theory is, therefore, simply to recommend bad practice.

SECTION I.

Theory of the Human Mind.—Its importance in the Doctrine of Education.

1. The first, then, of the inquiries embraced by the great subject of education is that which regards the nature of the human mind; and the business is, agreeably to the foregoing definition of theory, to put the knowledge which we possess respecting the human mind into that order and form which is most advantageous for drawing from it the practical rules of education. The question is, how the mind, with those properties which it possesses, can, through the operation of certain means, be rendered most conducive to a certain end? To answer this question, the whole of its properties must be known. The whole science of human nature is, therefore, but a branch of the science of education. Nor can education assume its most perfect form till the science of the human mind has reached its highest point of improvement. Even an outline, however, of the philosophy of the human mind would exceed the bounds of the present article; we must, therefore, show what ought to be done, rather than attempt in any degree to execute so extensive a project.

With respect to the human mind, as with respect to every thing else, all that passes with us under the name of knowledge is either matter of experience, or, to carry on the analogy of expression, matter of guess. The first is real knowledge; the properties of the object correspond to it. The latter is supposititious knowledge, and the properties of the object do or do not correspond to it; most likely not. The first thing desirable is, to make an exact separation of those two kinds of knowledge; and, as much as possible, to confine ourselves to the first.

What, then, is it which we experience with regard to the human mind? And what is it which we guess? We have experience of ourselves when we *see*, when we *hear*, when we *taste*, when we *imagine*, when we *fear*, when we *love*, when we *desire*, and so on. And we give names, as above, to distinguish what we experience of ourselves on one of those occasions, from what we experience on another. We have experience of other men exhibiting *signs* of having similar experiences of themselves, that is, of *seeing*, *hearing*, and so on. It is necessary to explain, shortly, what is here meant by a sign. When we ourselves *see*, *hear*, *imagine*, &c. certain actions of ours commonly follow. We know, accordingly, that if any one, observing those actions, were to infer that we had been *seeing*, *hearing*, &c. the inference would be just. As often then as we observe similar actions in other men, we infer that they, too, have been seeing or hearing; and we thus regard the action as the sign.

Having got names to distinguish the state or experience of ourselves when we say, *I see*, *I hear*, *I wish*, and so on, we find occasion for a name which will distinguish the having any (be it what it may) of those experiences, from the being altogether without them; and for this purpose we say *I feel*, which will apply generally to any of the cases in which we say *I see*, or *hear*, or *remember*, or *fear*, and comprehend the meaning of them all. The term *I think* is commonly used for a purpose nearly the same. But it is not quite so comprehensive; there are several things which we should include under the term *our experience of our mind*, to which we should not extend the term *I think*. But there is nothing included under it to which we should not extend the term *I feel*. This is truly, therefore, the generic term.

All our experience, then, of the human mind is confined to the several occasions on which the term *I feel* can be applied. And, now, what does all this experience amount to? What is the knowledge which it affords? It is first a knowledge of the *feelings* themselves; we can remember what, one by one, they were. It is next a knowledge of the order in which they follow one another; and this is all. But this description, though a just one, is so very general as to be little instructive. It is not easy, however, to speak about those feelings minutely and correctly, because the language which we must apply to them is ill adapted to the purpose.

Let us advert to the first branch of this knowledge, that of the feelings themselves. The knowledge of the simple cases may be regarded as easy; the feeling is distinct at the moment of experience, and is distinctly remembered afterwards. But the difficulty is great with the complex cases. It is found that a great number of simple feelings are apt to become so closely united as often to assume the appearance of only one feeling, and to render it extremely difficult to distinguish from one another the simple feelings of which it is composed. And one of the grand questions which divide the philosophers of the present day is, which feelings are simple, and which are complex. There are two sorts which all have regarded as simple; those which we have when we say, I hear, I see, I feel, I taste, I smell, corresponding to the five senses, and the copies of these sensations, called ideas of sense. Of these, the second take place only in consequence of the first; they are, as it were, a revival of them; not the same feelings with the sensations or impressions on the senses, but feelings which bear a certain resemblance to them. Thus, when a man sees the light of noon, the feeling he has is called an *impression*, the impression of light; when he shuts his eyes and has a feeling, the type or relict of the impression, he is not said to *see* the light, or to have the *impression* of light, but to *conceive* the light, or have an idea of it.

These two *impressions*, and their corresponding *ideas*, are simple feelings in the opinion of all philosophers. But there is one set of philosophers who think that these are the only simple feelings, and that all the rest are merely combinations of them. There is another class of philosophers who think that there are original feelings besides impressions and ideas; as those which correspond to the words *remember, believe, judge, space, time,* &c. Of the first are Hartley and his followers in England, Condillac and his followers in France; of the second description are Dr Reid and his followers in this country, Kant and the German school of metaphysicians in general on the Continent.

The determination of this question, namely, what the feelings are, is of very great importance with regard to the second branch of inquiry, namely, what is the order in which those feelings succeed one another. For how can it be known how they succeed one another, if we are ignorant which of them enter into those several groups which form the component parts of the train? It is of vast importance, then, for the business of education, that the analysis of mind should be accurately performed; in other words, that all our complex feelings should be accurately resolved into the simple ones of which they are composed. This, too, is of absolute necessity for the accurate use of language; as the greater number of words are employed to denote those groups of simple feelings which we call complex ideas.

In regard to all events relating to mind or body, our knowledge extends not beyond two points: the first is a knowledge of the events themselves; the second is a knowledge of the order of their succession. The expression in words of the first kind of knowledge is history; the expression of the second is philosophy; and to render that expression short and clear is the ultimate aim of philosophy.

The first steps in ascertaining the order of succession among events are familiar and easy. One occurs, and then another, and after that a third, and so on; but at first it is uncertain whether this order is not merely accidental, and such as may never recur. After a time it is observed, that events, similar to those which have already occurred, are occurring again and again. It is next observed, that they are always followed, too, by the same sort of events by which those events were followed to which they are similar; that these second events are followed, in the third place, by events exactly similar to those which followed the events which they resemble; and that there is thus an endless round of the same sequences.

If the order in which one event follows another were always different, we should know events only one by one, and they would be infinitely too numerous to receive names. If we could observe none but very short sequences; if, for example, we could ascertain that one event was, indeed, always followed by one other of the same description, but could not trace any constancy farther, we should thus know events by sequences of twos and twos. But those sequences would also be a great deal too numerous to receive names.

The history of the human mind informs us, that the sequences which are first observed are short ones. They are still, therefore, too numerous to receive names. But men compound the matter. They give names to sequences which they are most interested in observing, and leave the rest unnamed. When they have occasion to speak of the unnamed successions, they apply to them, the best way they can, the names which they have got; endeavouring to make a partial naming answer an universal purpose. And hence almost all the confusion of language and of thought arises.

The great object, then, is, to ascertain sequences more and more extensive, till, at last, the succession of all events may be reduced to a number of sequences sufficiently small for each of them to receive a name; then, and then only, shall we be able to speak wholly free from confusion.

Language affords an instructive example of this mode of ascertaining sequences. In language the words are as the events. When an ignorant man first hears another speak an unknown language, he hears the sounds one by one, but observes no sequence. At last he gathers a knowledge of the use of a few words, and then he has observed a few sequences; and so he goes on till he understands whatever he hears. The sequences, however, which he has observed, are each of no greater extent than is necessary to understand the meaning of the speaker; they are, by consequence, very numerous and confusing.

Next comes the grammarian; and he, by dividing the words into different kinds, observes that these kinds follow one another in a certain order, and thus ascertains more enlarged sequences, which, by consequence, reduces their number.

Nor is this all; it is afterwards observed, that words consist, some of one syllable, and some of more than one; that all language may thus be resolved into syllables, and that syllables are much less in number than words; that, therefore, the number of sequences in which they can be formed are less in number, and, by consequence, each is more extensive. This is another step in tracing to the most comprehensive sequences the order of succession in that class of events wherein language consists.

It is afterwards observed, that these syllables themselves are compounded; and it is at last found, that they may all be resolved into a small number of elementary sounds corresponding to the simple letters. All language is then found to consist of a limited number of sequences, made up of the different combinations of a few letters.

It is not pretended that the example of language is exactly parallel to the case which it is brought to illustrate. It is sufficient if it aids the reader in seizing the idea which we mean to convey. It shows the analogy between the analyzing of a complex sound, namely, a word, into the simple sounds of which it is composed, to wit, letters; and the analyzing of a complex feeling, such as the idea of a rose, into the simple feelings of sight, of touch, of taste, of smell, of which the complex idea or feeling is made up. It affords, also, a proof of the commanding knowledge which is attained of a train of events, by observing the sequences which are formed of the simplest elements into which they can be resolved; and it thus illustrates the two grand operations, by successful perseverance, in which the knowledge of the human mind is to be perfected.

It is upon a knowledge of the sequences which take place in the human feelings or thoughts, that the structure of education must be reared. And, though much undoubtedly remains to be cleared up, enough is already known of those sequences to manifest the shameful defects of that education with which our supineness, and love of things as they are, rest perfectly satisfied.

As the happiness, which is the end of education, depends upon the actions of the individual, and as all the actions of man are produced by his feelings or thoughts, the business of education is, to make certain feelings or thoughts take place instead of others. The business of education, then, is to work upon the mental successions. As the sequences among the letters or simple elements of speech may be made to assume all the differences between nonsense and the most sublime philosophy, so the sequences in the feelings which constitute human thought, may assume all the differences between the extreme of madness and of wickedness, and the greatest attainable heights of wisdom and virtue; and almost the whole of this is the effect of education. That, at least, all the difference which exists between classes or bodies of men is the effect of education, will, we suppose, without entering into the dispute about individual distinctions, be readily granted; that it is education wholly which constitutes the remarkable difference between the Turk and the Englishman, and even the still more remarkable difference between the most cultivated European and the wildest savage. Whatever is made of any *class* of men, we may then be sure is possible to be made of the whole human race. What a field for exertion! What a prize to be won!

Mr Hobbes, who saw so much farther into the texture of human thought than all who had gone before him, was the first man, as far as we remember, who pointed out (what is peculiarly *knowledge* in this respect) the order in which our feelings succeed one another, as a distinct object of study. He marked, with sufficient clearness, the existence, and the cause of the sequences; but, after a very slight attempt to trace them, he diverged to other inquiries, which had this but indirectly for their object.

"The succession," he says (*Human Nature*, chap. iv.), "of conceptions in the mind, series or consequence" (by *consequence* he means *sequence*), "of one after another, may be casual and incoherent, as in dreams, for the most part; and it may be orderly, as when the former thought introduceth the latter. The cause of the coherence or consequence (*sequence*) of one conception to another, is their first coherence or consequence at that time when they are produced by sense; as, for example, from St Andrew the mind runneth to St Peter, because their names are read together; from St Peter to a stone, for the same cause; from stone to foundation, because we see them together; and, according to this example, the mind may run almost from any thing to any thing. But, as in the sense the conception of cause and effect may succeed one another, so may they, *after* sense, in the imagination." By the succession in the *imagination* it is evident he means the succession of *ideas*, as by the succession in *sense* he means the succession of sensations.

Having said that the conceptions of *cause* and *effect* may succeed one another in the sense, and after sense in the imagination, he adds, "and, for the most part, they do so; the cause whereof is the appetite of them who, having a conception of the *end*, have next unto it a conception of the next *means* to that end; as when a man from a thought of honour, to which he hath an appetite, cometh to the thought of wisdom, which is the next means thereunto; and from thence to the thought of study, which is the next means to wisdom." (*Ibid.*) Here is a declaration with respect to three grand laws in the sequence of our thoughts. The first is, that the succession of ideas follows the same order which takes place in that of the impressions. The second is, that the order of cause and effect is the most common order in the successions in the imagination, that is, in the succession of ideas. And the third is, that the appetites of individuals have a great power over the successions of ideas; as the thought of the object which the individual desires, leads him to the thought of that by which he may attain it.

Mr Locke took notice of the sequence in the train of ideas, or the order in which they follow one another, only for a particular purpose; to explain the intellectual singularities which distinguish particular men. "Some of our ideas," he says, "have a natural correspondence and connection one with another. It is the office and excellence of our reason to trace these, and hold them together in that union and correspondence which is founded in their peculiar beings. Besides this, there is another connection of ideas, wholly owing to chance or custom: ideas that are not at all of kin come to be so united in some men's minds, that it is very hard to separate them; they always keep in company, and the one no sooner at any time comes into the understanding, but its associate appears with it; and if they are more than two which are thus united, the whole gang, always inseparable, show themselves together." There is no attempt here to trace the order of sequence, or to ascertain which antecedents are followed by which consequents; and the accidental rather than the more general phenomena are those which seem particularly to have struck his attention. He gave, however, a name to the matter of fact. When one idea is regularly followed by another, he called this constancy of conjunction *the association of ideas;* and this is the name by which, since the time of Locke, it has been commonly distinguished.

Mr Hume perceived, much more distinctly than any of the philosophers who had gone before him, that to philosophize concerning the human mind was to trace the order of succession among the elementary feelings of the man. He pointed out three great laws or comprehensive sequences, which he thought included the whole. Ideas followed one another, he said, according to *resemblance*, *contiguity* in time and place, and *cause and effect.* The last of these, the sequence according to cause and effect, was very distinctly conceived, and even the cause of it explained, by Mr Hobbes. That of contiguity in time and place is thus satisfactorily explained by Mr Hume. "It is evident," he says, "that as the senses, in changing their objects, are necessitated to change them regularly, and take them as they lie contiguous to each other, the imagination must, by long custom, acquire the same method of thinking, and run along the parts of space and time in conceiving its objects." (*Treatise of Human Nature*, P. i. b. i. sect. 4.) This is a reference to one of the laws pointed out by Hobbes, namely, that the order of succession among the ideas follows the order that took place among the impressions. Mr Hume shows, that the order of sense is much governed by contiguity, and why; and assigns this as a sufficient reason of the order which takes place in the imagination. Of the next sequence, that according to resemblance, he gives no account, and only appeals to the consciousness of his reader for the existence of the fact. Mr Hume further remarked, that what are called our complex ideas are only a particular class of cases belonging to the same law, namely, that of the succession of ideas; every complex idea being only a certain number of simple ideas, which succeed each other so rapidly as not to be separately distinguished without an effort of thought. This was a great discovery; but it must at the same time be owned, that it was very imperfectly developed by Mr Hume. That philosopher proceeded, by aid of these principles, to account for the various phenomena of the human mind. But though he made some brilliant developments, it is nevertheless true, that he did not advance very far in the general object. He was misled by the pursuit of a few surprising and paradoxical results, and when he had arrived at them he stopped.

After him, and at a short interval, appeared two philosophers, who were more sober minded, and had better aims. These were Condillac and Hartley. The first work of Condillac appeared some years before the publication of that of Hartley; but the whole of Hartley's train of thought has so much the air of being his own, that there is abundant reason to believe the speculations of both philosophers equally original. They both began upon the ground that all simple ideas are copies of impressions; that all complex ideas are only simple ideas united by the principle of association. They proceeded to examine all the phenomena of the human mind, and were of opinion that the principle of association, or the succession of one simple idea after another, according to certain laws, accounts for the whole; that these laws might by meditation be ascertained and applied; and that then the human mind would be understood as far as man has the means of knowing it.

The merit of Condillac is very great. It may yet, perhaps, be truer to say that he wrote admirably upon philosophy, than that he was a great philosopher. His power consists in expression; he conveys metaphysical ideas with a union of brevity and clearness which never has been surpassed. But though he professed rather to deliver the opinions of others than to aim at invention, it cannot be denied that he left the science of the human mind in a much better state than he found it; and this is equivalent to discovery. As a teacher, in giving in this field a right turn to the speculations of his countrymen, his value is incalculable; and there is, perhaps, no one, with the exception of Locke, who was his master, to whom in this respect the progress of the human mind is more largely indebted. It is also true, that to form the conception of tracing the sequences among our simple ideas, as comprehending the whole of the philosophy of the human mind, even with the helps which Hume had afforded, and it is more than probable that neither Condillac nor Hartley had ever heard of a work which, according to its author, had fallen dead-born from the press, was philosophical and sagacious in the highest degree.

It must be allowed, however, that, in expounding the various mental phenomena, Condillac does not display the same penetration and force of mind, or the same comprehensiveness, as Dr Hartley. He made great *progress* in showing how those phenomena might be resolved into the sequences of simple ideas; but Dr Hartley made still greater. We do not mean to pronounce a positive opinion either for or against the grand undertaking of Dr Hartley, to resolve the whole of the mental phenomena of man into sequences of impressions, and the simple ideas which are the copies of them. But we have no hesitation in saying, that he philosophizes with extraordinary power and sagacity; and it is astonishing how many of the mental phenomena he has clearly resolved—how little, in truth, he has left about which any doubt can remain.

We cannot afford to pursue this subject any farther. This much is ascertained, that the character of the human mind consists in the sequences of its ideas; that the object of education, therefore, is to provide for the constant production of certain sequences rather than others; and that we cannot be sure of adopting the best means to that end, unless we have the greatest knowledge of the sequences themselves.

In what has been already ascertained on this subject, we have seen that there are two things which have a wonderful power over those sequences. They are custom, and pain and pleasure. These are the grand instruments or powers, by the use of which the purposes of education are to be attained.

Where one idea has followed another a certain number of times, the appearance of the first in the mind is sure to be followed by that of the second, and so on. One of the grand points, then, in the study of education, is to find the means of making, in the most perfect manner, those repetitions on which the beneficial sequences depend.

When we speak of making one idea follow another, and always that which makes part of a good train, instead of one that makes part of a bad train, there is one difficulty, that each idea taken singly by itself is as fit to be a part of a bad train as of a good one; for good trains and bad trains are both made out of the same simple elements. Trains, however, take place by sequences of twos or threes, or any greater number; and the nature of these sequences, as complex parts of a still greater whole, is that which renders the train either salutary or hurtful. Custom is, therefore, to be directed to two points; first, to form those sequences which make the component parts of a good train; and, secondly, to join those sequences together so as to constitute the trains.

When we speak of making one idea follow another, there must always be a starting point; there must be some one idea from which the train begins to flow; and it is pretty evident that much will depend upon this idea. One grand question then is, "What are the ideas which most frequently operate as the commencement of trains?" Knowing what are the ideas which play this important part, we may attach to them by custom such trains as are the most beneficent. It has been observed, that most, if not all, of our trains start from a sensation, or some impression upon the external or internal nerves. The question then is, which are those sensations, or aggregates of sensations, which are of the most frequent recurrence? it being obviously of importance that those which give occasion to the greatest number of trains should be made if possible to give occasion only to the best trains. Now the sensations, or aggregates of sensations, which occur in the ordinary business of life, are those of most frequent recurrence, and from which it is of the greatest importance that beneficial trains should commence. Rising up in the morning and going to bed at night are aggregates of this description common to all mankind; so are the commencement and termination of meals. The practical sagacity of priests, even in the rudest ages of the world, perceived the importance of giving religious trains an ascendency in the mind—of uniting them, by early and steady custom, with those perpetually recurring sensations. The morning and evening prayers, the grace before and after meals, have something correspondent to them in the religion of perhaps all nations.

It may appear, even from these few reflections and illustrations, that if the sensations which are most apt to give commencement to trains of ideas are skilfully selected, and the trains which lead most surely to the happiness, first of the individual himself, and next of his fellow-creatures, are by custom effectually united with them, a provision of unspeakable importance is made for the happiness of the race.

Beside custom, it was remarked by Hobbes, that appetite had a great power over the mental trains. But appetite is the feeling toward pleasure or pain in prospect; that is, future pleasure or pain. To say that appetite, therefore, has power over the mental trains, is to say that the prospect of pleasure or pain has. That this is true every man knows by his own experience. The best means then of applying the prospect of pleasure and pain to render beneficent trains perpetual in the mind, is the discovery to be made, and to be recommended to mankind.

The way in which pleasure and pain affect the trains of the mind is as ends. As a train commences in some present sensation, so it may be conceived as terminating in the idea of some future pleasure or pain. The intermediate ideas between the commencement and the end may be either of the beneficent description or the hurtful. Suppose the sight of a fine equipage to be the commencement, and the riches which afford it the appetite or the end, of a train in the mind of two individuals at the same time. The intermediate ideas in the mind of the one may be beneficent, in the other hurtful. The mind of the one immediately runs over all the honourable and useful modes of acquiring riches, the acquisition of the most rare and useful qualities, the eager watch of all the best opportunities of bringing them into action, and the steady industry with which they may be applied. That of the other recurs to none but the vicious modes of acquiring riches—by lucky accidents, the arts of the adventurer and impostor, by rapine and plunder, perhaps on the largest scale, by all the honours and glories of war. Suppose the one of these trains to be habitual among individuals, the other not; what a difference for mankind!

It is unnecessary to adduce further instances for the elucidation of this part of our mental constitution. What, in this portion of the field, requires to be done for the science of education, appears to be, first, to ascertain what are the ends, the really ultimate objects of human desire; next, what are the most beneficent means of attaining those objects; and, lastly, to accustom the mind to fill up the intermediate space between the present sensation and the ultimate object with nothing but the ideas of those beneficent means. We are perfectly aware that these instructions are far too general. But we hope it will be carried in mind, that little beyond the most general ideas can be embraced in so confined a sketch; and we are not without an expectation that, such as they are, these expositions will not be wholly without their use.

SECTION II.

Qualities of Mind to the Production of which the Business of Education should be directed.

We come now to the second branch of the science of education, or the inquiry, what are the qualities with which it is of most importance that the mind of the individual should be endowed. This inquiry, we are in hopes, the preceding exposition will enable us very materially to abridge. In one sense, it might undoubtedly be affirmed that all the desirable qualities of the human mind are included in those beneficent sequences of which we have spoken above. But as it would require, to make this sufficiently intelligible, a more extensive exposition than we are able to afford, we must content ourselves with the ordinary language, and with a more familiar mode of considering the subject.

That intelligence is one of the qualities in question will not be denied, and may speedily be made to appear. To attain happiness is the object; and, to attain it in the greatest possible degree, all the means to that end which the compass of nature affords must be employed in the most perfect possible manner. But all the means which the compass of nature, or the system in which we are placed, affords, can only be known by the most perfect knowledge of that system. The highest measure of knowledge is therefore required. But mere knowledge is not enough; a mere magazine of remembered facts is a useless treasure. Amid the vast variety of known things, there is needed a power of choosing, a power of discerning which of them are conducive, which not, to the ends which we have in view. The ingredients of intelligence are two, knowledge and sagacity; the one affording the materials upon which the other is to be exerted; the one showing what exists, the other converting it to the greatest use; the one bringing within our ken what is capable and what is not capable of being used as means, the other seizing and combining, at the proper moment, whatever is fittest as means to each particular end. This union, then, of copiousness and energy, this possession of numerous ideas, with the masterly command of them, is one of the more immediate ends to which the business of education is to be directed.

With a view to happiness as the end, another quality will easily present itself as indispensable. Conceive that a man knows the materials which can be employed as means, and is prompt and unerring in the mode of combining them; all this power is lost if there is any thing in his nature which prevents him from using it. If he has any appetite in his nature which leads him to pursue certain things with which the most effectual pursuit of happiness is inconsistent, so far this evil is incurred. A perfect command, then, over a man's appetites and desires, the power of restraining them whenever they lead in a hurtful direction, that possession of himself which insures his judgment against the illusions of the passions, and enables him to pursue constantly what he deliberately approves, is indispensably requisite to enable him to produce the greatest possible quantity of happiness. This is what the ancient philosophers called temperance; not exactly the same with what is called the virtue or grace of temperance, in theological morality, which includes a certain portion (in the doctrines of some theological instructors a very large portion) of abstinence, and not only of abstinence, or the gratuitous renunciation of pleasure, but of the infliction of voluntary pain. This is done with a view to please the god, or object of worship, and to provide, through his favour, for the happiness of a second or future life. The temperance of the ancient philosophers had a view only to the happiness of the present life, and consisted in the power of resisting the immediate propensity, if yielding to it would lead to an overbalance of evil, or prevent the enjoyment of a superior good, in whatever the good or evil of the present life consists. This resisting power consists of two parts; the power of resisting pleasure, and that of resisting pain, the last of which has an appropriate name, and is called fortitude.

These two qualities, the intelligence which can always choose the best possible means, and the strength which overcomes the misguiding propensities, appear to be sufficient for the happiness of the individual himself, to the pursuit of which it cannot be doubted that he always has sufficient motives. But education, we have said, should be an instrument to render the individual the best possible artificer of happiness, not to himself alone, but also to others. What, then, are the qualities with which he ought to be endowed, to make him produce the greatest possible quantity of happiness to others?

It is evident enough to see what is the first grand division. A man can affect the happiness of others, either by abstaining from doing them harm, or by doing them positive good. To abstain from doing them harm receives the name of justice; to do positive good receives that of generosity. Justice and generosity, then, are the two qualities by which man is fitted to promote the happiness of his fellow-creatures. And it thus appears that the four cardinal virtues of the ancients do pretty completely include all the qualities to the possession of which it is desirable that the human mind should be trained. The defect, however, of this description is, that it is far too general. It is evident that the train of mental events which conduct to the proposed results must be far more particularized, to insure, in any considerable degree, the effects of instruction; and it must be confessed that the ethical instructions of the ancients failed by remaining too much in generals. What is wanting is, that the incidents of human life should be skilfully classified; both those on the occasion of which they who are the objects of the good acts are pointed out for the receipt of them, and those on the occasion of which they who are to be the instruments are called upon for the performance. It thus appears that the science of ethics, as well as the science of intellectuals, must be carried to perfection before the best foundation is obtained for the science of education.

SECTION III.

Happiness, the End to which Education is devoted. Wherein it consists not yet determined.

We have spoken of the qualities which are subservient to human happiness as means to an end. But before means can be skilfully adapted to an end, the end must be accurately known. To know how the human mind is to be trained to the promotion of happiness, another inquiry then is necessary: Wherein does human happiness consist? This is a controverted question; and we have introduced it rather with a view to show the place which it occupies in the theory of education, than that we have it in our power to elucidate a subject about which there is so much diversity of opinion, and which some of the disputants lead into very subtle and intricate inquiries. The importance of the question is sufficiently evident from this, that it is the grand central point to which all other questions and inquiries converge; that point by their bearing upon which the value of all other things is determined. That it should remain itself undetermined, implies that this branch of philosophy is yet far from its highest point of perfection.

The speculations on this subject, too, may be divided into two great classes; that of those who trace up all the elements of happiness, as they do all those of intellect, to the simple sensations which, by their transformation into ideas, and afterwards into various combinations, compose, they think, all the intellectual and moral phenomena of our nature; another, that of those who are not satisfied with this humble origin; who affirm that there is something in human happiness, and in the human intellect, which soars high above this corporeal level; that there are intellectual as well as moral forms, the resplendent objects of human desire, which can by no means be resolved into the grosser elements of sense. These philosophers speak of eternal and immutable truths; truths which are altogether independent of our limited experience, which are truly universal, which the mind recognizes without the aid of the senses, and which are the objects of pure intellect. They affirm, also, that there is a notion of right and of wrong wholly underived from human experience, and independent of the laws which regulate, in this world, the happiness and misery of human life; a right and wrong, the distinction between which is perceived, according to some, by a peculiar sense; according to others, by the faculty which discerns pure truth; according to others, by common sense: it is the same, according to some, with the notion of the fitness and unfitness of things; according to others, with the law of nature; according to others, with truth; and there is one eminent philosopher who makes it depend upon sympathy, without determining very clearly whether sympathy depends upon the senses or not.

We cannot too earnestly exhort philosophers to perfect this inquiry, that we may understand at last, not by vague abstract terms, but clearly and precisely, what are the simple ideas included under the term happiness, and what is the real object to which education is pointed; since it is utterly impossible, while there is any vagueness and uncertainty with respect to the end, that there should be the greatest precision and certainty in combining the means.

SECTION IV.

Instruments, and practical Expedients, of Education.

We come at last to the consideration of the means which are at the disposal of man for endowing the human mind with the qualities on which the generation of happiness depends. Under this head the discussion of the practical expedients chiefly occurs; but it also embraces some points of theory. The degree in which the useful qualities of human nature are, or are not, under the powers of education, is one of the most important.

This is the subject of a famous controversy, with names of the highest authority on both sides of the question. Helvetius, it is true, stands almost alone on one side. But Helvetius, alone, is a host. No one man, perhaps, has done so much towards perfecting the *theory* of education as M. Helvetius; and his books are pregnant with information of the highest importance. Whoever wishes to understand the groundwork of education, can do nothing more conducive to his end, than to study profoundly the expositions of this philosophical inquirer, whether he adopts his conclusions, in all their latitude, or not. That Helvetius was not more admired in his own country, is owing really to the value of his work. It was too solid for the frivolous taste of the gay circles of Paris, assemblies of pampered noblesse, who wished for nothing but amusement. That he has been so little valued in this country, is, it must be confessed, owing a little to the same cause; but another has concurred. An opinion has prevailed, a false one, that Helvetius is a peculiarly dangerous enemy to religion; and this has deterred people from reading him; or rather the old people who do not read have deterred the young who do. There is no book, the author of which does not disguise his unbelief, that can be read with more safety to religion. The author attacks nothing but priestcraft, and in one of the worst of its forms; the popish priestcraft of the dark and middle ages; the idea of which we are well accustomed, in this country, to separate from that of religion. When his phraseology at any time extends, and that is not often, to Christianity itself, or to religion in the abstract, there is nothing calculated to reduce; there is nothing epigrammatic and sparkling in the expression, nothing sophistical and artfully veiled in the reasoning; a plain proposition is stated, with a plain indication of its evidence; and if your judgment is not convinced, you are not deluded through the fancy.

M. Helvetius says, that if you take men who bring into the world with them the original constituents of their nature, their mental and bodily frame, in that ordinary state of goodness which is common to the great body of mankind; leaving out of the account the comparatively small number of individuals who come into the world imperfect, and manifestly below the ordinary standard; you may regard the whole of this great mass of mankind as equally susceptible of mental excellence, and may trace the causes which make them to differ. If this be so, the power of education embraces every thing between the lowest stage of intellectual and moral rudeness, and the highest state, not only of actual, but of possible perfection. And if the power of education be so immense, the motive for perfecting it is great beyond expression.

The conclusions of Helvetius were controverted directly by Rousseau; and defended, against the strictures of that writer, by the author himself. We recollect few writers in this country who have embraced them.[1] But our authors have contented themselves rather with rejecting than disproving; and, at best, have supported their rejection only by some incidental reflection, or the indication of a discrepancy between his conclusions and theirs.

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[1] There is one brilliant authority on the side of Helvetius: "It was a favourite opinion of Sir William Jones, that all men are born with an equal capacity of improvement." Lord Teignmouth's *Life of Sir William Jones*, vol. ii. p. 211.

One of the causes why people have been so much startled by the extent to which Helvetius has carried the dominion of education, seems to us to be their not including in it nearly so much as he does. They include in it little more than what is expressed by the term schooling; commencing about six or seven years of age, and ending at latest with the arrival of manhood. If this alone is meant by education, it is no doubt true that education is far indeed from being all-powerful. But if in education is included every thing which acts upon the being as it comes from the hand of nature, in such a manner as to modify the mind, to render the train of feelings different from what it would otherwise have been; the question is worthy of the most profound consideration. It is probable, that people in general form a very inadequate conception of all the circumstances which act during the first months, perhaps the first moments, of existence, and of the power of those circumstances in giving permanent qualities to the mind. The works of Helvetius would have been invaluable, if they had done nothing more than prove the vast importance of these circumstances, and direct towards them the attention of mankind. Rousseau began this important branch of the study of education. He remarked a variety of important facts, which, till his time, had been almost universally neglected, in the minds of infants, and how much might be done, by those who surround them, to give good or bad qualities to their minds, long before the time at which it had been supposed that education could commence. But Helvetius treated the subject much more profoundly and systematically. He traced the circumstances to the very moment of birth; he showed at how early an age indelible characters may be impressed; nay, that some of the circumstances over which man has a control (for he speaks not of others), circumstances on which effects of the greatest importance depend, may be traced beyond the birth.

It is evident how much it imports the science of education, that these circumstances should, by careful and continued observation, be all ascertained, and placed in the order best adapted for drawing from them the most efficient practical rules. This is of more importance than determining the question, whether the prodigious difference which exists among men ordinarily well organized, is owing wholly to the circumstances which have operated upon them since the first moment of their sensitive existence, or is in part produced by original peculiarities. Enough is ascertained to prove, beyond a doubt, that if education does not perform every thing, there is hardly anything which it does not perform; that nothing can be more fatal than the error of those who relax in the vigilance of education, because nature is powerful, and either renders it impossible for them to accomplish much, or accomplishes a great deal without them; that the feeling is much more conformable to experience, and much more conformable to utility, which ascribes every thing to education, and thus carries the motive for vigilance and industry, in that great concern, to its highest pitch. Thus much, at any rate, is certain, that all the difference which exists, or can ever be made to exist, between one *class* of men and another, is wholly owing to education. Those peculiarities, if any such there be, which sink a man below or elevate him above the ordinary state of aptitude to profit by education, have no operation in the case of large numbers or bodies. But large numbers or bodies of men are raised to a high degree of mental excellence, and might, without doubt, be raised to still higher. Other large bodies, or whole nations, have been found in so very low a mental state, as to be little above the brutes. All this vast distance is undeniably the effect of education. Thus much, therefore, may be affirmed on the side of Helvetius, that a prodigious difference is produced by education; while, on the other hand, it is rather assumed than proved that any difference exists, but that which difference of education creates.

1. *Circumstances of the physical kind which operate upon the Mind in the way of Education.*

The circumstances which are included under the term Education, in the comprehensive sense in which we have defined it, may be divided, we have said, into physical and moral. We shall now consider the two classes in the order in which we have named them; and have here again to remind the reader, that we are limited to the task of pointing out what we should wish to be done, rather than permitted to attempt the performance.

Three things are desirable with regard to the physical circumstances which operate in the way of education favourably or unfavourably; to collect them fully, to appreciate them duly, and to place them in the order which is most favourable for drawing from them practical rules.

This is a service, common to the sciences of education and mind, which has been very imperfectly rendered. It has been chiefly reserved to medical men to observe the physical circumstances which affect the body and mind of man; but of medical men few have been much skilled in the observation of mental phenomena, or have thought themselves called upon to mark the share which physical circumstances had in producing them. There are indeed some, and those remarkable, exceptions. There is Dr Darwin in our own country, and M. Cabanis in France. They have both of them taken the mind as a part at least of their study; and we are highly indebted to them for the number and value of their observations. They are both philosophers in the most important sense of the word; they both observed nature for themselves, observed her attentively, and with their view steadily directed to the proper end. But still it is not safe to rely upon them as guides. They were in too great a haste to establish conclusions, and were apt to let their belief run before their evidence. They were not sufficiently careful to distinguish between the different degrees of evidence, and to mark what is required to constitute proof. To do this steadily seems, indeed, to be one of the rarest of all endowments; and was much less characteristic of the two philosophers we have named, than a wide range of knowledge, from which they collected the facts, and great ingenuity in combining and applying them. Dr Darwin was the most remarkable, both for the strength and the weakness of which we speak. The work of Darwin, to which we chiefly allude, is the *Zoonomia;* though important remarks to the same effect are scattered in his other publications. Cabanis entitled his great work *Rapports du Physique et du Moral de l'Homme.* And there are some works recently announced by German physiologists, the titles of which promise aids in the same endeavour. But though we expect from them new facts and ingenious hints, we have less hope of any great number of sound conclusions.

There are certain general names already in use, including the greater number of the physical circumstances which operate in the way of education upon the mind. It will be convenient, because of their commonness, to make use of them on the present occasion, though neither the enumeration which they make is complete, nor the distribution logical.

All the physical circumstances which operate upon the mind are either, 1. inherent in the body, or, 2. external to the body. Those which are external to the body, operate upon the mind by first operating upon the body.

Of the first kind, the more remarkable seem to be healthiness or sickliness, strength or weakness, beauty or deformity, the temperament, the age, the sex.

Of the second sort, the more remarkable seem to be the aliment, the labour, the air, temperature, action, rest.

Previous to the inquiry concerning the power which physical circumstances exert in the formation of the mind, it may seem that we ought to determine the speculative question respecting the nature of the mind; that is, whether the phenomena of mind may possibly result from a certain organization of matter; or whether something of a different kind, and which we call spiritual, must not be conceived, as the source and origin of thought. We do not mean to enter into this controversy, which would detain us too long. It is not, in the least degree, necessary for the end which we have in view. Whether the one hypothesis, with respect to the mind, be adopted, or the other, the distribution of the circumstances which operate in the formation of human character, into those commonly called physical and those commonly called moral, will be as convenient as any distribution which the present state of our knowledge enables us to make; and all that inquiry can do, in regard to those circumstances, is, to trace them accurately, and to observe their effects; that is, to ascertain what they are, and what the order of the mental events by which they are followed. This is simply matter of experience; and what we experience is the same, whether we adopt one opinion or another with regard to the nature of that which thinks. It is in what we experience, all ascertained, and put into the best possible shape for ease of comprehension, and ready application to practice, that all useful knowledge on this, as on all other subjects, consists.

1. First, we are to consider the circumstances of the body which have an effect upon the mental sequences. The object is, to ascertain which have a tendency to introduce those sequences which are favourable, which to introduce those that are unfavourable, to human happiness, and how to turn this knowledge to account.

Health and sickness, or the states of body which those names most peculiarly express, are the first of the circumstances which we have enumerated under this head. That these states have a tendency to introduce very different trains of thought, is matter of vulgar experience; but very little has been done to examine such trains, and to ascertain what in each is favourable, and what is unfavourable, to human happiness.

We have already seen, that the trains which are favourable to intelligence, temperance, justice, and generosity, are the trains favourable to human happiness. Now, with respect to intelligence, it will be seen that health is partly favourable and partly unfavourable; and the same is the case with sickness. Health is favourable, by allowing that time to be given to study which many kinds of sickness withdraw, and by admitting a more vigorous attention, which the pain and languor of sickness often impair. It is unfavourable, by introducing that flow of pleasurable ideas which is called high spirits, adverse at a certain pitch to the application of attention; and by leading to that passionate pursuit of pleasure, which diminishes, if it does not destroy, the time for study. The mode in which disease operates upon the mental sequences is a subject of great complexity, and in which little has yet been done to mark distinctly the events, and ascertain the order of their succession. Cabanis, in his seventh memoir, entitled *De l'Influence des Maladies sur la Formation des Idées et des Affections Morales*, has made a useful beginning toward the elucidation of this subject; but here, as elsewhere, he is too often general and vague. Instruction may also be gleaned from Darwin; but the facts which bear upon this point rather drop from him incidentally, than are anywhere put together systematically for its elucidation. As they were both physicians, however, of great experience, and of unusual skill in the observation of mental phenomena, their opinions are entitled to the greatest respect. The result of the matter is, that an improved medicine is no trifling branch of the art and science of education. Cabanis accordingly concludes his memoir with the two following propositions:

"1*mo*, L'état de maladie influe d'une manière directe sur la formation des idées et des affections morales: nous avons même pu montrer dans quelques observations particulières, comment cette influence s'exerce.

"2*do*, L'observation et l'expérience nous ayant fait decouvrir les moyens de combattre assez souvent avec succès l'état de maladie, l'art qui met en usage ces moyens, peut donc modifier et perfectionner les opérations de l'intelligence et les habitudes de la volonté."

As it is chiefly through the nervous system, and the centre of that system, the brain, that the mental sequences are affected, and as all the sensitive parts have not an action equally strong, nor equally direct, upon the nerves and brain, diseases affect the mental sequences differently, according to the parts which they invade. The system of the nerves and brain is itself subject to different states of disease. Classified with regard to the functions which that system performs, as the organ of sensibility and of action, these states are thus described by M. Cabanis; "1. excess of sensibility to all impressions on the one part; excessive action on the organs of motion on the other. 2. Unfitness to receive impressions, in sufficient number, or with the due degree of energy; and a diminution of the activity necessary for the production of the motions. 3. A general disturbance of the functions of the system, without any remarkable appearance of either excess or defect. 4. A bad distribution of the cerebral virtue, either when it exerts itself unequally in regard to time, having fits of extraordinary activity, followed by others of considerable remission; or when it is supplied in wrong proportion to the different organs, of which some are to a great degree abandoned, while there appears in others a concentration of sensibility, and of the excitations or powers by which the movements are affected."

The effects upon the mental sequences are represented in the following general sketch, which has the advantage of being tolerably comprehensive, though it is unhappily both vague and confused: "We may lay it down as a general fact, that, in all the marked affections of the nerves, irregularities, less or greater, take place, relative both to the mode in which impressions are received, and to the mode in which the determinations, automatic or voluntary, are formed. On one part, the sensations vary incessantly and rapidly with respect to their vivacity, their energy, and even their number; on another, the strength, the readiness, the facility of action, exhibit the greatest inequalities. Hence perpetual fluctuation, from great excitement to languor, from elevation to dejection; a temper and passions variable in the highest degree. In this condition, the mind is always easily pushed to extremes. Either the man has many ideas, with great mental activity and acuteness, or he is, on the contrary, almost incapable of thinking. It has been well observed, that hypochondriacal persons are by turns both courageous and cowardly; and as the impressions are habitually faulty either by excess or defect, in regard to almost all objects, it is seldom that the images correspond to the reality of things, that the desires and the will obtain the proper force and direction. If, along with these irregularities which arise from the nervous system, should be found a weakness of the muscular organs, or of some important viscus, as, for example, of the stomach, the phenomena, though still analogous in the main, will be distinguished by remarkable peculiarities. During the interval of languor, the debility of the muscles renders the sense of weakness, the fainting and drooping, still more complete and oppressive; life appears ready to escape at every instant. The passions are gloomy, excited by trifles, selfish; the ideas are petty, narrow, and bear only upon the objects of the slightest sensations. At the times of excitation, which arrive the more suddenly the greater the weakness, the muscular determinations do not obey the impulses of the brain, unless by starts, which have neither energy nor duration. These impulses serve only to convince the patient more profoundly of his real imbecility; they give him only a feeling of impatience, of discontent, and anxiety. Desires, often sufficiently keen, but commonly repressed by the habitual feeling of weakness, still more increase the discouraging impression. As the peculiar organ of thought cannot act without the concurrence of several others, and as at that moment it partakes in some degree of the weakness which affects the organs of movement, the ideas present themselves in crowds; they spring up, but do not arrange themselves in order; the necessary attention is not enjoyed; the consequence is, that this activity of the imagination, which we might expect to afford some compensation for the absence of other faculties, becomes a new source of dejection and despair."

In this passage the mental sequences which particular states of disease introduce are clearly shown to have a prodigious influence upon human happiness; but the effects which are produced in respect to intelligence, temperance, generosity, and justice, are mixed up together; and the author rather shows how much this subject deserves to be studied, than gives us information from which any considerable degree of practical utility can be derived. The connection between particular states of body and particular mental trains ought to be carefully watched and recorded. When the events one by one are accurately distinguished, and made easy to be recognized, and when the order in which they follow one another is known, our power over the trains of those events, power to prevent such as are unfavourable, to produce such as are favourable, to human happiness, will then be at its height; and how to take care of his health will be one of the leading parts of the moral and intellectual education of man.

The state of the body with regard to health and disease is the inherent circumstance of the greatest importance, and we must pass over the rest with a cursory notice. The next we mentioned are strength and weakness, meaning chiefly muscular strength and weakness; and the natural, habitual, not the accidental or diseased state. It is a common observation, that muscular strength is apt to withdraw the owner from mental pursuits, and engage him in such as are more of the animal kind; the acquisition and display of physical powers. Few men of great bodily powers have been much distinguished for mental excellence; some of the greatest ornaments of human nature have been remarkable for bodily weakness. Muscular strength is liable to operate unfavourably upon the moral as well as the intellectual trains of thought. It diminishes that respect for other men which is so necessary to resist the impulses of passion; it presents innumerable occasions for playing the tyrant with impunity, and fosters, therefore, all that train of ideas in which the tyrannical vices are engendered. Cabanis remarks, and the fact is worthy of the greatest attention, "Presque tous les grands scélérats sont des hommes d'une structure organique vigoureuse, remarquables par la fermeté et la tenacité de leurs fibres musculaires." It is evident, therefore, how deeply it concerns the happiness of mankind, that the mental trains which this circumstance has a tendency to raise should be accurately known, as thus alone the means can be known, how that which is hurtful may be avoided, that which is useful may be introduced.

Of beauty and deformity, as circumstances affecting the mental trains, much will not be necessary to be said. Illustrations will occur to every body to prove that their power is not inconsiderable; so little, however, has been done to ascertain the facts, and record them in the best possible order, that any thing which deserves the name of knowledge on the subject hardly exists, and the principal service we can render is to point it out for study; to exhort future inquirers to observe diligently the trains which flow from beauty and deformity as their source, and to trace to the largest possible sequences, as above described, the connections which take place between them. Beauty and deformity, it may be observed, operate upon the mental trains in somewhat a different way from health and disease, rather mediately than immediately. It is the idea of their effect upon other people that is the more immediate cause of the trains to which they give occasion. The idea that beauty commands their favourable regards is apt to introduce the well-known trains denoted by the terms vanity, pride, contemptuousness, trains not very favourable to the virtues. The idea that deformity is apt to excite their unfavourable regards, is often observed to lead to acuteness and vigour of intellect, employed as instruments of protection, but to moroseness, and even malignity of temper. The mode, however, in which beauty and deformity operate upon the mental trains, namely, through the idea of their effect upon other people, is common to them with a great many other advantages or disadvantages, which derive their value chiefly from their influence upon other people; and materials for the illustration of this subject have been supplied by various writers upon the human mind.

To the word temperament no very precise idea has hitherto been annexed. It may be conceived in the following manner: The bodily structure, the composition of elements in the body of every individual, is different from that in the body of any other. It is observed, however, that the composition is more nearly resembling in some than in others; that those who thus resemble may be arranged in groups, and that they may all be comprehended in four or five great classes. The circumstances in which their bodily composition agrees, so as to constitute one of those large classes, have been called the temperament, and each of those more remarkable characters of the body has been observed to be attended with a peculiar character in the train of ideas; but the illustration of the trains of ideas, and hence of the qualities of mind, which are apt to be introduced by temperament, and by the diversities of age and of sex, we are obliged, by the rapid absorption of the space allotted to us, wholly to omit. The subject in itself is not very mysterious. Accurate observation and masterly recordation alone are required. To be sure, the same may be said of every object of human inquiry; but in some cases it is not so easy to conceive perfectly what observation and recordation mean. On these topics also we are happy to say that Cabanis really affords very considerable helps.

2. We come now to the second sort of physical circumstances, which have the power of introducing habitually certain trains of ideas, and hence of impressing permanent tendencies on the mind; the circumstances which

are external to the body. Some of these are of very great importance. The first is aliment.

Aliment is good or evil by quality and quantity. Hartley has remarked long ago, that though all the impressions from which ideas are copied are made on the extremities of the nerves which are ramified on the surface of the body, and supply the several organs of sense, other impressions are nevertheless made on the extremities of the nerves which are ramified on the internal parts of our bodies, and that many of those impressions are associated with trains of ideas; that the impressions made upon the extremities of the nerves which are ramified on the alimentary canal, are associated with the greatest number of those trains; and of such trains, that some are favourable to happiness, some altogether the reverse. If the quantity and quality of the aliment be the principal cause of those impressions, here is a physiological reason of the greatest importance for an accurate observation and recordation of the events occurring in this part of the field, what antecedents are attended by what consequents, and what the largest sequences that can be traced. Cabanis confirmed the doctrine of Hartley with regard to the internal impressions, and added another class. He said that not only the extremities of the nerves which terminate internally, but the centre of the nervous influence, the brain itself, received impressions; and that thus there were no fewer than three sources of mental and corporeal movements of man; one external, from which almost all our distinct ideas are copied; and two internal, which exert a very great influence upon the trains of ideas, and hence upon the actions of which these trains are the antecedents or cause.

On this too, as on most of the other topics belonging to the physical branch of education, we must note, as still uncollected, the knowledge which is required. It is understood in a general way, that deep impressions are by this means made upon the mind; but how they are made is a knowledge which, in any such detail and accuracy as to afford useful practical rules, is nearly wanting. There is a passage in Hartley, which we esteem it important to quote: "The sense of feeling may be distinguished into that of the external surface of the body, and that of the cavities of the nose, mouth, fauces, alimentary duct, pelvis, of the kidneys, uterus, bladder of urine, gall bladder, follicles, and ducts of the glands, &c. The sensibility is much greater in the last than in the first, because the impressions can more easily penetrate through the soft epithelium with which the internal cavities are invested. In the mouth and nose this sensibility is so great, and attended with such distinguishing circumstances, as to have the names of taste and smell assigned respectively to the sensations impressed upon the papillæ of those two organs." ......"The taste may also be distinguished into two kinds, viz. the general one, which extends itself to the insides of the lips and cheeks, to the palate, fauces, œsophagus, stomach, and whole alimentary duct, quite down to the anus. ......The pleasures of the taste, considered as extending itself from the mouth through the whole alimentary duct, are very considerable, and frequently repeated; they must, therefore, be one chief means by which pleasurable states are introduced into the brain and nervous system. These pleasurable states must, after some time, leave miniatures of themselves sufficiently strong to be called up upon slight occasions, viz. from a variety of associations with the common visible and audible objects, and to illuminate these and their ideas. When groups of these miniatures have been long and closely connected with particular objects, they coalesce into one complex idea, appearing, however, to be a simple one; and so begin to be transferred upon other objects, and even upon tastes back again, and so on without limits. And, from this way of reasoning, it may now appear that a great part of our intellectual pleasures are ultimately deducible from those of taste; and that one principal final cause of the greatness and constant recurrency of these pleasures, from our first infancy to the extremity of old age, is to introduce and keep up pleasurable states in the brain, and to connect them with foreign objects. The social pleasures seem, in a particular manner, to be derived from this source, since it has been customary in all ages and nations, and is in a manner necessary, that we should enjoy the pleasures of taste in conjunction with our relations, friends, and neighbours. In like manner, nauseous tastes and painful impressions upon the alimentary duct, give rise and strength to mental pains. The most common of these painful impressions is that from excess, and the consequent indigestion. This excites and supports those uneasy states which attend upon melancholy, fear, and sorrow. It appears also to me that these states are introduced in a great degree during sleep, during the frightful dreams, agitations, and oppressions, that excess in diet occasions in the night. These dreams and disorders are often forgotten; but the uneasy states of body which then happen leave vestiges of themselves, which increase in number and strength every day, from the continuance of the cause, till at last they are ready to be called up in crowds upon slight occasions, and the unhappy person is unexpectedly, and at once, as it were, seized with a great degree of the hypochondriac distemper, the obvious cause appearing noways proportionable to the effect; and thus it may appear that there ought to be a great reciprocal influence between the mind and alimentary duct, agreeably to common observation." Cabanis, in like manner, says, "Quoique les médécins aient dit plusieurs choses hazardées, touchant l'effet des substances alimentaires sur les organes de la pensée, ou sur les principes physiques de nos penchans, il n'en est pas moins certain que les différentes causes que nous appliquons journellement à nos corps, pour en renouveller les mouvements, agissent avec une grande efficacité sur nos dispositions morales. On se rend plus propre aux travaux de l'esprit par certaines précautions de régime, par l'usage, ou la suppression de certains alimens. Quelques personnes ont été guéries de violens accès de colère, auxquels elles etoient sujêtes, par la seule diète pythagorique; et dans le cas même où des délires furieux troublent toutes les facultés de l'âme, l'emploi journalier de certaines nourritures ou de certaines boissons, l'impression d'une certaine température de l'air, l'aspect de certains objets, en un mot, un système diététique particulier, suffit souvent pour y ramener le calme, pour faire tout rentrer dans l'ordre primitif."

As it is impossible for us here to attempt a full account of the mode in which aliments operate to produce good or bad effects upon the train of ideas, we shall single out that case which, as operating upon the greatest number of people, is of the greatest importance; we mean that in which effects are produced by the *poverty* of the diet; proposing, under the term poverty, to include both badness of quality and defect of quantity. On badness of quality we shall not spend many words. Aliments are bad in a variety of ways, and to such a degree as to impair the bodily health. Of such the injurious effect will not be disputed. Others, which have in them no hurtful ingredient, may contain so insignificant a portion of nourishment, that to afford it in the requisite degree, they must produce a hurtful distention of the organs. The saw-dust, which some northern nations use for bread, if depended upon for the whole of their nourishment, would doubtless have this effect. The potato, where solely depended upon, is not perhaps altogether free from it. Bad quality, however, is but seldom resorted to, except in consequence of deficient quantity. That is, therefore, the principal point of inquiry.

It is easy to see a great number of ways in which deficient quantity of food operates unfavourably upon the *moral* temper of the mind. As people are ready to sacrifice every thing to the obtaining of a sufficient quantity of food, the want of it implies the most dreadful poverty; that state in which there is scarcely any source of pleasure, and in which almost every moment is subject to pain. It is found by experience, that a human being, almost constantly in pain from his birth, hardly visited by a single pleasure, and almost shut out from hope, loses by degrees all sympathy with his fellow-creatures; contracts even a jealousy of their pleasures, and at last a hatred, and would like to see all the rest of mankind as wretched as himself. If he is habitually wretched, and rarely permitted to taste a pleasure, he snatches it with an avidity, and indulges himself with an intemperance, almost unknown to any other man. The evil of insufficient food acts with an influence not less malignant upon the intellectual than upon the moral part of the human mind. The physiologists account for its influence in this manner. They say, that the signs by which the living energy is manifested may be included generally under the term *irritability*, or the power of being put in action by stimulants. It is not necessary for us to be very particular in explaining these terms; a general conception will for the present suffice. A certain degree of this irritability seems necessary to the proper state, or rather the very existence, of the animal functions. A succession of stimulants of a certain degree of frequency and strength is necessary to preserve that irritability. The most important by far of all the useful stimulants applied to the living organs is food. If this stimulant is applied in less than a sufficient degree, the irritability is diminished in proportion; and all those manifestations of the living energy which depend upon it, mental as well as corporeal, are impaired; the mind loses a corresponding part of its force. We must refer to the philosophical writers on medicine for illustrations and facts, which we have not room to adduce, but which will not be difficult to collect. Dr Crichton places *poor diet* at the head of a list of causes which "weaken attention, and consequently debilitate the whole faculties of the mind."[1] From this fact, about which there is no dispute, the most important consequences arise. It follows, that when we deliberate about the means of introducing intellectual and moral excellence into the minds of the principal portion of the people, one of the first things which we are bound to provide for is a generous and animating diet. The physical causes must go along with the moral; and nature herself forbids that you shall make a wise and virtuous people out of a starving one. Men must be happy themselves before they can rejoice in the happiness of others; they must have a certain vigour of mind, before they can, in the midst of habitual suffering, resist a presented pleasure; their own lives and means of well-being must be worth something, before they can value, so as to respect, the life or well-being of any other person. This or that individual may be an extraordinary individual, and exhibit mental excellence in the midst of wretchedness; but a wretched and excellent people never yet has been seen on the face of the earth. Though far from fond of paradoxical expressions, we are tempted to say that a good diet is a necessary part of a good education; for in one very important sense it is emphatically true. In the great body of the people all education is impotent without it.

Labour is the next of the circumstances in our enumeration. We have distinguished labour from action, though action is the genus of which labour is one of the species; because, of those species, labour is so much the most important. The muscular operations of the body, by which men generally earn their bread, are the chief part of the particulars which we include under that term. The same distinction is useful here as in the former case; labour is apt to be injurious by its *quality* and by its *quantity*. That the quality of the labour in which a man is employed produces effects favourable or unfavourable upon his mind, has long been confessed. Dr Smith made the important remark, that the labour in which the great body of the people are employed, has a tendency to grow less and less favourable as civilization and the arts proceed. The division and subdivision of labour is the principal cause. This confines the attention of the labourer to so small a number of objects, and so narrow a circle of ideas, that the mind receives not that varied exercise, and that portion of aliment, on which almost every degree of mental excellence depends. When the greater part of a man's life is employed in the performance of a few simple operations in one fixed invariable course, all exercise of ingenuity, all adaptation of means to ends, is wholly excluded, and the faculty lost, as far as disuse can destroy the faculties of the mind. The minds, therefore, of the great body of the people are in danger of really degenerating, while the other elements of civilization are advancing, unless care is taken, by means of the other instruments of education, to counteract those effects which the simplification of the manual processes has a tendency to produce.

The *quantity* of labour is another circumstance which deserves attention in estimating the agents which concur in forming the mind. Labour may be to such a degree severe, as to confine the attention almost wholly to the painful ideas which it brings, and to operate upon the mind with nearly the same effects as an habitual deficiency of food. It operates perhaps still more rapidly, obliterating sympathy, inspiring cruelty and intemperance, rendering impossible the reception of ideas, and paralyzing the organs of the mind. The attentive examination, therefore, of the facts of this case, is a matter of first-rate importance. Two things are absolutely certain; that without the bodily labour of the great bulk of mankind, the well-being of the species cannot be obtained: and that if the bodily labour of the great bulk of mankind is carried beyond a certain extent, neither intellect, virtue, nor happiness can flourish upon the earth. What then is that precious middle point, at which the greatest quantity of good is obtained with the smallest quantity of evil, is in this part of the subject the problem to be solved.

The state of defective food and excessive labour is the state in which we find the great bulk of mankind; the state in which they are either constantly existing, or into which they are every moment threatening to fall. These are two, therefore, in settling the rank among the circumstances which concur in determining the degree of intellect and morality capable of being exhibited in the societies of men, which ought to stand in a very eminent place. The mode of increasing to the utmost the quantity of intellect, morality, and happiness in human society, will be very imperfectly understood, till they obtain a new degree of consideration.

We named, besides these, among the physical circumstances which contribute to give permanent characters to the mind, air, temperature, action, and rest. But of these we must leave the illustration wholly to other inquirers. It is mortifying to be obliged to relinquish a subject on which so much depends, and for which so little has been done, with so very imperfect an attempt for its improvement. We shall, however, have performed a service of some utility to education, if what we have said has any tendency to lead men to a juster estimate of the physical circumstances which concur in fashioning the human mind, and hence to greater industry and care in studying and applying them.

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[1] An Inquiry into the Nature and Origin of Mental Derangement, &c. By A. Crichton, M. D. T. 274.

2. *Circumstances of the moral kind, which operate upon the Mind in the way of Education.*

The moral circumstances which determine the mental trains of the human being, and hence the character of his actions, are of so much importance, that to them the term education has been generally confined; or rather, the term education has been generally used in so narrow a sense, that it embraces only one of the four classes into which we have thought it convenient to distribute the moral circumstances which operate to the formation of the human mind.

1. The first of these classes we have comprehended under the term *Domestic Education.* To this the groundwork of the character of most individuals is almost wholly to be traced. The original features are fabricated here; not indeed in such a manner as to be unsusceptible of alteration, but in such a manner decidedly as to present a good or bad subject for all future means of cultivation. The importance, therefore, of domestic education needs no additional words to explain it, though it is difficult to restrain a sigh when we reflect that it has but now begun to be regarded as within the pale of education; and a few scattered remarks, rather than a full exposition of the subject, is all the information upon it with which the world has been favoured.

By domestic education we denote all that the child hears and sees, more especially all that it is made to suffer or enjoy at the hands of others, and all that it is allowed or constrained to do in the house in which it is born and bred, which we shall consider generally as the parental.

If we consider that the mental trains, as explained above, are that upon which every thing depends, and that the mental trains depend essentially upon those sequences among our sensations which have been so frequently experienced as to create a habit of passing from the idea of the one to that of the other, we shall perceive immediately the reasons of what we have advanced.

It seems to be a law of human nature, that the first sensations experienced produce the greatest effects; more especially that the earliest repetitions of one sensation after another produce the deepest habit; the strongest propensity to pass immediately from the idea of the one to the idea of the other. Common language confirms this law when it speaks of the susceptibility of the tender mind. On this depends the power of those associations which form some of the most interesting phenomena of human life. From what other cause does it arise that the hearing of a musical air, which after a life of absence recalls the parental mansion, produces as it were a revolution in the whole being? That the sympathies between brothers and sisters are what they are? On what other cause originally is the love of country founded; that passionate attachment to the soil, the people, the manners, the woods, the rivers, the hills, with which our infant eyes were familiar, which fed our youthful imaginations, and with the presence of which the pleasures of our early years were habitually conjoined?

It is, then, a fact, that the early sequences to which we are accustomed form the primary habits, and that the primary habits are the fundamental character of the man. The consequence is most important; for it follows that, as soon as the infant, or rather the embryo, begins to feel, the character begins to be formed; and that the habits which are then contracted are the most pervading and operative of all. Education, then, or the care of forming the habits, ought to commence as much as possible with the period of sensation itself; and at no period is its utmost vigilance of greater importance than the first.

Very unconnected, or very general instructions, are all that can be given upon this subject, till the proper decompositions and recompositions are performed; in other words, till the subject is first analysed and then systemized; or, in one word, *philosophized*, if we may use that verb in a passive signification. We can, therefore, do little more than exhort to the prosecution of the inquiry.

The steady conception of the end must guide us to the means. Happiness is the end; and we have circumscribed the inquiry, by naming intelligence, temperance, and benevolence, of which last the two parts are generosity and justice, as the grand qualities of mind through which this end is to be attained. The question then is, how can those early sequences be made to take place on which the habits, conducive to intelligence, temperance, and benevolence are founded; and how can those sequences on which are founded the vices opposite to those virtues be prevented?

Clearness is attained by disentangling complexity; we ought therefore to trace the sequences conducive to each of those qualities in their turn. A part, however, must suffice when we cannot accomplish the whole. Intelligent trains of ideas constitute intelligence. Trains of ideas are intelligent when the sequences in the ideas correspond to the sequences in nature. A man, for example, knows the order of certain words when his idea of the one follows that of the other, in the same order in which the events themselves took place. A man is sagacious in devising means for the production of events when his ideas run easily in trains which are at once agreeable to knowledge, that is, to the trains of events, and at the same time new in the combination. They must be agreeable to knowledge; that is, one of the ideas must follow another in the order in which the objects of which they are the ideas follow one another in nature, otherwise the train would consist of mere chimeras, and, having no connection with things, would be utterly useless. As the event, however, is not in the ordinary course, otherwise sagacity would not be required to give it existence, the ordinary train of antecedents will not suffice; it must be a peculiar train, at once correspondent with nature and adapted to the end. The earliest trains produced in the minds of children should be made to partake as much as possible of those characters. The impressions made upon them should correspond to the great and commanding sequences established among the events on which human happiness principally depends. More explicitly, children ought to be made to see, and hear, and feel, and taste, in the order of the most invariable and most comprehensive sequences, in order that the ideas which correspond to their impressions, and follow the same order of succession, may be an exact transcript of nature, and always lead to just anticipations of events. Especially the pains and pleasures of the infant, the deepest impressions which he receives ought from the first moment of sensation to be made as much as possible to correspond to the real order of nature. The moral procedure of parents is directly the reverse; they strive to defeat the order of nature in accumulating pleasures for their children, and preventing the arrival of pains, when the children's own conduct would have had very different effects.

Not only are the impressions from which ideas are copied, made, by the injudicious conduct of those to whom the destiny of infants is confided, to follow an order very different from the natural one, or that in which the grand sequences among events would naturally produce them; but wrong trains of ideas, trains which have no correspondence with the order of events, are often introduced immediately by words or other signs of the ideas of other men. As we can only give very partial examples of a general error, we may content ourselves with one of the most common. When those who are about children express by their words, or indicate by other signs, that terrific trains of ideas are passing in their minds when they go into the dark; terrific trains, which have nothing to do with the order of events, come up also in the minds of the children in the dark, and often exercise over them an uncontrollable sway during the whole of their lives. This is the grand source of wrong education; to this may be traced the greater proportion of all the evil biases of the human mind. If an order of ideas corresponding with the order of events were taught to come up in the minds of children when they go into the dark, they would think of nothing but the real dangers which are apt to attend it, and the precautions which are proper to be taken; they would have no wrong feelings, and their conduct would be nothing but that which prudence or a right conception of the events would prescribe. If the expressions and other signs of the ideas of those who are about children indicate that trains, accompanied with desire and admiration, pass in their minds when the rich and powerful are named, trains accompanied with aversion and contempt when the weak and the poor, the foundation is laid of a character stained with servility to those above, and tyranny to those below them. If indication is given to children that ideas of disgust, of hatred, and detestation, are passing in the minds of those about them, when particular descriptions of men are thought of, as men of different religions, different countries, or different political parties in the same country, a similar train becomes habitual in the minds of the children, and those antipathies are generated which infuse so much of its bitterness into the cup of human life.

We can afford to say but very few words on the powers of domestic education with regard to temperance. That virtue bears an immediate reference to pain and pleasure. The grand object evidently is, to connect with each pain and pleasure those trains of ideas which, according to the order established among events, tend most effectually to increase the sum of pleasures upon the whole, and diminish that of pains. If the early trains create a habit of over-valuing any pleasure or pain, too much will be sacrificed during life to obtain the one or avoid the other, and the sum of happiness, upon the whole, will be impaired. The order in which children receive their impressions, as well as the order of the trains which they copy from others, has a tendency to create impatience under privation; in other words, to make them in prodigious haste to realize a pleasure as soon as desired, to extinguish a pain as soon as felt. A pleasure, however, can be realized in the best possible manner, or a pain removed, only by certain steps, frequently numerous ones; and if impatience hurries a man to overlook those steps, he may sacrifice more than he gains. The desirable thing would be, that his ideas should always run over those very steps, and none but them; and the skilful use of the powers we have over the impressions and trains of his infancy would lay the strongest foundation for the future happiness of himself, and of all those over whom his actions have any sway. It is by the use of this power that almost every thing is done to create what is called the temper of the individual; to render him irascible on the one hand, or forbearing on the other; severe and unforgiving, or indulgent and placable.

Intelligence and temperance are sometimes spoken of as virtues which have a reference to the happiness of the individual himself, benevolence as a virtue which has a reference to the happiness of others. The truth is, that intelligence and temperance have a reference not less direct to the happiness of others than to that of the possessor; and benevolence cannot be considered as less essential to his happiness than intelligence and temperance. In reality, as the happiness of the individual is bound up with that of his species, that which affects the happiness of the one must also, in general, affect that of the other.

It is not difficult, from the expositions we have already given, to conceive in a general way how sequences may take place in the mind of the infant which are favourable to benevolence, and how sequences may take place which are unfavourable to it. The difficulty is, so to bring forward and exhibit the details, as to afford the best possible instruction for practice. We have several books now in our own language, in particular those of Miss Edgeworth, which afford many finely selected instances, and many detached observations of the greatest value, for the cultivation of benevolence in the infant mind. But the great task of the philosopher, that of *theorizing* the whole, is yet to be performed. What we mean by "theorizing the whole," after the explanations we have already afforded, is not, we should hope, obscure. It is, to observe exactly the facts; to make a perfect collection of them, nothing omitted that is of any importance, nothing included of none; and to record them in that order and form in which all that is best to be done in practice can be most immediately and certainly perceived.

The order of the impressions which are made upon the child by the spontaneous order of events is, to a certain degree, favourable to benevolence. The pleasures of those who are about him are most commonly the cause of pleasure to himself; their pains of pain. When highly pleased, they are commonly more disposed to exert themselves to gratify him. A period of pain or grief in those about him is a period of gloom, a period in which little is done for pleasure, a period in which the pleasures of the child are apt to be overlooked. Trains of pleasurable ideas are thus apt to arise in his mind at the thought of the pleasurable condition of those around him; trains of painful ideas at the thought of the reverse; and he is thus led to have an habitual desire for the one, aversion to the other. But if pleasures, whencesoever derived, of those about him, are apt to be the cause of good to himself, those pleasures which they derive from himself are in a greater degree the cause of good to himself. If those about him are disposed to exert themselves to please him when they are pleased themselves, they are disposed to exert themselves in a much greater degree to please him in particular when it is he who is the cause of the pleasure they enjoy. A train of ideas, in the highest degree pleasurable, may thus habitually pass through his mind at the thought of happiness to others produced by himself; a train of ideas, in the highest degree painful, at the thought of misery to others produced by himself. In this manner the foundation of a life of beneficence is laid.

The business of a skilful education is so to arrange the circumstances by which the child is surrounded, that the impressions made upon him shall be in the order most conducive to this happy result. The impressions, too, which are made originally upon the child, are but one of the causes of the trains which are rendered habitual to him, and which, therefore, obtain a leading influence in his mind. When he is often made to conceive the trains of other men, by the words or other signs by which their feelings are betokened, those borrowed trains become also habitual, and exert a similar influence on the mind. This, then, is another of the instruments of education. When the trains, signified to the child, of the ideas in the minds of those about him, are trains of pleasure at the thought of the happiness of other human beings, trains of the opposite kind at the conception of their misery; and when such trains are still more pleasurable or painful as the happiness or misery is produced by themselves; the association becomes in time sufficiently powerful to govern the life.

The grand object of human desire is a command over the wills of other men. This may be attained either by qualities and acts which excite their love and admiration, or by those which excite their terror. When the education is so wisely conducted as to make the train run habitually from the conception of the good end to the conception of the good means; and as often, too, as the good means are conceived, viz. the useful and beneficial qualities, to make the train run on to the conception of the great reward, the command over the wills of men; an association is formed which impels the man through life to pursue the great object of desire, by fitting himself to be, and by actually becoming, the instrument of the greatest possible benefit to his fellow men.

But, unhappily, a command over the wills of men may be obtained by other means than by doing them good; and these, when a man can command them, are the shortest, the easiest, and the most effectual. These other means are all summed up in a command over the pains of other men. When a command over the wills of other men is pursued by the instrumentality of pain, it leads to all the several degrees of vexation, injustice, cruelty, oppression, and tyranny. It is, in truth, the grand source of all wickedness, of all the evil which man brings upon man. When the education is so deplorably bad as to allow an association to be formed in the mind of the child between the grand object of desire, the command over the wills of other men, and the fears and pains of other men as the means, the foundation is laid of the bad character, the bad son, the bad brother, the bad husband, the bad father, the bad neighbour, the bad magistrate, the bad citizen, to sum up all in one word, the bad man. Yet, true it is, a great part of education is still so conducted as to form that association. The child, while it yet hangs at the breast, is often allowed to find out by experience that crying, and the annoyance which it gives, is that by which chiefly it can command the services of its nurse, and obtain the pleasures which it desires. There is not one child in fifty who has not learned to make its cries and wailings an instrument of power; very often they are an instrument of absolute tyranny. When the evil grows to excess, the vulgar say the child is spoiled. Not only is the child allowed to exert an influence over the wills of others by means of their pains; it finds, that frequently, sometimes most frequently, its own will is needlessly and unduly commanded by the same means, pain, and the fear of pain. All these sensations concur in establishing a firm association between the idea of the grand object of desire, command over the acts of other men, and the idea of pain and terror, as the means of acquiring it. That those who have been subject to tyranny are almost always desirous of being tyrants in their turn; that is to say, that a strong association has been formed in their minds between the ideas of pleasure and dignity on the one hand, and those of the exercise of tyranny on the other, is a matter of old and invariable observation. An anecdote has just been mentioned to us, so much in point, that we will repeat it, as resting on its own probability, though it is hearsay evidence (very good, however, of its kind) on which we have received it. At Eton, in consequence, it is probable, of the criticisms which the press has usefully made upon the system of *fagging* (as it is called) at the public schools, a proposition was lately made among the boys themselves for abolishing it. The idea originated with the elder boys, who were in possession of the power; a power of a very unlimited and formidable description, and by them was warmly supported. It was, however, opposed with still greater vehemence by the junior boys, the boys who were then the victims of it. The expected pleasure of tyrannizing in their turn outweighed the pain of their present slavery. In this case, too, as in most others, the sources of those trains which govern us are two; the impressions made upon ourselves, and the trains which we copy from others. Besides the impressions just recounted, if the trains which pass in the minds of those by whom the child is surrounded, and which he is made to conceive by means of their words and other signs, lead constantly from the idea of command over the wills of other men as the grand object of desire, to the ideas of pain and terror as the means, the repetition of the copied trains increases the effect of the native impressions, and establishes and confirms the maleficent character. These are the few things we can afford to adduce upon the subject of domestic education.

2. In the next place comes that which we have denominated *Technical Education.* To this the term education has been commonly confined; or, rather, the word education has been used in a sense so unhappily restricted, that it has extended only to a part of that which we call technical education. It has not extended to all the arts, but only to those which have been denominated liberal.

The question here occurs, what is the sort of education required for the different classes of society, and what should be the difference in the training provided for each? Before we can treat explicitly of technical education, we must endeavour to show in what manner at least this question ought to be resolved.

There are certain qualities the possession of which is desirable in all classes. There are certain qualities the possession of which is desirable in some, not in others. As far as those qualities extend which ought to be common to all, there ought to be a correspondent training for all. It is only in respect to those qualities which are not desirable in all, that a difference in the mode of training is required.

What then are the qualities the possession of which is desirable in all? They are the qualities which we have already named as chiefly subservient to the happiness of the individual himself and of other men, intelligence, temperance, and benevolence. It is very evident that these qualities are desirable in all men; and if it were possible to get them all in the highest possible degree in all men, so much the more would human nature be exalted.

The chief difficulty respects intelligence; for it will be readily allowed that almost equal care ought to be taken in all classes, of the trains leading to the settled dispositions which the terms temperance and benevolence denote. Benevolence, as we have described it, can hardly be said to be of more importance to the happiness of man in one class than in another. If we bear in mind also the radical meaning of temperance, that is, the steady habit of resisting a present desire for the sake of a greater good, we shall readily grant that it is not less necessary to happiness in one rank of life than in another. It is only necessary to see that temperance, though always the same disposition, is not always exerted on the same objects in the different conditions of life. It is no demand of temperance, in the man who can afford it, to deny himself animal food; it may be an act of temperance in the man whose harder circumstances require that he should limit himself to coarser fare. It is also true, that the trains which lead to temperance and benevolence may be equally cultivated in all classes. The impressions which persons are made to receive, and the trains of others which they are made to copy, may, with equal certainty, be guided to the generating of those two qualities in all the different classes of society. We deem it unnecessary, here indeed it is impossible, to enter into the details of what may be done in the course of technical education, to generate or to confirm the dispositions of temperance and benevolence. It can be nothing more than the application of the principles which we developed, when we endeavoured to show in what manner the circumstances of domestic education might be employed for generating the trains on which these mental qualities depend.

Technical education we shall then consider as having chiefly to do with *intelligence*.

The first question, as we have said before, respects what is desirable for all; the second what is desirable for each of the several classes. Till recently, it was denied that intelligence was a desirable quality in the great body of the people; and as intelligence is power, such is an unavoidable opinion in the breasts of those who think that the human race ought to consist of two classes, one that of the oppressors, another that of the oppressed. The concern which is now felt for the education of the working classes, shows that we have made a great step in knowledge, and in that genuine morality which ever attends it.

The analysis of the ideas decides the whole matter at once. If education be to communicate the art of happiness, and if intelligence consists of two parts, a knowledge of the order of those events of nature on which our pleasures and pains depend, and the sagacity which discovers the best means for the attaining of ends; the question whether the people should be educated, is the same with the question whether they should be happy or miserable. The question whether they should have more or less of intelligence, is merely the question whether they should have more or less of misery, when happiness might be given in its stead. It has been urged that men are by daily experience evinced not to be happy, not to be moral, in proportion to their knowledge. It is a shallow objection. Long ago it was observed by Hume, that knowledge, and its accompaniments, morality and happiness, may not be strictly conjoined in every individual, but that they are infallibly so in every age and in every country. The reason is plain; a natural cause may be hindered of its operation in one particular instance, though in a great variety of instances it is sure to prevail. Besides, there may be a good deal of knowledge in an individual, but not knowledge of the best things. This cannot easily happen in a whole people; neither the whole nor the greater part will miss the right objects of knowledge when knowledge is generally diffused.

As evidence of the vast progress which we have made in right thinking upon this subject, we cannot help remarking, that even Milton and Locke, though both men of great benevolence toward the larger family of mankind, and both men whose sentiments were democratical, yet seem, in their writings on education, to have had in view no education but that of the *gentleman*. It had not presented itself, even to their minds, that education was a blessing in which the indigent orders could be made to partake.

As we strive for an equal degree of justice, an equal degree of temperance, an equal degree of veracity, in the poor as in the rich, so ought we to strive for an equal degree of intelligence, if there were not a preventing cause. It is absolutely necessary for the existence of the human race, that labour should be performed, that food should be produced, and other things provided, which human welfare requires. A large proportion of mankind is required for this labour. Now, then, in regard to all this portion of mankind that labours, only such a portion of time can by them be given to the acquisition of intelligence as can be abstracted from labour. The difference between intelligence and the other qualities desirable in the mind of man is this, that much of time, exclusively devoted to the fixing of the associations on which the other qualities depend, is not necessary; such trains may go on while other things are attended to, and amid the whole of the business of life. The case is to a certain extent the same with intelligence, but to a great extent it is not. Time must be exclusively devoted to the acquisition of it; and there are degrees of command over knowledge to which the whole period of human life is not more than sufficient. There are degrees, therefore, of intelligence, which must be reserved to those who are not obliged to labour.

The question is, and it is a question which none can exceed in importance, what is the degree attainable by the most numerous class? To this we have no doubt it will in time very clearly appear that a most consolatory answer may be given. We have no doubt it will appear that a very high degree is attainable by them. It is now almost universally acknowledged that, on all conceivable accounts, it is desirable that the great body of the people should not be wretchedly poor; that when the people are wretchedly poor, all classes are vicious, all are hateful, and all are unhappy. If so far raised above wretched poverty as to be capable of being virtuous, though it be still necessary for them to earn their bread by the sweat of their brow, they are not bound down to such incessant toil as to have no time for the acquisition of knowledge and the exercise of intellect. Above all, a certain portion of the first years of life are admirably available to this great end. With a view to the productive powers of their very labour, it is desirable that the animal frame should not be devoted to it before a certain age, before it has approached the point of maturity. This holds in regard to the lower animals; a horse is less valuable, less in regard to that very labour for which he is valuable at all, if he is forced upon it too soon. There is an actual loss, therefore, even in productive powers, even in good economy, and in the way of health and strength, if the young of the human species are bound close to labour before they are fifteen or sixteen years of age. But if those years are skilfully employed in the acquisition of knowledge, in rendering all those trains habitual on which intelligence depends, it may be easily shown that a very high degree of intellectual acquirements may be gained; that a firm foundation may be laid for a life of mental action, a life of wisdom, and reflection, and ingenuity, even in those by whom the most ordinary labour will fall to be performed.

Beside the knowledge or faculties which all classes should possess in common, there are branches of knowledge and art which they cannot all acquire, and in respect to which education must undergo a corresponding variety. The apprenticeships, for example, which youths are accustomed to serve to the useful arts, we regard as a branch of their education. Whether these apprenticeships, as they have hitherto been managed, have been good instruments of education, is a question of importance, about which there is now, among enlightened men, hardly any diversity of opinion. When the legislature undertakes to do for every man what every man has abundant motives to do for himself, and better means than the legislature; the legislature takes a very unnecessary, commonly not a very innocent trouble. Into the details, however, of the best mode of teaching, to the working people, the arts by which the different commodities useful or agreeable to man are provided, we cannot possibly enter. We must content ourselves with marking it out as a distinct branch of the subject, and an important object of study.

With respect to the education of that class of society who have wealth and time for the acquisition of the highest measure of intelligence, there is one question to which every body must be prepared with an answer. If it be asked, whether, in the constitution of any establishment for the education of this class; call it university, call it college, school, or any thing else; there ought to be a provision for perpetual improvement, a provision to make the institution keep pace with the human mind; or whether, on the other hand, it ought to be so constituted as that there should not only be no provision for, but a strong spirit of resistance to, all improvement, a passion of adherence to whatever was established in a dark age, and a principle of hatred to those by whom improvement should be proposed; all indifferent men will pronounce that such institution would be a curse rather than a blessing. That he is a *progressive* being, is the grand distinction of man. He is the only progressive being upon this globe. When he is the most rapidly progressive, then he most completely fulfils his destiny. An institution for *education* which is hostile to progression, is, therefore, the most preposterous and vicious thing which the mind of man can conceive.

There are several causes which tend to impair the utility of old and opulent establishments for education. Their love of ease makes them love easy things, if they can derive from them as much credit as they would from others which are more difficult. They endeavour, therefore, to give an artificial value to trifles. Old practices, which have become a hackneyed routine, are commonly easier than improvements; accordingly they oppose improvements, even when it happens that they have no other interest in the preservation of abuses. Hardly is there a part of Europe in which the universities are not recorded in the annals of education as the enemies of all innovation. "A peine la compagnie de Jésus," says d'Alembert, "commençait elle à se montrer en France, qu'elle essuya des difficultés sans nombre pour s'y établir. Les universités surtout firent les plus grands efforts pour écarter ces nouveaux venus. Les Jésuites s'annonçaient pour enseigner gratuitement; ils comptoient déjà parmi eux des hommes savans et célèbres, supérieures peut-être à ceux dont les universités pouvaient se glorifier; l'interêt et la vanité pouvaient donc suffire à leurs adversaires pour chercher les exclure. On se rapelle les contradictions semblables à que les ordres mendians essuyèrent de ces mêmes universités quand ils voulurent s'y introduire; contradictions fondées à peu près sur les mêmes motifs." (*Destruction des Jésuites en France*). The celebrated German philosopher Wolf remarks the aversion of the universities to all improvement, as a notorious fact, derived from adequate motives: "Non adeo impune turbare licet scholarium quietem, et docentibus lucrosam, et discentibus jucundam." (Wolfii *Logica*, Dedic. p. 2.)

But though such and so great are the evil tendencies which are to be guarded against in associated seminaries of education; evil tendencies which are apt to be indefinitely increased when they are united with an ecclesiastical establishment, because, whatever the vices of the ecclesiastical system, the universities have in that case an interest to bend the whole of their force to the support of those vices, and to that end to vitiate the human mind, which can only be rendered the friend of abuses in proportion as it is vitiated intellectually, or morally, or both; it must notwithstanding be confessed, that there are great advantages in putting it in the power of the youth to obtain all the branches of their education in one place, even in assembling a certain number of them together, when the principle of emulation acts with powerful effect; and in carrying on the complicated process according to a regular plan, under a certain degree of discipline, and with the powerful spur of publicity. All this ought not to be rashly sacrificed, nor does there appear to be any insuperable difficulty in devising a plan for the attainment of all those advantages, without the evils which have more or less adhered to all the collegiate establishments which Europe has yet enjoyed.

After the consideration of these questions, we ought next to describe, and prove by analysis, the exercises which would be most conducive in forming those virtues which we include under the name of intelligence. But it is very evident that this is a matter of detail far too extensive for so limited a design as ours. And though, in common language, education means hardly any thing more than making the youth perform those exercises, and a treatise on education means little more than an account of them, we must content ourselves with marking the place which the inquiry would occupy in a complete system, and proceed to offer a few remarks on the two remaining branches of the subject, *Social Education* and *Political Education.*

The branches of moral education heretofore spoken of operate upon the individual in the first period of life, and when he is not as yet his own master. The two just now mentioned operate upon the whole period of life, but more directly and powerfully after the technical education is at an end, and the youth is launched into the world under his own control.

3. *Social Education* is that in which society is the institutor. That the society in which an individual moves produces great effects upon his mode of thinking and acting, every body knows by indubitable experience. The object is, to ascertain the extent of this influence, the mode in which it is brought about, and hence the means of making it operate in a good rather than an evil direction.

The force of this influence springs from two sources; the principle of imitation, and the power of the society over our happiness and misery.

We have already shown, that when, by means of words and other signs of what is passing in the minds of other men, we are made to conceive, step by step, the trains which are governing them, those trains, by repetition, become habitual to our own minds, and exert the same influence over us as those which arise from our own impressions. It is very evident that those trains which are most habitually passing in the minds of all those individuals by whom we are surrounded, must be made to pass with extraordinary frequency through our own minds, and must, unless where extraordinary means are used to prevent them from producing their natural effect, engross to a proportional degree the dominion of our minds. With this slight indication of this source of the power which society usurps over our minds, that is, of the share which it has in our education, we must content ourselves, and pass to the next.

Nothing is more remarkable in human nature than the intense desire which we feel of the favourable regards of mankind. Few men could bear to live under an exclusion from the breast of every human being. It is astonishing how great a portion of all the actions of men are directed to these favourable regards, and to no other object. The greatest princes, the most despotical masters of human destiny, when asked what they aim at by their wars and conquests, would answer, if sincere, as Frederic of Prussia answered, *pour faire parler de soi;* to occupy a large space in the admiration of mankind. What are the ordinary pursuits of wealth and of power, which kindle to such a height the ardour of mankind? Not the mere love of eating and of drinking, or all the physical objects together, which wealth can purchase or power command. With these every man in the long run is easily satisfied. The easy command which those advantages procure over the favourable regards of society; this it is which renders the desire of wealth unbounded, and gives it that irresistible influence which it possesses in directing the human mind.

Whatever, then, are the trains of thought, whatever is the course of action, which most strongly recommends us to the favourable regards of those among whom we live, these we feel the strongest motive to cultivate and display; whatever trains of thought and course of action expose us to their unfavourable regards, these we feel the strongest motives to avoid. These inducements, operating upon us continually, have an irresistible influence in creating habits, and in moulding, that is, educating us, into a character conformable to the society in which we move. This is the general principle; it might be illustrated in detail by many of the most interesting and instructive phenomena of human life; it is an illustration, however, which we cannot pursue.

To what extent the habits and character which those influences tend to produce may engross the man, will no doubt depend, to a certain degree, upon the powers of the domestic and technical education which he has undergone. We may conceive that certain trains might, by the skilful employment of the early years, be rendered so habitual as to be uncontrollable by any habits which the subsequent period of life could induce, and that those trains might be the decisive ones on which intelligent and moral conduct depends. The influence of a vicious and ignorant society would in this case be greatly reduced; but still the actual rewards and punishments which society has to bestow upon those who please and those who displease it, the good and evil which it gives and withholds, are so great, that to adopt the opinions which it approves, to perform the acts which it admires, to acquire the character, in short, which it "delighteth to honour," can seldom fail to be the leading object of those of whom it is composed. And as this potent influence operates upon those who conduct both the domestic education and the technical, it is next to impossible that the trains which are generated, even during the time of their operation, should not fall in with, instead of counteracting, the trains which the social education produces; it is next to impossible, therefore, that the whole man should not take the shape which that influence is calculated to impress upon him.

4. The *Political Education* is the last which we have undertaken to notice of the agents employed in forming the character of man. The importance of this subject has not escaped observation. Some writers have treated of it in a comprehensive and systematical manner, and a still greater number have illustrated it by occasional and striking remarks. It is nevertheless true, that the full and perfect exposition of it yet remains to be made.

The political education is like the key-stone of the arch, the strength of the whole depends upon it. We have seen that the strength of the domestic and the technical education depends almost entirely upon the social. Now it is certain that the nature of the social depends almost entirely upon the political; and the most important part of the physical (that which operates with greatest force upon the greatest number, the state of aliment and labour of the lower classes) is in the long run determined by the action of the political machine. The play, therefore, of the political machine acts immediately upon the mind, and with extraordinary power: but this is not all; it also acts upon almost every thing else by which the character of the mind is apt to be formed.

It is a common observation, that such as is the direction given to the desires and passions of men, such is the character of the men. The direction is given to the desires and passions of men by one thing, and one alone, the means by which the grand objects of desire may be attained. Now this is certain, that the means by which the grand objects of desire may be attained depend almost wholly upon the political machine. When the political machine is such that the grand objects of desire are seen to be the natural prizes of great and virtuous conduct, of high services to mankind, and of the generous and amiable sentiments from which great endeavours in the service of mankind naturally proceed, it is natural to see diffused among mankind a generous ardour in the acquisition of all those admirable qualities which prepare a man for admirable actions, great intelligence, perfect self-command, and over-ruling benevolence. When the political machine is such that the grand objects of desire are seen to be the reward, not of virtue, not of talent, but of subservience to the will, and command over the affections of the ruling few; interest with the *man above* to be the only sure means to the next step in wealth, or power, or consideration, and so on; the means of pleasing the man above become, in that case, the great object of pursuit. And as the favours of the man above are necessarily limited, as some, therefore, of the candidates for his favour can only obtain the objects of their desire by disappointing others, the arts of supplanting rise into importance; and the whole of that tribe of faculties denoted by the words intrigue, flattery, backbiting, treachery, &c. are the fruitful offspring of that political education which government, where the interests of the subject-many are but a secondary object, cannot fail to produce. (A. A. A.)

EDULCORATION properly signifies the rendering substances more mild. Chemical edulcoration consists almost always in taking away acids and other saline substances; and this is effected by washing the bodies to which they adhere in a large quantity of water. The washing of diaphoretic antimony, powder of algaroth, and the like, until the water comes off quite pure and insipid, are instances of chemical edulcoration.

EDWARD, the name of several kings of England. See ENGLAND.

EDWARDS, GEORGE, fellow of the Royal and Antiquarian Societies, was born at Stratford, a hamlet belonging to Westham in Essex, on the 3d of April 1693. After having spent some time at school, he was put as apprentice to a tradesman in Fenchurch Street. His master, who was eminent both for his piety and skill in the languages, treated him with very great kindness; but about the middle of his apprenticeship an accident happened which totally put a stop to the hopes of young Edwards advancing himself in the way of trade. Dr Nicolas, a person of emiwards, orge.

nence in the physical world, and a relation of his master's, happened to die. The doctor's books were removed to an apartment occupied by Edwards, who eagerly employed all his leisure hours, both during the day and great part of the night, in perusing those which treated of natural history, sculpture, painting, astronomy, and antiquities. The reading of these books entirely deprived him of any inclination which he might have formerly had for mercantile business, and he resolved to travel into foreign countries. In 1716 he visited most of the principal towns in Holland, and in about a month returned to England. Two years afterwards he took a voyage to Norway, at the invitation of a gentleman who was disposed to be his friend, and who was nephew to the master of the ship in which he embarked. At this time Charles XII. was besieging Frederickshall, an operation which prevented our young naturalist from making such excursions into the country as he would otherwise have done, for the Swedes were very careful to intercept such strangers as could not give a good account of themselves. But notwithstanding all his precaution he was confined by the Danish guard, who supposed him to be a spy employed by the enemy to procure intelligence of their designs. However, by obtaining testimonials of his innocence, a release was granted. In 1718 he returned to England, and next year he visited Paris by the way of Dieppe. During his stay in France he made two journeys of one hundred miles each, the first to Châlons in Champagne, in May 1720, and the second on foot to Orleans and Blois; but an edict happening at that time to be issued for securing vagrants, in order to transport them to America, as the banks of the Mississippi wanted population, our author narrowly escaped a western voyage. On his arrival in England, Mr Edwards closely pursued his favourite study of natural history, applying himself to drawing and colouring such animals as fell under his notice. In this pursuit he paid a strict attention to natural rather than to picturesque beauty. Birds first engaged his particular attention; and having purchased some of the best pictures of them, he was induced to make a few drawings of his own, which were admired by the curious, who encouraged the young naturalist to proceed, by paying a good price for his early labours. Amongst his first patrons and benefactors may be mentioned Mr James Theobalds of Lambeth, a gentleman zealous for the promotion of science. Being thus unexpectedly encouraged, he increased in skill and assiduity, and, by application to his favourite pursuit, procured a decent subsistence and a large acquaintance. However, he remitted his industry in 1731, when, in company with two of his relations, he made an excursion to Holland and Brabant, where he collected several scarce books and prints, and had an opportunity of examining the original pictures of several great masters at Antwerp, Brussels, Utrecht, and other cities. In December 1733, by the recommendation of Sir Hans Sloane, then president of the College of Physicians, he was chosen librarian to that body, and had apartments assigned him in the college. This office was peculiarly agreeable to his taste and inclination, as he had the opportunity of a constant recourse to a valuable library filled with scarce and curious books on the subject of natural history, which he so assiduously studied. By degrees he became one of the most eminent ornithologists in this or in any other country. His merit in this respect is too well known to render it necessary to pronounce any eulogium on his performances; but it may be observed, that he never trusted to others what he could perform himself, and he often found it so difficult to satisfy his own mind, that he frequently made three or four drawings in order to delineate the object in its most lively character, attitude, and representation. In the year 1743, the first volume of the *History of Birds* was published in quarto. As the number of his subscribers exceeded even his most sanguine expectations, a second volume appeared in 1747. The third volume was published in 1750; and in 1751 appeared the fourth volume. This being the last which he intended to publish at that time, he seems to have considered it as the most perfect of his productions in natural history; and therefore devoutly offered it up to the great God of nature, in humble gratitude for all the good things which he had received from Him in this world. Our author, in 1758, continued his labours under a new title, that of *Gleanings of Natural History*. A second volume of the Gleanings was published in 1760. The third part, which formed the seventh and last volume of his works, appeared in 1764. Thus our author, after a long series of years, the most studious application, and the most extensive correspondence in every quarter of the world, concluded a work which contains engravings and descriptions of more than six hundred subjects in natural history not before described or delineated. He likewise added a general index in French and English, which was afterwards perfected with the Linnæan names, by Linnæus himself, who frequently honoured him with his friendship and correspondence. Some time after Mr Edwards had been appointed librarian to the Royal College of Physicians, he was, on St Andrew's Day, in the year 1750, presented by the president and council of the Royal Society with the gold medal, the donation of Sir Godfrey Copley, annually given on that day to the author of any new discovery in art or nature, in consideration of his natural history just then completed. A copy of this medal he had afterwards engraved, and placed under the title in the first volume of his history. He was a few years afterwards elected fellow of the Royal Society and of the Society of Antiquaries, London, and also a member of many of the academies of sciences and learning in different parts of Europe. In return for these honorary distinctions from learned bodies, he presented elegantly-coloured copies of all his works to the Royal College of Physicians, the Royal Society, the Society of Antiquaries, and to the British Museum; and also to the Academy of Sciences at Paris, from which he received a very polite and obliging letter of thanks by their then secretary M. Defouchy. His collection of drawings, which amounted to upwards of nine hundred, were purchased by the Earl of Bute. They contain a great number of British as well as foreign birds, and other animals hitherto not accurately delineated or described. After the publication of the last work, having arrived at his seventieth year, he found his sight beginning to fail, and his hand losing its wonted steadiness. He retired from public employment to a little house which he had purchased at Plaistow, previously to which he disposed of all the copies as well as plates of his works. The conversation of a few select friends, and the perusal of a few select books, were the amusement of the evening of his life; and now and then he made an excursion to some of the principal cities in England, particularly to Bristol, Bath, Exeter, and Norwich. Some years before his death, the alarming depredation of a cancer, which baffled all the efforts of medical skill, deprived him of the sight of one of his eyes; and he also suffered much from the stone, to which at different periods of his life he had been subject; but in the severest paroxysms of pain he was scarcely known to utter a single complaint. Having completed his eightieth year, emaciated with age and sickness, he died, deservedly lamented, on the 23d of July 1773.

Edwards, Bryan.

Edwards, *Bryan*, the well-known historian of the *West Indies*, was born at Westbury, in Wiltshire, on the 21st of May 1743. His father had a small paternal estate;

but as this did not exceed L.100 per annum, he found it insufficient for the maintenance of a numerous family, and endeavoured to improve his circumstances by dealing in corn and malt. This hazardous trade proved, as it often does, only a means of more deeply involving his affairs; and he died in 1756, leaving a widow and six children in a very distressed situation. Mrs Edwards, however, had two opulent brothers in the West Indies, the eldest of whom, Zachary Bayly, possessing a princely fortune, and being of a very amiable and generous disposition, undertook the support and education of young Edwards. He had already been placed by his father at the school of Mr Foot, a dissenting clergyman at Bristol, where he had been taught the elementary branches of education; but, for some reason which he never was able to divine, that person was strictly prohibited from initiating him in any branches of classical learning. He gave a species of instruction, however, not usual in schools, and from which his pupil probably derived the greatest benefit. He was accustomed to make the boys write letters, or rather essays, on various subjects, such as the beauty and dignity of truth, the obligations to a religious life, the benefits of good education, and the like, giving them, where it appeared necessary, an outline of the arguments which might be employed on the subject. When the papers were given in, he made such observations as appeared proper, insisting at least that they should be correct in point of grammar and orthography. These exercises gave occasion to display the superior talents of Edwards, whose powers of elegant composition already began to appear. He soon became the favourite of his master, who liberally praised these youthful performances, and often transmitted them for the gratification of his parents. They were entirely satisfied; but when the care of his education devolved on his uncle, the agent employed by him at Bristol was much surprised to find an entire deficiency in classical knowledge, and, imputing the blame to the master, removed him immediately to a French boarding school in the same city. It is not said that he acquired here any great portion of Greek and Latin, but he became master of the French language, and having access to an extensive circulating library, cultivated a taste for reading which adhered to him throughout the whole of his future life.

In 1759, another uncle, the younger brother of him under whose care he had hitherto been, arrived in England. He, too, was possessed of an ample fortune, became member of parliament, first for Abingdon, and afterwards for his native town, and set up a splendid establishment in London. He appeared quite disposed to befriend young Edwards, and even took the latter to reside with him; but the nephew observes, that, after enumerating his external advantages, he had nothing else to say in favour of his uncle. What the bad qualities were which drew forth so unfavourable a sentence we are not informed; but in a few months they separated, and Edwards went out to his other uncle. In this friend he seems to have found every thing he could desire; the most enlightened mind, the sweetest temper, and the most generous disposition. To this was added a truly paternal regard for himself, which was returned with all the warmth of filial affection. His uncle, finding him possessed of literary talents, but deficient in classical acquirements, engaged a Mr Teale, a clergyman, and formerly master of a free grammar-school, to reside in his house, and give him the instruction of which he stood in need. This choice proved most acceptable to Edwards; he found in Mr Teale a man of extensive information, and one, too, possessing considerable taste in poetry. He viewed him, therefore, as a companion rather than as a teacher; but this relation between the tutor and pupil, however agreeable to both, was not favourable for instilling the dry principles of grammar and prosody. A much larger proportion of their time was spent in tasting the beauties of Dryden and Pope, and in laughing at the comic sallies of Molière. Mr Edwards, upon the whole, acquired, during this period, small Latin and less Greek; but he continued to practise composition, both in prose and verse; and the two companions sent occasional pieces to the colonial newspapers.

The time was now coming when Mr Edwards' talents were to be exercised in a wider sphere. His uncle dying, bequeathed to him his property; and in 1773 he became heir to the much larger estate of Mr Hume, also of Jamaica. His wealth and talents united, now entitled him to take a lead in the political concerns of the island. In 1784 he published *Thoughts on the Proceedings of Government respecting the Trade of the West India Islands with the United States of America.* This was followed by a speech delivered at a free conference between the Council and Assembly at Jamaica, held on the 25th of November 1789, on the subject of Mr Wilberforce's propositions in the House of Commons concerning the slave trade. It was in 1793, however, that he published his great work, on which he had been many years engaged, entitled *History, Civil and Commercial, of the British Colonies in the West Indies*, 2 vols. 4to. He begins the work by giving a view of the original inhabitants of the West Indies, their manners, institutions, and the means by which they have been so entirely exterminated. This was followed by a sketch of the revolutions through which these islands have passed since the first European invasion. He gives next a geographical and statistical description of each particular island. He treats finally, at great length, of the government, the social state, and above all the commerce, of this remarkable region. In the course of the discussion, he enters fully into its relations with the African coast and the negro slave trade. Mr Edwards, as a great and long-resident proprietor, was almost inevitably led to be a supporter of this traffic. He reasons, however, in a liberal and candid manner on the question, and does not even attempt to deny the extent of the evils with which it was accompanied. He only insists that these evils have been overrated; and that Great Britain, by renouncing it whilst it was still prosecuted by the other nations of Europe, would ruin her own colonies, without doing any thing to improve the condition of the Africans. In 1796 he published, in one volume quarto, a *History of St Domingo*, an island which had excited a deep interest, in consequence of the insurrection of the slaves, and the consequent establishment of an independent negro government. In 1801 a new edition of both these works was published, in three vols. 8vo, under the general title of *History of the West Indies.* A fifth edition issued from the press in the year 1819. When Park returned from his celebrated journey, Mr Edwards, from his oral information, drew up a report of it, which was submitted to the African Society, and published in their *Transactions.* Mr Park afterwards incorporated the greater part of this into the general narrative of his *Travels*, in preparing which he availed himself much of the assistance and suggestions of Mr Edwards. It has been currently said that this narrative was entirely written by Mr Edwards; but as this assertion has been pointedly contradicted by Park, who has elsewhere shown respectable talents for composition, it can only be understood in the limited sense which has now been stated. It appears, however, that Mr Park was induced, by Mr Edwards' influence, to give rather a more favourable view of the trade in slaves than reflection afterwards led him to sanction.

Mr Edwards, after his removal to England, took up his residence at Polygon, near Southampton; and in 1796 he became member of parliament for the borough of Grampound, which he continued to represent till his death, which took place on the 15th of July 1800. He left a short narrative of his life, which was prefixed to the edition of his history published in 1801. (E.)

Edwards, *Jonathan*, a celebrated American metaphysician and divine, was born on the 5th of October 1703, at Windsor, in the province of Connecticut. His family had originally emigrated from England in the reign of Queen Elizabeth. His father, Mr Timothy Edwards, was a clergyman of great piety and respectability, and by his mother he was grandson of Mr Solomon Stoddard, a noted and zealous divine of Northampton. Jonathan was accordingly reared in the bosom of Puritanism, and all his ideas were early imbued with the cast of thought which was native to the stock from which he had sprung. There was something indeed not a little singular in the prevailing character of religion in America in those days. A conversion seems to have been a regular era in a man's life, which could be fixed down to a date, as much as his coming of age or his being married. A very curious document remains of Jonathan's conversion, the whole steps and progress of which he has detailed for the behoof of his children; and it is a document which, even amidst all its frequent weakness and extravagance, impresses us with a high sense of the genius and of the worth of this remarkable man. We cannot avoid giving our readers a little insight into it, especially as it contains some passages of deep feeling and sensibility, which form a striking contrast to the controversial hardness of his other writings. It is full of bursts of tenderness; and even whilst the subjects of his earliest meditations were the same dark doctrines, in their most tremendous form, which he afterwards defended so ably by the help of his mature reason, amidst all the gloom which naturally surrounds them, they seem to have left upon his mind no sentiments but those of gentleness and charity. At the same time, this document affords us a distinct proof that such doctrines take their origin, in a great measure, in peculiar circumstances of society, or of the individual mind; and since they were quite as fully impressed upon Edwards before he was capable of any profound reasoning concerning them, as afterwards, the presumption is, that his early prepossessions came strongly in aid of his later conclusions.

It was in the midst of these youthful musings that he acquired a full and firm persuasion of tenets which we will own scarcely seem to us to be either so lovely, or of so good report, as the more natural sentiments of his unconverted state, which he gave up in exchange for them. "I had a variety," says he "of concerns and exercises about my soul from my childhood; but had two more remarkable seasons of awakening before I met with that change by which I was brought to those new dispositions, and that new sense of things, that I have since had. The first time was when I was a boy, some years before I went to college, at a time of remarkable awakening in my father's congregation. I was then very much affected for many months, and concerned about the things of religion." This state of mind, however, appears to have passed off; but, in his last year at college, he was visited by a severe sickness, which made him form many wise and holy resolutions, which he was afterwards for the most part enabled to keep. So far it was well; but now follows the grand proof of his conversion. "From my childhood up," he says, "my mind had been wont to be full of objections against the doctrine of God's sovereignty in choosing whom he would to eternal life, and rejecting whom he pleased, leaving them eternally to perish, and be everlastingly tormented in hell. It used to appear like a horrible doctrine to me. But I remember very well when I seemed to be convinced and fully satisfied as to this sovereignty of God, and his justice in thus eternally disposing of men according to his sovereign pleasure. But I never could give an account how or by what means I was thus convinced, not in the least imagining in the time of it, nor a long time after, that there was any extraordinary influence of God's Spirit in it, but only that now I saw farther, and my reason apprehended the justice and reasonableness of it. However, my mind rested in it, and it put an end to all those cavils and objections that had till then abode with me all the preceding part of my life. And there has been a wonderful alteration in my mind with respect to God's sovereignty from that day to this, so that I scarce ever have found so much as the rising of an objection against God's sovereignty in the most absolute sense, in showing mercy to whom he will show mercy, and hardening and eternally damning whom he will. God's absolute sovereignty and justice, with respect to salvation and damnation, is what my mind seems to rest assured of as much as of any thing that I see with my eyes." This doctrine continued throughout Mr Edwards' life in peculiar favour with him; and he employs the whole resources of his dialectics to support it, with a full conviction that he was thereby glorifying God, and performing an important service to mankind.

In this document of Mr Edwards' early opinions, we have said that, amidst all the horrors of his creed, there are many intimations of the natural fineness and sensibility of his spirit. The following passages are remarkably beautiful, and have about them a tone of pastoral or rather scriptural poetry. "Not long after I first began to experience these things, I gave an account to my father of some things that had passed in my mind. I was pretty much affected by the discourse we had together; and when the discourse was ended, I walked abroad alone in a solitary place in my father's pasture for contemplation. And as I was walking there, and looked up on the sky and clouds, there came into my mind so sweet a sense of the glorious majesty and grace of God that I know not how to express it....God's excellency, his wisdom, his purity and love, seemed to appear in every thing; in the sun, moon, and stars; in the clouds and blue sky; in the grass, flowers, trees; in the water and all nature, which used greatly to fix my mind. I often used to sit and view the moon for a long time, and so in the day time spent much time in viewing the clouds and sky, to behold the sweet glory of God in these things; in the mean time singing forth with a loud voice my contemplations of the Creator and Redeemer...I used to be a person uncommonly terrified with thunder; and it used to strike me with terror when I saw a thunder-storm rising; but now, on the contrary, it rejoiced me. I felt God at the first appearance of a thunder-storm, and used to take an opportunity at such times to fix myself to view the clouds, and see the lightnings play, and hear the majestic and awful voice of God's thunder." These confessions have let us already into the inside of Edwards' mind, and there is no need to return upon them whilst we pursue the account of his studies, life, and writings. There is a poetry and grandeur in some of his passages of this sort which show a moral sublimity of genius in the midst of enthusiastic reveries, often, in inferior minds, more productive of dark and disorderly sentiments than of sound and elevated piety. When he comes, however, to reason on his theological or philosophical tenets, he is no longer either an enthusiast or a poet; for he then proceeds with all the pertinacity and ingenuity of a hard-headed dialectician, determined neither to tolerate nor employ any weapon but stern argument.

He went young to Yale College, and as early as his thirteenth year had read Locke *On the Human Under-*

standing with great delight and profit. He had a great taste for natural philosophy, but the moral and divine sciences were his chief object; and after a long residence at college, during which time he prepared himself assiduously for the ministry, he was in due form licensed to preach. In August 1722 he was invited to preach to the English Presbyterians at New York, where he continued with approbation above eight months; but as this society was too small to maintain a preacher, he returned in the year 1723 to his father's house at Connecticut, where, for some time, he applied to his studies with much industry and perseverance; and this severe application became habitual to him, although he was of a delicate constitution. In the spring of 1724, having taken his master's degree, he was appointed tutor of Yale College, being then in his twenty-first year; an office which, notwithstanding his youth, he filled for two years with great success and reputation. In September 1726 he received an invitation from the people of Northampton in Connecticut, to become assistant to his mother's father, Mr Stoddard, to whom he was ordained colleague in his twenty-fourth year, and continued as pastor of this congregation till the year 1750. During this time he married, had many children, and wrote several pious and useful treatises, chiefly suggested by the events of the times, such as his *Faithful Narrative of the Surprising Work of God, in the Conversion of many Hundred Souls in Northampton* (for these, as his biographer[1] tells us, were remarkable times for the out-pouring of God's Spirit); but particularly a sensible and useful treatise on *Religious Affections*, in which he endeavoured to restrain the extravagance and fanaticism into which, under these strong impressions, the religion of his flock was but too apt to degenerate. He was a most faithful and conscientious minister, but at last fell under the displeasure of his people, from no other cause except his anxiety for their spiritual interests. They appear, indeed, to have been a very stiff-necked generation, full of absurd whimsical vagaries on the subject of religion, but at the same time evincing little of its spirit in their lives and conversations. They had all a voice in the election and continuance of their clergyman, and they were very ready to seize any opportunity to show their power. Mr Edwards discovered that some licentious books had got among the youth of his congregation, a fact as to which he wished some investigation to take place; and this was the first point upon which his people flew off from him. There arose afterwards another point about the administration of the holy communion. His grandfather Mr Stoddard had, it seems, a notion that the administration of the sacrament was a moment which the Divine Spirit was much disposed to seize for the conversion of sinners; and that, therefore, the most notorious sinners were almost without scruple to be admitted to that holy ordinance, in the hope that this conversion would fall upon them. The result of this precious notion was, that the utmost licentiousness, mingled as it was with wild religious fancies floating in every brain, began to prevail amongst the people. When Mr Edwards, on his grandfather's death, obtained the entire charge, he endeavoured to make a change in this particular; but the outcry against him was loud and overbearing. Even his brethren of the clergy tamely gave way to a clamour which they condemned; and this excellent, able, and pious clergyman was thus driven away by the misguided flock, for whom he had laboured assiduously during twenty-four years; and at an advanced period of life, with a wife and a large family, he was thrown upon the world and the care of providence.

His next position was at Stockbridge, in the western part of Massachusetts Bay, where he was put at the head of a mission for converting the Indians. He was not enabled to do much as a missionary; but here he had a great deal of leisure, which he employed in writing his principal works. It was now he completed his chief treatise on the subject of free will; a work concerning the rapid execution of which we have the following information in Sir Henry Moncreiff Wellwood's able and interesting *Life of Dr Erskine*. "It was not till the month of July 1752, that he appears to have resumed his studies on the subject of free will; for on the 7th of that month he writes Dr Erskine, that 'he hoped soon to be at leisure to resume his design;' and gives him another sketch of the plan of his book, in which, though there be nothing new, there is more detail than in that which he had formerly sent him. Whatever opinion," continues this able writer, "may be held with regard to Mr Edwards' argument, it must appear astonishing to those who are capable of appreciating the difficulty of his subject, that, in nine months from the date of this letter, on the 14th of April 1753, he could write Dr Erskine, that he had almost finished the first draught of what he originally intended; though he was under the necessity of delaying the publication till he knew the result of proposals which he had circulated for printing his book by subscription. His book was published in 1754, and, though he had made some progress in preparing his materials before he left Northampton, was certainly written, and nearly completed, within the time ascertained by the two letters referred to, and must be admitted to convey a very striking idea, both of his mental resources and of his literary ardour."

In 1757, on the death of Mr Aaron Burr, Mr Edwards was chosen president of New Jersey College. He had only been here, however, a very short time, when he was carried off on the 22d of March 1758, in the fifty-fifth year of his age, by the small-pox. This disease was at that time raging in the neighbourhood. Mr Edwards, who had never had it, proposed to be inoculated, which his physicians approved of. He had the disease favourably, but a secondary fever set in, and by reason of a number of pustules in his throat, the obstruction became such that he could not swallow the necessary medicines, and the fatal result was what we have stated. The character of Mr Edwards is that of a very primitive, self-mortified, simple, and amiable man, and affords a strong proof of the power of genuine Christian piety upon the heart, in spite of the most gloomy and repulsive tenets. He was solely occupied with his professional duties and his theological studies, insomuch that, as is mentioned with inimitable simplicity by the author of his life, "he was less acquainted with most of his temporal affairs than many of his neighbours, and seldom knew when and by whom his forage for winter was gathered in, or how many milk-kine he had; whence his table was furnished," or by what means his wants were provided for. Mrs Edwards, however, a most valuable and sensible woman, fully supplied his defects in these particulars. We must quote another passage from this piece of biography, which is equal in simplicity, though by no means in any thing else, to some of the exquisite biographies of Isaac Walton. After being informed that he did not permit dancing, against which

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[1] This primitive piece of biography, from which all our quotations are taken, is prefixed to a volume of sermons published after Mr Edwards' death. Its author is not mentioned. The edition from which we quote is printed at Edinburgh, by Alexander Jardine, 1799.

amusement, indeed, he wrote a sermon, we are told that "he allowed not his children to be from home after nine o'clock at night, when they went abroad to see their friends and companions; neither were they allowed to sit up much after that time, in his own house, when any came to make them a visit. If any gentleman desired acquainttance with his daughters, after handsomely introducing himself, by properly consulting the parents, he was allowed all proper opportunity for it, and a room and fire, if needed; but must not intrude on the proper hours of rest and sleep, nor the religion and order of the family."

Mr Edwards comes nearer Bishop Butler as a philosophical divine than any other theologian with whom we are acquainted. His style, like Butler's, is very much that of a man thinking aloud. In both these authors the train of thinking in their own minds is more clearly exhibited to us than perhaps by any other writer, whilst they show us with great truth and distinctness what their notions are, and how they came by them, with very little concern about the form of expression in which they are brought out. Butler, however, had a larger mind than Edwards, and was by no means so much of a mere dialectician. If, therefore, he be less acute than the American, he is more comprehensive, and gives fairer play to every opposing argument. We do not mean here to enter into any of Edwards' speculations. Both on the subject of original sin, and on the freedom of the will, he seems to us to unite a great deal too closely the views which originated, as we have seen, in no small degree, amidst his early reveries, with the infallible discoveries of divine revelation. Our notion is, that in all discussions on such subjects which have hitherto appeared, the speculatists have forgotten how little a part either of the history or the nature of man we are in fact acquainted with; and how ready we ever are, in laying the foundations of our theories, to place a tortoise beneath the elephant. The whole difficulty, for instance, on the freedom of the will, turns upon a puzzle in the idea of cause and effect. Perhaps this idea is far from being precise in our minds (Mr Edwards uses it very loosely in his speculations); yet we do not scruple, in our reasonings upon it, to draw the most positive inferences from the assumptions with which we set out. We suspect, indeed, that the true and accurate notion of causation always involves the idea of volition; and, on that supposition, to ask for the cause of volition itself is absurd. It may be very true that we cannot will to do any thing without previous thought or motive; neither can we think without previous existence. But is our existence the cause of our thinking? Just as much as our thinking is the cause of our willing. We are far, however, from wishing to add our own crude conceptions to those which have been piled up on this subject from the beginning of time to the present hour, without, we believe, doing the slightest service to the cause of moral and religious truth, or accomplishing any thing, in short, beyond affording an exercise for ingenuity, and too often a handle for uncharitable rancour and presumptuous absurdity. Mr Edwards, with all his great powers, has accordingly, we apprehend, done but little good to the world, we mean as a philosopher; for he did much good in his own day, whilst he was living the life of a zealous and faithful Christian minister. But it is "thus we play the fools with the time; and the spirits of the wise sit in the clouds and mock us." Exalted above all the folly of human wisdom, the spirit of this truly good and pious man is now, it may be, disposed to regard with some such sentiment many of his own most severe and laborious speculations, which were carried on in the serious belief, that if "the knots of Calvinism were trimmed off, or its doctrines, in the whole length and breadth of them, were not rigidly maintained, a man could nowhere set his foot down with consistency and safety, short of Deism, or even Atheism itself, or rather universal Scepticism."

Edwards' works consist of several volumes of sermons, printed at various times, and often reprinted in this country as well as in America. Besides these, he wrote, 1. *A Treatise concerning Religious Affections*, 1746, 8vo; 2. *An Account of the Life of the Reverend David Brainerd*, 1749, 8vo; 3. *An Inquiry into the Qualifications for full Communion in the Visible Church*, 1749, intended as a vindication of his principles in the matter which occasioned his dismission from Northampton; 4. *A careful and strict Inquiry into the Modern Notion of that Freedom of Will which is supposed to be essential to Moral Agency*, 1754; 5. *The Great Christian Doctrine of Original Sin defended, containing a Reply to the Objections of Dr John Taylor*, 1758; 6. *A History of Redemption*; 7. *Miscellaneous Observations on Important Theological Subjects*, London, 1793; 8. *Remarks on Important Theological Controversies*, ibid. 1796. Some of these were posthumous, as were a few other tracts of less importance written by him. (L. L. L.)

EEKEREN, a town of the Netherlands, in the province of Antwerp, about four miles from that city. It has some distilleries and tanneries, and 4740 inhabitants.

EECHAAK, a town of Hindustan, in the province of Bahar, 103 miles south-south-east from Patna. Long. 85. 46. E. Lat. 24. 10. N.

EEL. See Ichthyology.

EETCOORE, a town of Hindustan, in the province of Bahar, and district of Ramgur, 92 miles south from Patna. Long. 85. 17. E. Lat. 24. 18. N.

EFBE, an island in the Eastern Seas, about five or six miles in length, near the south coast of Mysol, with which it forms a harbour. Captain Forrest found two villages on the island, where vessels may procure supplies. Long. 127. E. Lat. 2. 12. S.

EFFEMINATE, womanish, unmanly, voluptuous.

Effeminate (*effeminati*), according to the vulgate, are mentioned in several places of Scripture. The word is there used to signify such as were consecrated to some profane god, and prostituted themselves in honour of him. The Hebrew word *hadesh*, translated *effeminatus*, properly signifies *consecrated;* and hence it was applied to those of either sex, who publicly prostituted themselves in honour of Baal and Astarte. Moses expressly forbids these irregularities among the Israelites; but the history of the Jews shows that they were notwithstanding frequently practised.

EFFENDI, in the Turkish language, signifies *master*, and accordingly is a title very extensively applied, as to the mufti and emirs, to the priests of mosques, to men of learning, and of the law. The grand chancellor of the empire is called *reis effendi.*

EFFERVESCENCE, an intestine motion excited among the parts of two bodies of different natures, when they reciprocally dissolve each other. Effervescences are commonly attended with bubbles, vapours, small jets of the liquid, and a hissing noise; which phenomena again are occasioned by the air disengaging itself. Sometimes also they are accompanied with a great degree of heat, from the decomposition of some substances and the formation of new compounds.

Formerly the word *fermentation* was also applied to effervescences; but now that word is confined to the motion naturally excited in animal and vegetable matters, and from which new combinations among their principles take place.

EFFIGY, the portrait, figure, or exact representation of a person.

Effigy, is also used for the print or impression of a coin, representing the prince's head who struck it.

Effigy, to execute or degrade in, denotes the execution or degradation of a condemned contumacious criminal, who cannot be personally seized.

EFFLORESCENCE, in *Chemistry*, denotes the formation of a kind of mealy powder on the surface of certain bodies. Efflorescence is occasioned either by decomposition or by drying. The efflorescence which happens to cobalt and martial pyrites is of the former; and that observed on the crystals of soda, Glauber's salt, and the like, of the latter kind. An efflorescence is sometimes also a species of crystallization, such as the beautiful vegetations which shoot up from different saline substances. See Crystallization.

EFFLORESCENTIA, in *Botany* (from *effloresco*, to bloom), the precise time of the year and month in which every plant shows its first flowers. Some plants flower twice a year, as is common between the tropics; others oftener, as the monthly rose. The former are called by botanists *biferæ*, the latter *multiferæ*.

EFFLUVIUM, in *Physiology*, a term much used by philosophers and physicians to express the minute particles which exhale from most, if not all, terrestrial bodies, in form of sensible vapours.

EFFRONTES, in *Ecclesiastical History*, a sect of heretics, in 1534, who scraped the forehead with a knife till it bled, and then poured oil into the wound. This ceremony served them instead of baptism. They are likewise said to have denied the divinity of the Holy Spirit.

EFFUSION, the pouring out of any liquid. In the ancient heathen sacrifices there were divers effusions of wine and other liquors, called *libations*.

Effusion, or Fusion, in *Astronomy*, denotes that part of the sign Aquarius represented on celestial globes and planispheres by the water issuing out of the urn of the water-bearer.

EGENOTISO, an island in the Eastern Seas, about twenty miles in circumference, and fifty miles from the north-east coast of Sumatra. Long. 104. 45. E. Lat. 0. 27. S.

EGER, a circle of the Austrian kingdom of Bohemia, extending over 110 square miles, and containing 22,500 inhabitants. The chief place is the city of the same name. It contains 776 houses, and 8111 inhabitants, who are employed in various manufactures. It is celebrated as the place where Wallenstein was put to death, and also for its mineral water, which is extensively dispensed in Germany. Long. 12. 18. E. Lat. 50. 5. N.

EGERIA, a nymph who assisted Numa in framing a code of laws for the people of Rome. The king and the nymph used to meet at night in a wood at the gates of Rome, then called Lucus Camœnarum, which is now, according to popular opinion, *La Caffarella*. When Numa died, Egeria was so violently affected with grief, that she frequently interrupted by her weeping the sacrifice of Diana, till the goddess in pity changed her into a fountain of the same name. (Ovid. *Met.* xv. 547; Liv. i. 19; Juv. v. 10.)

EGG, in *Physiology*, a body formed in certain females, in which is contained an embryo or fœtus of the same species, under a cortical surface or shell. The exterior part of an egg is a shell, which in a hen, for instance, is a white, thin, and friable cortex, including all the other parts. The shell becomes more brittle by being exposed to a dry heat. It is lined everywhere with a very thin but pretty tough membrane, which dividing at or very near the obtuse end of the egg, forms a small bag, where only air is contained. In new-laid eggs this follicle appears very little, but becomes larger when the egg is kept. Within this are contained the albumen or white, and the vitellus or yolk; each of which has its different virtues. The albumen is a cold, viscous, white liquor in the egg, different in consistence in its different parts. It is observed, that there are two distinct albumens, each of which is inclosed in its proper membrane. Of these, one is very thin and liquid, the other is more dense and viscous, and of a somewhat whiter colour, but, in old and stale eggs, after some days incubation, inclining to a yellow. As this second albumen covers the yolk on all sides, so it is itself surrounded by the other external liquid. The albumen of a fecundated egg is as sweet and free from corruption during the whole time of incubation as it is in new laid eggs; and so is also the vitellus. As the eggs of hens consist of two liquors separated one from another, and distinguished by two branches of umbilical veins, one of which goes to the vitellus, and the other to the albumen; so it is very probable that they are of different natures, and consequently appointed for different purposes. When the vitellus grows warm with incubation, it becomes more humid, resembling melting wax or fat; and hence it occupies more space. For as the fœtus increases, the albumen insensibly wastes away and condenses; the vitellus, on the contrary, seems to lose little or nothing of its bulk when the fœtus is perfected, and only appears more liquid and humid when the abdomen of the fœtus begins to be formed. The chick in the egg is first nourished by the albumen, and, when this is consumed, by the vitellus, as with milk. If we compare the *chalazæ* to the extremities of an axis passing through the vitellus, which is of a spherical form, this sphere will be composed of two unequal portions, its axis not passing through its centre; consequently, since it is heavier than the white, its smaller portion must always be uppermost in all positions of the egg. The yellowish white round spot, called *cicatricula*, is placed on the middle of the smaller portion of the yolk; and therefore, from what has been said above, must always appear on the superior part of the vitellus. Not long before the exclusion of the chick, the whole yolk is taken into its abdomen; and the shell, at the obtuse end of the egg, frequently appears cracked some time before the exclusion of the chick. The chick is sometimes observed to perforate the shell with its beak. After exclusion, the yolk is gradually wasted, being conveyed into the small guts by a small duct.

Eggs differ very much, according to the birds which lay them, as to their colour, form, size, age, and the different ways of dressing them: those most used in food are hens' eggs. As to the preservation of eggs, it is observed that the egg is always quite full when it is first laid by the hen; but from that time it gradually becomes less and less so, till its decay; and however compact and close its shell may appear, it is nevertheless perforated with a multitude of small holes, though too minute for the discernment of our eyes, the effect of which is a daily decrease of matter within the egg, from the time of its being laid. This perspiration is much quicker in hot weather than in cold. To preserve the egg fresh, there needs no more than to preserve it full, and stop its transpiration; the method of doing which is, by stopping up those pores with matter which is not soluble in watery fluids; and on this principle it is that all kinds of varnish, prepared with spirit of wine, will preserve eggs fresh for a long time, if it be carefully rubbed all over the shell. Tallow, or mutton fat, is also good for this purpose.

Artificial Method of Hatching Eggs. See Hatching.

EGGENFELDEN, a bailiwick of the circle of the Lower Danube, in the kingdom of Bavaria, extending over 220 square miles. It contains five market-towns, 133 villages, and 867 hamlets, with 22,566 inhabitants. The capital is the town of the same name. It is situated on the river Roth, and contains 226 houses, with 1340 inhabitants.

EGHAM, a village of the hundred of Godley and Chertsey, in the county of Surrey, 18 miles from London. It is situated on the banks of the Thames, which is the boundary towards Middlesex, and over which is a bridge connecting it with Staines. The great western road passing through it gives some animation. The country around it is pleasant. The population amounted in 1801 to 2190, in 1811 to 2823, in 1821 to 3616, and in 1831 to 4203.

EGINHARD, or EGINHART, a celebrated historian of the ninth century, was a native of one of the eastern provinces of France. His family is not known, and those who have pretended that he was of noble descent have given no other proof of their assertion than the reception which he met with at the court of Charlemagne. He was instructed in letters by Alcuin, who foresaw the success of his pupil, and recommended him to the favour of the emperor. Being afterwards admitted to receive lessons along with the young princes, he justified the opinions which had been formed of his merits by the progress which he made in his studies; and Charlemagne, wishing to attach to his person a young man of so much promise, appointed the latter his secretary. Eginhard is said to have formed a strong attachment for Emma or Imma, one of the daughters of Charlemagne, whom, with the consent of the emperor, he is stated to have espoused; but, however this may be, it is certain that he married a lady of rank belonging to the court of Charlemagne. The expressions in the ancient manuscripts, though somewhat vague, leave no doubt as to this circumstance. After the death of Charlemagne, Eginhard passed into the service of Louis le Debonnair, who confided to him the education of his son Lothaire. But use and experience having inspired him with a disgust for the court, he obtained permission to quit it; and accordingly having resigned his employments, he withdrew to the monastery of Fontenelle, whilst his wife Emma, and his son Vussin, also embraced the monastic life. Having governed this monastery during seven years, he, in 823, resigned the administration to his friend Ansegise, and then retired first to the abbey of St Pierre, and afterwards to that of St Bavon de Gaud. He afterwards left his retreat, however, and returned to the court, where he is stated by some to have taken part in the troubles of which Louis le Debonnair became the victim. But this is contradicted by his letters, which prove that he neglected no means to prevent the execution of the plot entered into against this unfortunate prince by his own children. Eginhard is supposed to have died about the year 839. He left several works, of which the following are the most important: 1. *Vita et Gesta Caroli Magni*, Cologne, 1521, in 4to, rare; 2. *Annales Regum Francorum Pipini, Caroli Magni, Ludovici Pii, ab anno Christi* 741 *ad annum* 829, contained in the collection of Pierre Pithou, Paris, 1588, and Francfort, 1613; 3. *Eginhardi Epistolæ*, contained in the collection of Duchêne, tom. ii. in the *Eginhardus Vindicatus* of John Weinekens, and also in the collection of Dom Bouquet; 4. *De Translatione SS. Martyrum Marcellini et Petri*; 5. *Breviarium Chronologicum ab orbe condito ad Ann. Chr.* 809, which is merely an abridgment of the Chronicle of Bede.

EGMONT ISLAND, or NEW GUERNSEY, the principal island in the group called Queen Charlotte's Islands, in the South Pacific Ocean. It is about 54 miles in length, and from 20 to 32 in breadth. The country in general is mountainous, covered with woods, and intersected with numerous valleys and small rivers. The inhabitants are brave, vigorous, and active, but treacherous and dishonest. Long. 166. E. Lat. 11. S.

EGMONT ISLAND, a small woody island in the South Pacific Ocean, six miles in length by about four in breadth. Long. 138. 30. W. Lat. 19. 20. N.

EGNATIA, or GNATIA, a city of Peucetia, a province of Apulia, situated on the coast, the inhabitants of which are ridiculed by Horace for exciting the wonder of the ignorant multitude by burning incense on an altar without the process of ignition. Pliny, with the utmost gravity, makes the prodigy still more surprising, by stating that this sacred stone possessed the power of setting fire to any species of wood by mere juxtaposition (ii. 107). Attempts of this kind to impose on the credulity of a superstitious people were by no means uncommon amongst the ancients; and this trick, with some slight variations, was practised by the priests in very different parts of the world. Aristotle mentions a stone in Thrace from which, on being moistened with water, flames issued forth; and, according to Pliny, the same thing occurred in the country of the primitive Sabines. In Lydia, Pausanias was witness to a miracle of a somewhat similar nature. There was a small chapel set apart for this particular purpose; on entering he found the altar covered with ashes of a peculiar colour, and one of the magi having made his appearance, placed dry wood upon it, and his tiara on his head. He then repeated a few prayers, when a beautiful and brilliant flame issued from the altar without the application of fire. This city gave name to the Via Egnatia, which passed from Brundusium through Egnatia to Canusium. Its ruins are found at the *Torre d'Agnazzo*, where the inhabitants still pretend to show the temple alluded to by Horace.

EGREMONT, a market-town of the ward of Allerdale, in Cumberland, about five miles from the sea, and 290 from London. It formerly returned members to Parliament; and the family of Wyndham derive from a castle near it, now dilapidated, the title of earl. The market is held on Saturday. The population amounted in 1801 to 1515, in 1811 to 1741, and in 1831 to 1741.

EGYPT.

Egypt, a country not less remarkable for its physical character than its historical records, and forming as it were the connecting link between Africa and the civilized world, consists, first, of a long and narrow valley, which follows the course of the Nile from Assouan to Cairo; and secondly, of the extensive plain which is situated between the northern extremity of this valley and the Mediterranean Sea. Including the valley and the plain, it extends from the parallel of 24° N. where the river appears to force a passage for itself through the mountains of Nubia, to the vicinity of Damietta, in 31° 35′ N. where the principal stream discharges itself into the ocean. The natural boundaries of Egypt are so distinctly marked, that its nominal or territorial extent has seldom much exceeded the area which is included within its physical limits. Immediately above the cataracts of Syene, or Assouan, there is a small island, called Philæ by the Greeks, and Bilak by the Arabs,[1] which from the earliest times constituted the southern limit or extremity of Egypt. From Syene to Cairo, the river flows along a narrow valley, included between two mountain ridges, which an Arabian author calls "the wings of the Nile," one of them extending to the Red Sea, and the other terminating in the deserts of ancient Libya. The river occupies the middle of the valley as far as the strait called Djibbel-Silsili, which is about forty miles long; but at the mouth of this strait it runs along the right side of the valley, which is bounded by a steep line of rocks, cut as it were into peaks, whilst the ridge of hills on the left side is less precipitous, and generally presents an accessible slope, varying in acclivity. The mountains which confine the basin of the Nile in Upper Egypt are intersected by defiles, which on one side lead to the shores of the Red Sea, and on the other to the Oases.[2] Near Benisouef, the valley of the Nile, already much widened on the west, presents on that side an opening, through which are observed the fertile plains of Fayoum, forming a sort of table-land, separated from the surrounding mountains on the north and west by a wide valley, of which a portion, always laid under water, constitutes what the inhabitants call Birket-el-Kâroon. From the southern extremity of the Delta, near Cairo, the mountains recede eastward and westward; one called Djibbel-el-Nairon, stretching north-west towards the Mediterranean, the other named Djibbel-el-Attaka, running straight east to Suez, and both forming an angle of divergence of about 140°. At Battu-el-Bahara the river divides into two large branches, one of which flowing to Rosetta, and the other to Damietta, contain between them the triangular piece of insulated land called from its shape the Delta, Δ. The whole length of this tract, from Philæ in 24° 3′ 45″ N. to the northernmost point of the Delta, amounts to about four hundred and fifty geographical miles; the mean width of the valley between Syene and Cairo is about nine miles; and the whole area, or superficial extent, from the shores of the Delta to the first cataract, falls little short of eleven thousand square miles.[3]

The country of which we have described the boundaries and configuration is one which, to the scholar, the antiquary, and the philosopher, has long appeared the most interesting on the face of the earth. If not the very first, it was at least amongst the earliest, seats of civilization, which, from causes altogether unknown, struck its roots deep into the alluvial mud of the Nile. Long before the nations of the West had emerged from their primeval forests, Egypt had reached its zenith, and exhibited, completely formed, that extraordinary state of society in respect of laws, government, religion, and manners, which has occupied without exhausting the curiosity of succeeding times. The land of the Pharaohs was at once the cradle of science, the birth-place of letters, and the parent source of art as well as superstition; and, at a period long anterior to the dawn of civil history in other countries, it was covered with those monuments which the fury of five successive conquests, and the ravages of near forty centuries, have failed to annihilate. To Egypt Greece was indebted for the letters, science, art, philosophy, laws, government, and superstition, which she afterwards extended, altered, modified, or improved; and hence the polished nations of modern Europe, whose civilization is principally a derivative of that of ancient Greece, may trace the rudiments of their science, literature, and arts, to the ingenious people who were the primary instructors of the Greeks, and who, from a period far beyond the records of history, had settled on the banks of the Nile. But out of the materials which have reached our times, and which, in their transit through so many ages, have suffered almost every species of injury and mutilation, it must obviously be a task of prodigious difficulty to construct a chain of narrative, which shall connect the present with the past, without omitting some essential links; and it is plainly impossible, from piecing together mere fragments of ruins, to establish an unbroken concatenation between that which is and that which has once been. Like the bridge in the vision of Mirza, which in its nearer portion appeared tolerably entire, but in its more remote consisted only of broken arches, which gradually disappeared in the impenetrable mist that overhung the vast ocean of time in which it was lost, the history of Egypt, though it enables us to advance a certain way with a considerable degree of security, becomes at length only a collection of dislocated fragments, and is finally lost in that abyss of the elder time, of which there exists neither record nor monument. Still the materials on which we have to work are more ample and various than might be suspected by a superficial or perfunctory inquirer. We have, first, those monumental remains which have outlasted the ravages of time, war, revolution, conquest, and fanatical barbarism; we have, next, the direct accounts or incidental notices and statements of the Greek, Roman, and Arabian writers; we have, thirdly, the lights which modern science has diffused respecting the monuments which ancient science had constructed, and the institutions which ancient policy had founded; and we have, lastly, the marked advantage derived from the partial success which has crowned the efforts of modern ingenuity in attempting to decipher those inscriptions and writings which have formed the mystery of ages. From all these sources, and aided by the learned labours of those distinguished archæologists who have devoted themselves

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[1] Both words, *Philæ* and *Bilak*, are corruptions of the Coptic word *Pi-lakh*, meaning extremity. Quatremère, *Mémoires Géographiques sur l'Egypte*, i. 388.

[2] Malte-Brun, *Universal Geography*, iv. 22, English Translation.

[3] Girard, *Mémoires sur l'Egypte*, iii. 4.

to illustrate the history, literature, and antiquities of ancient Egypt, we hope to derive sufficient materials to enable us to exhibit a clear and distinct digest of all that is at present known respecting the wonderful country, whose learning had become proverbial even in the days of Moses, and whose high civilization is attested by the colossal splendour of its monumental ruins. With this view we shall commence with its civil history.

SECTION I.

HISTORY OF ANCIENT EGYPT.

Origin and Etymology of the name.—High Antiquity of early Egyptian History.—Obscurity in which it is involved.—The only authority on which dependence can be placed.—Territorial Division of Egypt.—Whence and how peopled.—Ancient Inhabitants.—Copts.—Reign of the Priests.—Revolution.—Menes.—Age of this Monarch determined.—His Character and Actions.—Commencement of Legitimate History.—Fabulous extravagance of the Egyptian Chronology.—Dynasties from Menes to Mœris.—Invasion and Conquest of Egypt by the Shepherds.—Substance of Manetho's account.—Additional particulars of these Invaders.—Havoc committed by them.—Their ultimate expulsion and retreat into Syria.—Opinion of Bruce as to the origin of this people.—Other opinions.—Indian tradition respecting the Pali or Shepherds.—Palestine.—Expulsion of the Shepherds not to be confounded with the Exode of the Israelites.—Amenoph.—Thothmosis I.—Thothmosis II.—Mœris.—Thothmosis III.—Works executed by these Pharaohs, particularly Mœris.—Lake Mœris or Lake Fayoum.—Rhamses the Great, otherwise called Sesostris.—Era of this Conqueror.—His Education.—His Exploits.—His Indian Expedition.—Results.—Return of Sesostris.—Usurpation and treachery of his brother.—Expulsion of Armaïs, called also Danaus.—General State of Egypt at this period.—Monuments erected and Improvements executed.—Component parts of the Egyptian Empire.—Internal condition.—Division of the people into Castes.—Trade, Commerce, and Industry.—Successors of Sesostris.—Rhamses-Meiammon.—His Military Enterprises and Civil Labours.—State of Egypt under the succeeding Pharaohs.—Expeditions of Chechonk and Osorchon.—Ethiopian Invasion and Conquest of Egypt.—Sabacon.—Anysias.—Sethon.—Twelve contemporary Kings.—Psammeticus I.—His proceedings.—Attempt made by him to discover the Sources of the Nile.—Pharaoh-Necho or Nechus.—Circumnavigation of Africa.—War with Assyria.—Nechus defeated by Nebuchadnezzar, who became master of Egypt to the gates of Pelusium.—Psammeticus II. or Psammis.—Pharaoh-Hophra or Ouaphré, called also Apries.—His treachery towards the Jews.—Egyptians defeated by the Cyreneans.—Revolt.—Apries defeated by Amasis, and strangled by his own people.—Reign of Amasis.—Condition of Egypt.—Amasis succeeded by Psammenitus.—Persian Invasion under Cambyses.—Siege and capture of Pelusium.—Egyptians defeated in a general battle.—Capture of Memphis.—Barbarity of the Conquerors.—Fatal consequences of the invasion.—Depressed state of Egypt.—Insurrections.—Put down by the Persians.—Alexander the Great.—Greek Dynasty.—Ptolemy Lagus, called also Soter.—Events of his Reign.—His Character.—Ptolemy Philadelphus, surnamed Euergetes.—His Expeditions and Conquests.—Favour shown by him towards the Jews.—State of the Egyptian empire at this period.—Ptolemy Philopater.—Dissolute character of this Prince.—His Cruelty.—Conduct towards the Jews.—Minority.—Ptolemy Epiphanes.—Ptolemy Philometor.—Euergetes II. called also Physcon.—Disputed Succession.—Various fortune of the struggle.—Interference of the Romans in the Affairs of Egypt.—Death of Philometor.—Monstrous cruelty of Physcon.—His treatment of his wives; an Egyptian Henry VIII. in this respect.—Revolt.—Physcon restored.—His Death.—Ptolemy Lathyrus.—Cleopatra his mother.—Revolt quashed.—Capture and destruction of Thebes.—Alexander II.—His barbarous conduct.—Ptolemy Auletes.—Events of his Reign.—Policy of Rome respecting Egypt.—Pompey.—Julius Cæsar.—Mark Antony.—Conduct of Auletes.—His Death.—Cleopatra and her brother Ptolemy Dionysius.—Expulsion of the former.—Restored by Cæsar after Pharsalia.—Death of Cæsar.—The Triumvirate.—Defeat and Death of Antony.—Suicide of Cleopatra.—Egypt reduced into a province of the Roman Empire.—Hadrian.—Severus.—Claudius.—Aurelian.—Introduction of Christianity.—State of Egypt under Constantine.—Rise and Progress of Islamism.

The country latterly known by the name of Egypt was anciently denominated סצרים, *Mitzraim*, מצור, *Matzor*, and האריץכם, *haretz Cham*, the land of Cham. These names, especially the first, occur frequently in Scripture, and, according to the general opinion, the country was called *Mitzrim*, or *Mitzraim*, after the second son of Cham, though some have been inclined to think that the second son of Cham might have been called *Mitzrim*, after the country. The name of *Mitzrim*, pointed by the Masorites *Mitzraim* in the dual form, probably indicated the two divisions of Egypt into Upper and Lower. Bochart has clearly established that מצור, *Matzor*, signifies a fortress; and that Egypt was so called either from its being a region fortified by nature, or from the word *tzor*, which signifies *narrow*, and is sufficiently descriptive of the valley of Upper Egypt. The first of these etymologies, however, is to be preferred, because amongst the ancients Upper Egypt was considered as a natural fortification. With regard to *Mitzrim*, it is most probably a contracted mode of writing *Matzorim*, the plural of *Matzor*; and as it may be considered as perilous to give it a dual form on the authority of the Masorites, the word *Mitzrim*, with its plural termination, may therefore be held as denoting the Upper, the Middle, and Lower Egypt. Amongst the ancient inhabitants of the country, it was denominated *Chemi* or *Chame*, either from *Chmom*, signifying heat, or from *Chame* or *Kame*, signifying black, probably by reason of the burnt and black appearance of the soil. The etymology of the word *Egypt* has occupied the attention and puzzled the ingenuity of many learned writers. The most common opinion is, that Αἴγυπτος is composed of *αἶα* for *γαια*, *terra*, land, and Γυπτος, or rather Κοπτος, and consequently signifies the *land of Kopt*, or the *Koptic land*. But this etymology has been objected to; first, by reason of the alleged improbability that the whole country would be so named from an obscure town in the Thebais; and, secondly, because it was the river, and not the land on its banks, which was first called Ægyptus; objections which appear to be insuperable. The more probable opinion is that the word *Aiguptos* is a mere softening of *Gups-Pta*, or *Aigups-Ptas*, formed of *gups* or *aigups*, a vulture, and *Pta* or *Ptas*, dæmon; the vulture being one of the principal symbols of the *Ikh-Ptahor* or *Dæmon Ptah* of the ancient Egyptians. But be this as it may, there can be little doubt that, whatever be the true etymology of the word *Aiguptos* or *Ægyptus*, the name of Copts or Kobths is nothing else than a corruption of the Greek term; and that by the name of Kobthi were designated, first, the Egyptians in general, and afterwards the Christians of Egypt in particular. But the natives of Egypt were not known by the name of Copts until the time of Amru.[1]

The early history of Egypt claims a much higher antiquity than that of any other country, excepting perhaps China and Hindustan, and is consequently involved in darkness the more impenetrable. It is utterly impossible indeed to reconcile the accounts of different authors with each other, or with any common standard; and even the same authors are not always consistent with themselves. But some idea may be formed of the comparative value of the different catalogues of sovereigns, by observing which of them is confirmed by the testimony of the greatest number of respectable and unconnected writers, and by inquiring, at the same time, what internal evidence they afford of the truth or falsehood of their statements.

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[1] Drummond's *Origines*, or Remarks on the Origin of several Empires, States, and Cities, vol. ii. chap. 2.

The only authorities on which dependence can be placed respecting the early history of Egypt, are Herodotus, Manetho, Eratosthenes, Diodorus Siculus, and Strabo, all of whom had been for longer or shorter periods in the country. Herodotus lived soon after the conquest of Egypt by the great Persian conqueror Cambyses, when the names of the later monarchs could scarcely have been forgotten. The earlier part of his history is certainly of a very apocryphal character; but as he does not continue the series of the kings further than Sesostris and Mœris, almost all his names are therefore sufficiently recent to be considered as within the province of legitimate history. Manetho lived under Ptolemy Philadelphus, to whom he dedicated his three books of the *History of Egypt;* and there is little doubt that the extracts preserved by Josephus, Eusebius, and Syncellus, although some of these may have passed from one compiler to another, are in general perfectly authentic. How much of the work was originally fabulous, and how much has been distorted by transposition and anachronism, it is impossible accurately to determine. But besides the original inadmissibility of so long a series of successive generations, the invention of which may possibly be imputed to the same national vanity which led the priests to boast to Herodotus of three hundred and thirty kings between Menes and Sesostris, there are several coincidences pointed out by Marsham, in the names and qualifications of princes mentioned at very remote periods, which tend strongly to encourage the opinion that the originals were respectively one and the same person. There are also other instances which render it not improbable that several of the persons enumerated may have been contemporary sovereigns of different subdivisions of the country: but, perhaps, this portion of Marsham's theory has been carried a little too far; and, amidst so much confusion, it is not to be wondered that all his learning and ingenuity should have failed to establish any satisfactory result. He holds the catalogue of Eratosthenes in high and just estimation, although he was not acquainted with the very strong argument in favour of its authenticity, derived from the agreement of many of the etymologies with the acknowledged meaning of the terms in the Egyptian language; an agreement, indeed, which renders it more than probable that Eratosthenes, who lived in the reign of Ptolemy Euergetes, did actually receive these names from the priests of Diospolis. This interesting catalogue has been successively copied by Apollodorus, Africanus, Eusebius, and Syncellus; but how many of the names contained in it were really those of actual sovereigns of Egypt, and how many had been negligently or ignorantly read and pronounced, it is by no means easy to ascertain. It may be observed, that scarcely any of them are to be found in the works of other chronologers or historians. Diodorus is, upon the whole, a very candid and judicious writer; and although some modern critics have entertained considerable prejudices against him, it will be afterwards found that he had a correct knowledge of the Egyptian institutions. The accuracy and good sense of Strabo are so well known, that we cannot but regret the paucity of historical facts respecting Egypt to be found in his writings. Besides the works of these authors, there is an anonymous chronicle copied by Africanus, and from him by Syncellus, which affords a series of kings somewhat shorter than that of Manetho, and also more regularly filled; but it seems to be principally a compilation from Manetho, with some reference to the contemporary events of the scriptural chronology.[1]

Such being the principal sources of early Egyptian history, we shall now proceed to the more immediate object of this section, namely, to exhibit an outline of the civil history of ancient Egypt. And here, in order to render our narrative intelligible, it is proper to state both the ancient and modern divisions of the country. These have been suggested by the course of the river, and the general configuration of the valley of the Nile, between the cataract of Assouan and the sea. Anciently this remarkable country was divided into three parts, namely, Upper Egypt, called the *Thebaid,* because Thebes was its capital; Middle Egypt, called the *Heptanomis,* or Seven Governments; and Lower Egypt, or the Delta, extending to the Mediterranean.[2] The Arabs and Ottomans have only changed the names of these divisions, which in fact are marked out by the hand of nature. First, Upper Egypt is called the *Saïd,* and includes the provinces of Thebes, Djirdjeh, and Siout; second, Middle Egypt, called the *Vostani,* consists of the provinces of Fayoum, Benisouef, and Minyeh; third, Lower Egypt, called *Bahari,* or the maritime country, includes the provinces of Bahyreh, Raschid or Rosetta, Gharbyeh, Menouf, Massoura, Sharkieh, and the Cairo district, consisting of the subdivisions of Kelioubeh and Atfihieh. The appellation of Upper Egypt is sometimes taken in a strictly physical acceptation, and made to include all the provinces above Cairo.

The first tribes who peopled Egypt, that is, the valley of the Nile between the cataract of Assouan and the sea, probably came from Abyssinia or Sennaar. The current of population appears to have descended along the course of the stream, and to have gradually overspread the valley fertilized by its waters; but it is impossible to fix the period of this first migration, which, however, must have been very remote. The ancient inhabitants of Egypt belonged to a race of men in most respects resembling the Kennous or Barabras, the actual inhabitants of Nubia. In the Copts of Egypt we find none of the characteristics of the ancient population of that country. The Copts are the product of a confused mixture of all the nations who have successively domineered over Egypt; and it would therefore be absurd to expect to find amongst them the characteristic features of the ancient race. The first settlers who arrived in Egypt were nomadic, and had not more fixed dwellings than the Bedouins of the present day; they were then destitute of science, of arts, and of definite forms of civilization. It was the work of ages of favourable circumstances which led the Egyptians, at first errant, to apply at length to agriculture, and to establish themselves in a fixed and permanent manner: then, and then only, arose the first towns, which in their beginnings were only small villages, but, by the successive development of civilization, became at length great and powerful cities. The most ancient towns of Egypt were Thebes (Luxor and Karnak) Esneh, Edfou, and the others of the Saïd above Dendera. Middle Egypt was then peopled; but Lower Egypt had neither inhabitants nor towns until a later period. It was only in consequence of prodigious works executed by the labour of man that Lower Egypt became habitable.[3]

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[1] Young on Egyptian Literature and Antiquities, art. *Historiography of Egypt.*

[2] The figure of Egypt may be compared to the head and horn of an unicorn, the delta being the head, and the long narrow valley of the Nile the horn inserted, as it were, therein.

[3] "Notice Sommaire sur l'Histoire d'Egypte, redigée à Alexandrie pour le Vice-roi, et remise à S. A. au mois de Novembre 1829," being appendix No. 1 to the "Lettres écrites d'Egypte et de Nubie en 1828 et 1829, par Champollion le Jeune." Paris, 1833.

The Egyptians in the early stage of their progress were ruled by priests. The latter administered the government in every district of Egypt under a high priest, who again pretended to issue his orders in the name of God. This form of government, which is called a theocracy, resembled that by which the Arabians were governed under the first caliphs, though, in several respects, its construction was much less perfect. From its peculiar character, a government of this kind easily became unjust and oppressive, and, for a very long period, it retarded the advance of civilization. It had divided the nation into three distinct parts or castes; first the priests, then the military, and, thirdly, the people. The people alone laboured, and the fruit of all their toils was devoured by the priests, who kept the military in their pay, and employed them in keeping in check the rest of the population. But a period arrived when the military became weary of yielding a blind obedience to the priests. A revolution broke out, and the change which proved fortunate for Egypt was brought about by a military chief, named Menei or Menes, who became the head of the nation, established the royal government, and transmitted the power to his descendants in the direct line. From this period the country was ruled by kings, and the government became milder and more enlightened; for the royal power found a sort of counterpoise in the influence which the priesthood necessarily possessed, now that it was confined to its proper province of inculcating the laws of morality, and teaching the principles of the arts. Thebes still remained the capital of the kingdom; but king Menes, and his son and successor Athothes, laid the foundations of Memphis, which they rendered a strong city, and constituted their second capital. It was built at a short distance from the Nile; and its ruins have been found in the villages of Menf, Mokhnan, and particularly Mit-Rhahinch.

As the reign of Menes forms the extreme limit of legitimate curiosity in this interesting field of inquiry; and as all correct notions of Egyptian chronology must in a great measure rest on the determination of the period at which that monarch assumed or exercised the supreme power; various attempts have been made to fix this important epoch, from the data furnished either by monuments or by lists of dynasties and kings as given by the ancient authors. It will be sufficient for our present purpose, however, merely to state the results at which different inquirers have arrived. Menes, then, commenced his reign,

	B. C.	
According to Dr Hales, *New Analysis of Ancient Chronology*, vol. iv. p. 418	2412	
According to Old Chronicle, *New Analysis*, vol. iv. p. 407	2231	
According to Eratosthenes, Prichard's *Egyptian Antiquities*	2220	
According to Eusebius, *New Analysis*, vol. iv. p. 417	2258	or 2262
According to Julius Africanus, *ibid*	2218	
According to Dr Prichard, *Egyptian Antiquities*, p. 91	2214	

The mean of these different calculations is 2256, which, therefore, may be taken as perhaps the closest approximation to the truth. Amongst the principal authorities on which the reign of Menes has been determined as above, may be mentioned the statement of Josephus,[1] that Menes lived many years before Abraham, and that he governed Egypt more than 1300 years before Solomon. But Abraham was born 2153 years, and the son of David ascended the throne of Israel 1030 years before Christ; and these facts, combined with the account which is given in the old chronicle of the dynasty of kings which proceeded from Mitzraim, seem to warrant the conclusions of modern chronologers. It is evident, therefore, that Champollion has committed an egregious error in stating that, according to the ancient histories of Egypt, the epoch of the revolution which placed Menes on the throne was about six thousand years before the publication of Islamism. This is very nearly the double of the truth as ascertained by the very authorities to which he refers.

The actions of this monarch have been conveyed to us through the obscure and uncertain channel of tradition. On his accession he found the kingdom, like all priest-governed countries, in a most deplorable condition. Excepting the Thebais, the whole of it was a morass; and, though ruled by priests, the people were destitute of every kind of religion, as well as sunk in utter ignorance. According to Herodotus, Menes applied himself to remedy these evils. He diverted the course of the Nile, which before his time had washed the base of the sandy ridge near the borders of the Libyan desert, and thus protected from the inundations of the river the ground on which Memphis was afterwards erected. To accomplish this object, he erected a mound about twelve miles south from the future capital of Egypt; turned the course of the stream, a large branch of which had previously made its way through the valley of Fayoum, towards the Delta; and conducted it to the sea at an equal distance from the elevated ground by which on either side the country is bounded. Menes also acquired glory in war; but his best renown consists in having improved his country, and instructed his subjects in the arts of life. His death is said to have been occasioned by a hippopotamus.

We may here give an example of the fabulous extravagance of Egyptian chronology, as founded on the statements of the priests. Menes or Menas was the first mortal who sat upon the throne of Egypt, the country having before his time been governed by eight gods in succession. But Herodotus mentions, that the priests recited to him, from books, three hundred and thirty sovereigns, successors of Menes, of whom eighteen were Æthiopian princes, and one a queen called Nitocris. Now, allowing thirty-three years for a generation, the joint reigns of three hundred and thirty kings would amount to about eleven thousand years; a period which, according to the forged records of these priests, must have intervened between the reign of Menes and that of Sesostris. The statement of Diodorus Siculus, however, is by no means so violently opposed to truth and probability. He agrees with Herodotus in representing Menes as the first king of Egypt who reigned after the gods; but he says that after Menes fifty-two kings reigned during a period of fourteen hundred years, or about twenty-seven years at an average for each reign. This statement, though it falls short of the ordinary calculation, has at least a reasonable amount of probability in its favour, and indeed seems to be a pretty close approximation to the truth. Of the three hundred and thirty monarchs mentioned by Herodotus, on the authority of the sacred records, none except Mœris was distinguished by any acts of magnificence or renown; and hence he prudently abstains from loading his pages with the appellations and titles of this catalogue of royal lumber. It may, however, serve to assist the recollection of the reader, on this obscure and intricate subject, if we exhibit an abridged list of the kings who occupy the space between the accession of the first mortal sovereign of Egypt and the death of Mœris.

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[1] *Judæor. Antiquitat.* lib. viii.

First Dynasty, Egyptians, 253 Years.

	Y.	B. C.
Menes and his successors, ending with Timaus,	253	2412

Second[1] Dynasty, Shepherd Kings, 260 Years.

	Y.	B. C.
1. Salatis, Silites, or Nirmaryada	19	2159
2. Baion, Byon, or Babya	44	2140
3. Apachnes, Pachman, or Ruchma	37	2096
First Pyramid begun about		2095
Abraham visits Egypt about		2077
4. Apophes	61	2059
5. Janias or Sethos	50	1998
6. Assis or Aseth	49	1948
Expulsion of the Shepherds	260	1899

Third Dynasty, Native Kings, 251 Years.

	Y.	B. C.
Alisphragmuthosis, &c	27	1899
Joseph appointed governor or regent	9	1872
Jacob's family settle in Goshen	215	1863
Death of Joseph		1792
Queen Nitocris		1742
Exode of the Israelites	251	1648

Fourth Dynasty, 340 Years.

	Y.	B. C.
1. Amosis, Thuthmosis, or Thummosis	25	1648
2. Chebron	13	1623
3. Amenophis I.	20	1610
4. Amesses	21	1589
5. Mephres	12	1567
6. Misphragmuthosis	25	1554
7. Thmosis or Thothmosis	9	1528
8. Amenophis II.	30	1518
9. Orus or Horus	36	1488
10. Acenchris	12	1452
11. Rathosis	9	1440
12. Acencheres I.	12	1431
13. Acencheres II.	20	1418
14. Armais or Harmais	4	1398
15. Ramesses	1	1394
16. Ramesses Meiamun	66	1393
17. Amenophis III. or Mœris	19	1327
Death of Mœris	340	1308

During the long interval between the reign of Menes and the death of Mœris, the most remarkable event which occurred, and one, too, which forms the first distinct piece of history we meet with respecting Egypt, was the invasion of the Pastors or Shepherds, which, according to the chronology here adopted, took place more than two thousand years before the birth of Christ. This irruption, as related by Manetho, happened in the reign of Timaus king of Egypt, when God being displeased with the Egyptians, exposed them to a great revolution; for a multitude of men, of obscure origin, pouring from the East into Egypt, made war on the inhabitants, who, being apparently unwarlike, submitted almost without resistance. The Shepherds, however, behaved with the greatest cruelty; they burned the cities, threw down the temples of the gods, put to death the inhabitants, and carried the women and children into captivity. This people came from Arabia, and were called Hycsos, or King-Shepherds. They held Egypt in subjection for more than two centuries and a half, at the end of which period they were compelled by a king of Upper Egypt, named Amosis, or Thothmosis, to abandon the country. This prince's father had, it seems, gained great advantages over them, and shut them up in a place named Abaris or Avaris, that is, the Pass (afterwards called Pelusium), where they had collected all their cattle and plunder. Here they were closely besieged by Thothmosis with an army of 480,000 men; but at last the king, finding himself unable to reduce them by force, proposed a sort of capitulation, which was readily accepted: the Shepherds in consequence withdrew from Egypt with their families, to the number of 240,000 souls. Accordingly, they crossed the desert, and entered Syria; but fearing the Assyrians, who were then very powerful, and held Asia in subjection, they entered the land of Judæa, and built there a city capable of containing so great a multitude, which they called Jerusalem.

Such is the substance of Manetho's statement, as preserved by Josephus in his tract against Appion; and, with the exception of the concluding part, where he seems to identify the savage invaders of Egypt with the peaceful family of Jacob, its accuracy can scarcely be called in question. It appears, indeed, that these barbarians having established themselves in Egypt, tyrannized over it for several centuries; that the progress of civilization was arrested, and the inhabitants ruined, by exactions and rapine; that the barbarians having elected a chief, the latter took the name of Pharaoh; and that it was under the fourth of these foreign chiefs that Joseph the son of Jacob became the prime minister of Egypt, and afterwards brought thither the family of his father, which thus became the source of the Jewish nation. But in process of time different parts of Upper Egypt freed themselves from the yoke of the strangers; and at the head of this resistance appeared the princes descendants of the Egyptian line of kings whom the barbarians had dethroned. Of these the most distinguished was Amosis, who, having collected sufficient forces, drove them from Memphis, which they had made their capital; attacked them in Lower Egypt, where they were firmly established; and ultimately, by means of the capitulation of Avaris or Avara, delivered Egypt from their tyranny.

Various opinions have been entertained as to the origin of the detested race which overthrew Thebes and tyrannized over all Egypt. According to Bruce, the Shepherds who invaded Egypt were no other than the inhabitants of Barabra, and carriers to the Cushites, who lived farther to the south. The latter had built many stately temples in Thebes and other cities of Egypt; yet, according to him, they had no other dwelling-places than holes or caves in the rocks. Being a commercial people, they remained at home collecting and preparing their articles, which were dispersed by the Barabers or Shepherds already mentioned. These, from the nature of their employment, lived in moveable habitations, as the Tartars do at this day. By the Hebrews, he tells us, they were called Phut, but Shepherds by every other people; and from the name Baraber the word Barabra is derived. By their employment, which consisted in dispersing the Arabian and African goods all over the continent, they had become a great and powerful people; and, from their opposite dispositions and manners, were frequently enemies of the Egyptians. To Salatis Bruce ascribes the destruction of Thebes in Upper Egypt, so much celebrated by Homer for its grandeur and magnificence. In fact, he reckons three invasions of this people; the first being that of Salatis already mentioned, who overthrew the primary dynasty of Egyptian kings from Menes, and destroyed Thebes; the second that of Sabacon or So, a word which, according to him, was not the name of a single prince, but of a people, and signifies *shepherd;* and the third, when, after the building of Memphis, 240,000 of these people were besieged as above mentioned. But this hypothesis is in the highest degree inconsistent; for how is it possible that the third invasion, antecedent to the building of Jerusalem, could be posterior to the second, if the latter happened only in the days of Hezekiah?

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[1] This is the 17th of Manetho.

There is less doubt as to the destruction of these barbarians. When forced to evacuate Egypt in virtue of the capitulation entered into with Amosis, they appear to have thrown themselves upon Syria, where several of their tribes fixed themselves, and became the ancestors of the Philistines, who occupied the eastern shores of the Mediterranean, and occasionally extended their power as far as the banks of the Euphrates.[1] It is not a little remarkable that a tradition of the conquest of the Shepherds is still preserved among the tribes of Central India. In one of the sacred books of the Hindus, a record is preserved of two migrations from the East in remote times; one of the Yadavas or Sacred Race, and the other of the Pali or Shepherds, who were a powerful tribe, and governed the whole country from the Indus to the mouth of the Ganges. Having passed the shores of the Persian Gulf, they took possession of Arabia, then crossed or turned the Red Sea, and occupied the lands on its western shore. But to a legend so wholly unsupported as this is, no weight or value can be attached. Many circumstances, however, conspire to render it probable that this people, whose memory was held in the greatest abhorrence in Egypt, by reason of their tyranny, were a Tartar or nomadic horde, and that, when expelled from that country, they settled on the shores of Syria, in the country which from them was called Palesthan or Palestine. The exode of the Israelites must not therefore be confounded with the expulsion of the Shepherds.

Amenoph, the son of Amosis, and the first of that name, having assisted in the expulsion of the Shepherds, with whom he had concluded the capitulation above mentioned, united all Egypt under his dominion, and raised the throne of the Pharaohs, that is to say, of the kings of the Egyptian race. He was the chief or head of the eighteenth dynasty. His entire reign, and that of his three successors, Thothmosis I., Thothmosis II., and Mœris-Thothmosis III. were devoted to the object of re-establishing a regular government, and raising up the nation, which had been crushed by so many years of servitude under a foreign yoke. The barbarians had destroyed everything; all therefore had to be reconstructed. These great kings spared no pains to raise up Egypt from its state of debasement; order was re-established throughout the whole kingdom; the canals, which had been neglected or destroyed, were repaired or re-formed; whilst agriculture and the arts, encouraged and protected, soon brought back abundance, and at once increased and perpetuated the resources of the government. In a little time the towns were rebuilt; edifices consecrated to religion appeared on all sides; and several of the monuments which are admired on the banks of the Nile belong to this interesting epoch of the restoration of Egypt by the wisdom of its kings. Of this number are the monuments of Semneh and Amada in Nubia, and several of those of Karnak and Medinet-Abou, which are the works of Thothmosis I. or of Thothmosis III. who is also called Mœris. This king, under whom the two obelisks of Alexandria were erected, is the Pharaoh who achieved the greatest undertakings; it is to him that Egypt owes the existence of the great lake of Fayoum. By immense works which he caused to be executed, and by means of canals and sluices, this lake became a reservoir which served to maintain, in the lower country, a perpetual equilibrium between the inundations of the Nile; to supply water when these were insufficient, or to withdraw it when they were excessive. Formerly it bore the name of Lake Mœris; at present it is called Birket-el-Karoun. These kings, and several of their successors, appear to have preserved in all its plenitude the royal power which they had recovered from the Shepherd chiefs; but they used it only for the advantage of the country, in correcting and reconstituting society, corrupted by slavery, and in restoring Egypt to the first political rank amongst surrounding nations.

At this period several nations of Asia had already attained a certain degree of civilization, and their power was believed to endanger the tranquillity of Egypt. Mœris and his successors often took arms, and carried the war into Asia or Africa, either to establish the dominion of Egypt, or to ravage and enfeeble those states, and thus to ensure the tranquillity of the Egyptian nation. Amongst these conquerors may be reckoned Amenoph II., the son of Mœris, who rendered tributary Syria and the ancient kingdom of Babylon; Thothmosis IV. who invaded Abyssinia and Sennaar; and, lastly, Amenoph III. who completed the conquest of Abyssinia, and undertook great expeditions into Asia. There still exist monuments of this king. It was he who caused to be built the palace of Sohleb in Upper Nubia, the magnificent palace of Luxor, and all that part south of the grand palace of Karnak at Thebes. The two colossal statues at Kourna are understood to represent this illustrious prince. His son Horus chastised a revolt of the Abyssinians, and continued the works of his father; but two of his children who succeeded him, having neither the firmness nor the courage of their ancestors, lost in a few years the influence which Egypt had exercised over neighbouring countries. King Menephtha I., however, restored the glory of the country, and carried his victorious arms into Syria, Babylonia, and even the north of Persia.[2]

We come now to the era of his son Rhamses the Great, known also in history by the name of Sesostris.[3] He was the first mighty warrior whose conquests are recorded with any degree of distinctness. Much diversity of opinion prevails as to the date of his reign. Some chronologers, among whom is Sir Isaac Newton, are of opinion that he is the Sesak or Shishak who took and plundered Jerusalem in the reign of Rehoboam the son of Solomon. Others, however, place him still earlier; and Mr Whitson contends that he was the Pharaoh who refused to part with the Israelites, and was at last drowned in the Red Sea. Larcher, who builds his calculation on Herodotus, asserts that Sesostris mounted the throne of Egypt 1356 years before Christ; Hales places his accession to the crown at the commencement of the thirteenth century before Christ; and Sir William Drummond, who contests the assertion of Larcher, fixes the commencement of his reign at a period still more recent, namely, about the beginning of the eleventh century anterior to our era. Mr Bryant, again, endeavours to prove that no such person ever existed; but that in his history, as well as in that of many ancient heroes, we have an abridgment of that of the Cushites or Babylonians, who spread themselves over great part of the then known world, and everywhere brought the people in subjection to them. His reign is the most extraordinary portion of the Egyptian history. The father of Sesostris was told in a dream, by the god Ptha, that his son, who was then newly born, should be lord of the whole earth. Upon the credit of this vision, he got together all the males in the land of Egypt who were born on the same day with Sesostris, appointed nurses and proper persons to take care of them, and had them treated like his own child; being persuaded that they who were the constant companions of his youth would prove the most faithful ministers and soldiers in his riper years. As they grew up they were inured to laborious exercises, and, in particular, were never permitted to taste food till they had performed a journey of upwards of twenty-two of our miles. When the old king imagined they were sufficiently educated and trained in martial exercises, he sent them, by way of trial of their qualities, against the Arabians. In this expedition Sesostris proved successful, and in the end subdued that people, who had never before been conquered. He was then sent to the westward, where he conquered the greater part of Africa, and was only stopped in his career by the Atlantic Ocean. Whilst he was absent on this expedition his father died; and then Sesostris resolved to fulfil the prediction of Ptha at his birth, by actually conquering the whole world. With this view he divided the kingdom into thirty-six provinces, and endeavoured to secure the affections of the people by gifts both of money and land. He forgave all those who had been guilty of offences, and discharged the debts of his soldiers. He then constituted his brother Armais or Harmais regent, but forbade him to use the diadem, and commanded him to offer no injury to the queen or her children, and to abstain from the royal concubines. His army consisted of 600,000 infantry, 24,000 cavalry, and 27,000 chariots. Besides these land forces, he had two fleets; one of them, according to Diodorus, of four hundred vessels. Of these fleets, one was designed to make conquests in the west, and the other in the east; and therefore the former was built on the Mediterranean, and the latter on the Red Sea. The first of these conquered Cyprus, the coast of Phœnicia, and several of the islands called Cyclades; and the second subdued all the coasts of the Red Sea; but its progress was stopped by shoals and other difficulties which the navigators of those days were unable to pass, so that he seems not to have made many conquests by sea.

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[1] In the language of Asia the word *Pali* denotes shepherds, and *stan* or *sthan* means country; so that *Palis-tan* literally signifies shepherd-land, or the country of shepherds. But as *Palistan* is manifestly identical with *Palestine*, or the country of the Philistines, it is hence not improbable that the warlike nation which so frequently disputed the possession of the Syrian border with the descendants of Abraham were the progeny of the fierce herdsmen who for more than two centuries and a half held Lower, Middle, and even part of Upper Egypt subject to their despotic sway. (Russell's *Egypt*, p. 69, 2d ed.)

[2] Champollion, *Notice Sommaire sur l'Histoire d'Egypte*, 1829; *Lettres écrites d'Egypte*, appendix.

[3] This monarch has been designated by a great variety of names. Thus he has been called Sesostris, Sesoosis, Sesochis, Sesonchosis, Sethosis, Sethos, Ramesses, Rameses, Ramestes, Rhampstes, Rhamses, Vexores, and Ægyptus. But most of these appellations were probably titular. Thus, *Sesostris* may be ΣΕ-ΣΙΟΣ-Τ-ΡΗ, *Se-sios-t-re*, which signifies *filius domini, donum solis. Sesoosis* may, in like manner, be a corruption for ΣΕ-ΣΙΟΣ-ΣΙΟΣ, *Se-sios-sios, filius domini dominorum;* and *Ramesses*, derived from ΡΗ, *Ré, sol*, and ΜΕΣ, *mes, gignere*, may have signified *begotten by the sun.* But it is impossible to render ancient Egyptian according to the grammatical rules established in the Coptic language. (Drummond's *Origines*, vol. ii. p. 500.)

With the land forces Sesostris marched against the Ethiopians and Troglodytes, whom he overcame, obliging them to pay him a tribute of gold, ebony, and ivory. He then proceeded as far as the promontory of Dira, which lay near the Straits of Babelmandeb, where he set up a pillar with an inscription in sacred characters or hieroglyphics. He then marched on to the country where cinnamon grows, or at least to a country whence cinnamon at that time was brought, probably some place in India; and here he in like manner set up pillars, which were to be seen many ages afterwards. As to his further conquests, it is agreed by almost all authors of antiquity that he overran the greater part of the continent of Asia, and some part of that of Europe. Having crossed the Ganges, he erected pillars on its banks; and thence marching northward, he ascended the plateau of Central Asia, subdued the Assyrians and Medes, directed his course towards the Caspian and the Black Sea, and invaded the Scythians and Thracians. Authors are not agreed that he conquered the nations last mentioned. Some even affirm that he was overthrown with great slaughter on the banks of the Phasis, by Timaus, prince of the Scythians, and obliged to abandon a great part of his booty and military stores; but whether he was successful or the reverse in these parts, it is a common opinion that he settled a colony in Colchis. Herodotus, however, does not say whether the colony was designedly planted by Sesostris, or whether part of his army, having refused to accompany him further, settled in that region. From his own knowledge he asserts that the inhabitants of the country were undoubtedly of Egyptian descent. This was indeed evident from the personal resemblance they bore to the Egyptians, who were of swarthy complexions, with frizzled hair;[1] but more especially from the conformity of their customs, particularly that of circumcision. The utmost limit of this monarch's conquests, however, was in Thrace or Rumelia; for beyond this country his pillars were nowhere to be seen. These pillars he was accustomed to set up in every region which he conquered, with the following inscription, or one to the same purpose: "*Sesostris, King of Kings and Lord of Lords, subdued this country by the power of his arms.*" Besides these, he left also statues of himself, two of which, according to Herodotus, were to be seen in his time; the one on the road between Ephesus and Phocæa, and the other between Smyrna and Sardis. They were armed after the Ethiopian and Egyptian manner, with a javelin in one hand and a bow in the other; whilst across the breast a line was drawn from one shoulder to the other, with the following inscription: "*This region I obtained by these my shoulders.*" They were mistaken for images of Memnon.

The reasons assigned by this warlike prince for returning into Egypt from Thrace, and thus leaving the conquest of the world unfinished, were the want of provisions for his army, and the difficulty of the passes. Most probably, however, his return was hastened by the intelligence he received from the high priest of Egypt, concerning the rebellious proceedings of his brother, who, encouraged by his long absence, had assumed the diadem, violated the queen, and appropriated the royal concubines. On receiving this news, Sesostris hastened from Thrace, and, nine years after he had set out on his expedition, arrived at Pelusium in Egypt, attended by an innumerable multitude of captives taken from many different nations, and loaded with the spoils of Asia. His brother met him at this city, where, it is said, though with but little probability, Sesostris accepted from the traitorous regent an invitation to an entertainment. On this occasion he drank freely, as old soldiers are wont to do, whilst the queen and the rest of the royal family joined in the compotation; but during the entertainment Armais caused a quantity of dried reeds to be laid round the apartment where they were to sleep; and as soon as the party, filled with wine and wassail, had retired to rest, he set fire to the reeds. Sesostris, however, perceived the danger, and finding that his guards, overcharged with liquor, were incapable of assisting him, he rushed through the flames, and was followed by his wife and children. For this wonderful deliverance he made several donations to the gods, particularly to the god of fire; and he then took vengeance on his brother Armais, who is said to be the Danaus of the Greeks, and who, being now driven out of Egypt, withdrew into Greece, where, under his new name, he acquired great renown.

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[1] These physical marks of the African race, although they may afford a proof that the founders of the Colchian colony were, if not Africans, at least of African descent, yet warrant not the conclusion that the ancient Egyptians belonged exclusively to this family of mankind. That Africans, particularly the inhabitants of the countries now called Nubia and Abyssinia, served in the army of Sesostris, seems to admit of little doubt; and it is by no means impossible that the founders of the Colchian colony were exclusively of this race, which having been subdued by Sesostris, and afterwards compelled to serve in his army, might naturally take the first opportunity that offered to detach themselves from a standard which to them was the emblem of subjection and humiliation. But it is a remarkable fact, that of the bodies found in the mummy cases, almost all those which have been unswathed and examined have strong red hair, and a cast of features somewhat resembling those of a New Zealander, and are as remote as possible from the general contour and expression of the negro countenance.

This illustrious conqueror, the history of whose achievements is so dashed and brewed with fable and romance, is generally supposed to have been one of the best of princes, as well as bravest of warriors. He employed all the riches taken from the conquered nations, and the tributes he received from them, in the execution of immense works of public utility. He founded new cities, endeavoured to elevate the ground of some, and surrounded others with strong embankments of earth, to protect them from the inundation of the river; he dug new canals, and to him is attributed the first idea of a canal for connecting the Nile with the Red Sea; and he covered Egypt with a great number of magnificent structures, many of which are still in existence. These are the monuments of Ibsambul, Derri, Guircheh-Hanan, and Wady-Essebouah, in Nubia; and in Egypt those of Kournah, of El Medineh near Kournah, a portion of the palace of Luxor, and the grand hall with columns in the palace of Karnak, which had been commenced by his father. This last monument is the most magnificent structure ever reared by the hand of man. But Sesostris did not confine himself to these more than Herculean labours. Not content with adorning Egypt with sumptuous edifices, and desirous to promote the real welfare of the people, he published a body of new laws, the most important of which was that which gave to all classes of his subjects the right of property in its fullest extent. By this he divested himself of that absolute and unlimited power which his ancestors had preserved after the expulsion of the Shepherds; and immortalized his name, which, in fact, was always venerated as long as there existed in the country a man of Egypt acquainted with ancient history. Hence it was under the reign of Rhamses the Great, or Sesostris, that Egypt arrived at the highest pitch of political power and internal splendour.

Amongst the countries which were either subject or tributary to him, this great monarch reckoned Egypt, the whole of Nubia, Abyssinia, Sennaar, several countries of the south of Africa; all the wandering tribes of the deserts east and west of the Nile; Syria; Arabia, in which the most ancient kings had establishments, near the valley of Pharaoh; and also in the places now called Djebbel-el-Mokatteb, El Magara, and Sabouth-el-Kadim, where there appear to have existed brass-founderies; the kingdoms of Babylon and Nineveh, now called Mossul; a great part of Anatolia, or Asia Minor; the Isle of Cyprus, and several islands of the Archipelago; and a considerable portion of the country now known by the name of Persia. At this period, when the star of the Pharaohs had reached its zenith, there existed regular and frequent communications between the Egyptian empire and that of India. The intercourse between these countries, indeed, appears to have been carried on with much activity; and the discoveries which are daily made in the tombs of Thebes, of stuffs of Indian fabric, of articles in wood the growth of India, and of hard-cut stones which certainly came from that country, leave no manner of doubt as to the commerce which ancient Egypt carried on with India, at a period when the European tribes and a great portion of the Asiatics were still in a state of barbarism. It is impossible indeed to explain the number and magnificence of the ancient monuments of Egypt, except on the supposition that the principal source of the immense wealth expended in producing them consisted in the ancient commercial prosperity of the country. Hence it is well ascertained that Memphis and Thebes were the first centre of that commerce, before Babylon, Tyre, Sidon, Alexandria, Tadmor (Palmyra), and Bagdhad, all cities in the vicinage, as it were, of Egypt, enjoyed that advantage and distinction.

With regard to the internal condition of Egypt at this period, it appears that the arts and the sciences, as well as what may be denominated police, were then carried to a high degree of advancement. The country was divided into thirty-six provinces or governments, administered by functionaries of different grades, according to a complete code of written laws. The population amounted in all to between five and seven millions. Of this a part specially devoted to the study of the sciences, and to promote the advancement of the arts, was charged, besides the ceremonies of worship, with the administration of justice, the assessment and collection of the imposts invariably fixed according to the nature and extent of each portion of property measured beforehand, and with all the branches of the civil administration. This was the instructed and learned part of the nation, and it was called the *Sacerdotal Caste*. The principal functions of this caste were exercised or directed by members of the royal family. Another portion of the Egyptian nation was specially entrusted with watching over the external defence, and guarding the internal tranquillity, of the country. It was in the numerous families endowed and supported at the expense of the state, and which formed the *Military Caste*, that all the conscriptions and levies of soldiers took effect. They regularly maintained the Egyptian army on the footing of a war establishment, at the total strength of about 180,000 men.[1] The third class of the population formed the *Agricultural Caste*. Its members devoted all their labour and attention to the cultivation of the soil, whether as proprietors or as farmers; and the products belonged to them *en propre*, subject only to the deduction of a portion destined for the support of the king, and also for that of the sacerdotal and military castes, which formed the principal, and indeed the most certain, revenues of the state. According to the statements of ancient historians, the annual revenue of the Pharaohs, including the tributes paid by foreign nations, may be estimated at not less than from L.27,000,000 to L.28,000,000 sterling. The artizans, the workmen of all kinds, and the merchants, composed the fourth class of the nation, or the *Industrious Caste*, which was subjected to a proportional impost, and thus contributed by its labours to defray the expense, as well as to augment the wealth, of the state. The productions of this caste raised Egypt to its highest pitch of prosperity. All kinds of industry were in fact practised by the ancient Egyptians; and their commerce with other nations more or less advanced, who formed the political world of that period, had experienced great development.

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[1] The first but smallest of the divisions of this army was trained to fight on cars or chariots drawn by two horses. This constituted the *cavalry* of that period, for cavalry properly so called did not then exist in Egypt. The remainder consisted of corps of infantry of different arms, viz. the soldiers of the line armed with a cuirass, a buckler, a lance, and a sword; and the light troops, the archers, the slingers, and corps armed with hatchets or battle-axes. The troops were exercised in regular manœuvres, marched and performed movements in line by divisions and companies, and executed their evolutions to the sound of the drum and the trumpet. These circumstances indicate an advanced civilization. See the article ARMY.

Egypt carried on a regular and extensive commerce in the grain which remained after supplying its own consumption. It derived great profit from its herds, and also from its horses. It supplied the world with its linen fabrics and with its cotton tissues, equalling in perfection and in fineness any thing which India or Europe has yet produced. The metals, of which Egypt contained no mine, but which it derived from the tributary countries, or by advantageous exchanges with independent nations, came out of its workshops manufactured into various forms, and changed either into arms, instruments, utensils, or into articles of luxury and dress, which were eagerly sought after by all the neighbouring nations. It exported annually a considerable quantity of pottery of every kind, as well as innumerable products wrought in glass and in enamel; arts which the Egyptians had carried to the highest pitch of perfection. Lastly, it provided the neighbouring nations with *papyrus* or *paper*, formed from the interior pellicles of a plant which several centuries ago ceased to exist in Egypt.[1] The Egyptians had no monetary system at all similar to ours. For small commerce they had a money of convention; but in considerable transactions payments were made in rings of pure gold of a certain weight and diameter, or in rings of silver of a denomination and weight equally fixed. With them silver was a legal tender as well as gold. In regard to the state of the marine at this early period, we have not sufficient information to enable us to speak with confidence. It appears, however, that Egypt had a navy composed of large galleys, propelled both by oars and sails; and it may be presumed that the mercantile marine had also made considerable advances, although it is not improbable that commerce and navigation on an extended scale were carried on, in quality of brokers or agents, by a small tributary people of Egypt, whose principal cities were Sour, Saïd, Beirout, and Acre. In short, the internal prosperity of Egypt was founded on the great development of its agriculture and its industry. In the tombs of Thebes and of Sakkara are discovered at every step objects of improved and elaborate workmanship, showing that this people were acquainted with all the comforts of life, and all the enjoyments of luxury. No nation, ancient or modern, has in truth carried further than the old Egyptians the grandeur and richness of their edifices, or taste and *recherche* in furniture, utensils, costume, and decoration.

Such was Egypt at the period of its greatest known splendour. This prosperity dates from the epoch of the last kings of the eighteenth dynasty, to which belonged Rhamses the Great or Sesostris; a sovereign terrible to his enemies, but the benefactor of the nation, which he governed with prudence, and improved by his wise institutions. His successors enjoyed in peace the fruits of his labours, and preserved the greater part of his conquests, which the fourth of these in order, called *Rhamses-Meiammon*, a warlike and ambitious prince, still further extended, his entire reign being occupied with a series of successful enterprises against the most powerful nations of Asia. This king built the beautiful palace of Medinet-Abou at Thebes, on the walls of which may still be seen sculptured and painted all the campaigns of this Pharaoh in Asia, the battles which he fought on land and on sea, the siege and capture of several cities, and the ceremonies of his triumph on his return from his distant expeditions. This conqueror appears also to have improved the navy of Egypt, which had been neglected by his immediate predecessors.

Under the Pharaohs who reigned after Rhamses surnamed Meiammon, or Beloved of Ammon, Egypt enjoyed a long tranquillity. During this period of profound repose, although the warlike and conquering spirit with which the country had been animated during the preceding dynasties declined, Egypt must necessarily have improved its internal government, and advanced progressively in art and industry; but its external dominion became contracted from age to age, by reason of the increasing civilization of the countries, which thus scarcely owned its sway, and which, improved by their very connection with Egypt, could not be kept in subjection except by means of a military establishment out of all proportion to the resources and population of that country. A new political world had in fact been formed around Egypt. The tribes of Persia, incorporated into one nation, already menaced the great united kingdoms of Nineveh and Babylon; whilst, on the other hand, the latter, aiming at depriving Egypt of important branches of commerce, disputed with that country the possession of Syria, and employed the Arab nations and tribes to harass its frontiers. In this conflict, the Phœnicians, naturally the commercial agents of these powerful rivals, sided sometimes with the one party and sometimes with the other, according to the interest of the moment; but the struggle was long and obstinate, the commercial existence of one or other of these powerful empires being at stake.

The military expeditions of Pharaoh Chechonk I. and those of his son Osorchon I. who overran Western Asia, maintained during some time the supremacy of Egypt; and it might long have enjoyed the fruits of these victories, if an invasion of Æthiopians or Abyssinians had not turned its whole attention to the south. But all its efforts were unavailing. Sabacon, king of the Ethiopians, having seized upon Nubia, passed the last Cataract with an army augmented by all the barbarous races of Africa, and poured this savage horde like a torrent down the valley of the Nile. After an unavailing struggle, in which its native prince, Pharaoh Bok-hor, perished, Egypt yielded to the conqueror. Sabacon began his reign with an act of great cruelty, causing the conquered prince to be burnt alive; nevertheless, when he saw himself firmly established on the throne of Egypt, he is said to have become a new man, and in fact he is highly extolled for his mercy, clemency, and wisdom. Sabacon is probably the So mentioned in Scripture, who entered into a league with Hoshea king of Israel against Shalmaneser king of Assyria.

Of Sabacon's immediate successor little or nothing is known. After him reigned Sethon, who was both king and priest of Ptha. He gave himself up to religious contemplation; and not only neglected the military class, but deprived them of their lands. They were so much incensed at this, that they entered into an agreement not to bear arms under him; and in this state of affairs Sennacherib king of Assyria arrived before Pelusium with a mighty army. Sethon now applied to his soldiers, but in vain; they unanimously persisted in refusing to march under his banner. Being therefore destitute of all human aid, he had recourse to Ptha, who, according to the legend, promised, that if Sethon would but go out against the Assyrians, he should obtain a complete victory. Encouraged by this assurance, the king assembled a body of artificers, shopkeepers, and labourers, and with this undisciplined rabble marched towards Pelusium. He had no occasion, however, to fight; for the very night after his arrival at Pelusium, an innumerable multitude of field rats having entered the enemies' camp, gnawed to pieces the quivers, bowstrings, and shield straps; so that, next morning, when Sethon found the enemy disarmed, and on that account beginning to fly, he pursued them with terrible slaughter. In memory of this extraordinary event, a statue of Sethon was erected in the temple of Ptha, holding in one hand a rat, whilst the words, "Whosoever beholdeth me, let him be pious," appeared to be issuing from the mouth.

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[1] The *papyrus*, called *berd* by the ancient Arabs, grew principally in marshy soils, and the cultivation of it proved a source of wealth to those who lived on the banks of Lakes Bourlos and Menzaleh or Tennis.

Soon after the death of Sethon, the form of government was totally changed, and the kingdom divided into twelve parts, over which as many of the chief nobility presided. But this division subsisted only for a short time; for Psammeticus I. one of the twelve, dethroned all the rest, fifteen years after the division was made. The history of Egypt now begins to be divested of fable; and from this time it may be accounted as certain as that of any other ancient nation. The vast conquests of Sesostris were now merely matters of tradition, and Psammeticus possessed only Egypt itself. Indeed none of the successors of Sesostris, not even that monarch himself, had made use of any means to keep in subjection the countries which he had once conquered. Perhaps his original design was rather to pillage than to conquer; and hence his vast empire speedily fell to pieces. Psammeticus, however, endeavoured to extend his dominions by making war on his neighbours; but by putting more confidence in foreign auxiliaries than in his native subjects of the military caste, the latter were so much offended that upwards of 100,000 fighting men emigrated in a body, passed the Cataracts, and took up their residence in Ethiopia, where they established an independent state. To repair this loss, Psammeticus earnestly applied himself to the advancement of commerce, and opened his ports to all strangers, whom he greatly caressed, contrary to the maxims of his predecessors, who had refused to admit them into the country. He also laid siege to the city of Azotus in Syria, which held out for twenty-nine years against the whole strength of his kingdom; a sufficient proof that, as a warrior, Psammeticus was by no means very formidable to his enemies. He is said to have been the first king of Egypt who drank wine. He also sent to explore the sources of the Nile, and attempted to discover the most ancient nation in the world by an experiment which has been often recorded. Having procured two newly-born children, he caused them to be brought up without hearing the sound of a human voice; imagining that these children would naturally speak the original language of mankind. When, therefore, at two years of age, they pronounced the Phrygian word for bread, or some sound resembling it, he concluded that the Phrygians were the most ancient people in the world. This Pharaoh was but an indifferent logician.

Nechus, the son and successor of Psammeticus, and the Pharaoh-Necho of Scripture, was a prince of an enterprising and warlike genius. In the beginning of his reign he attempted to cut through the isthmus of Suez, between the Red Sea and the Mediterranean; but owing to obstacles which nature had thrown in the way of such an undertaking, he was obliged to abandon the enterprise, after having lost 120,000 men in the attempt. After this he sent a fleet, manned with Phœnician mariners, on a voyage to explore the coast of Africa. Accordingly, having left the Red Sea, he sailed round the continent of Africa, doubling the Cape of Good Hope, and after three years returned to Egypt by the Mediterranean, having of course passed the Straits of Gibraltar. The most remarkable wars in which this king was engaged are recorded in the sacred writings. He marched against the king of Assyria; and being opposed by the king of Judæa, he defeated and killed his opponent at Megiddo; after which he set up King Jehoiakim, and imposed on him an annual tribute of a hundred talents of silver and one talent of gold. He then proceeded against the king of Assyria, and having weakened him so much that the empire was soon afterwards dissolved, he became master of Syria and Phœnicia. But the end of his reign was unfortunate; for Nebuchadnezzar, king of Babylon, having come against him with a mighty army, the Egyptian monarch boldly ventured a battle, but was overthrown with great slaughter, and Nebuchadnezzar became master of all the country as far as the gates of Pelusium. His son Psammeticus II., called also Psammis, endeavoured to recover the provinces which had been detached from Egypt, but without success.

But his successor Apries, the Pharaoh-Hophra of Scripture, in Egyptian *Ouaphré*, was in some respects more fortunate. He is represented as a martial prince, and in the beginning of his reign as very successful. He took by storm the rich city of Sidon; and having overcome the Cypriots and Phœnicians in a sea-fight, returned to Egypt laden with spoil. It was probably this success which induced Zedekiah, king of Judæa, to enter into an alliance with Ouaphré against Nebuchadnezzar, king of Babylon; an alliance the unfortunate result of which was foretold by the prophet Jeremiah; for when Nebuchadnezzar sat down with his army before Jerusalem, Apries marched from Egypt to relieve the city, but no sooner did he perceive the Babylonians approaching him, than he retreated as fast as he could, leaving the Jews exposed to the mercy of their enemies. By this cowardly or treacherous conduct, Apries justly brought upon himself the vengeance denounced by the prophet. The Cyreneans, a colony of Greeks, being strengthened by a body of their countrymen under their third king Battus, and encouraged by the Pythian oracle, began to expel their Libyan neighbours, and divide among themselves the possessions of those whom they had driven out. In these circumstances Andica, king of Libya, sent an embassy to Apries to implore his protection against the Cyreneans. Apries complied with this request, and sent a powerful army to his relief. But the Egyptians were defeated with great slaughter; and those who returned complained that the army had been sent out in order to be destroyed, and that the king might tyrannize without control over the remainder of his subjects. This notion having caught the attention of the multitude, an almost universal defection ensued. Apries sent Amasis, a friend in whom he thought he could confide, to endeavour to bring back the people to a sense of duty. But he was betrayed by Amasis, who, taking the opportunity of the ferment, caused himself to be proclaimed king. Both parties now prepared for war. The usurper had under his command the whole body of native Egyptians, and Apries such Ionians, Carians, and other mercenaries as he could engage in his service. The army of Apries amounted only to 30,000; but though greatly inferior in number to the troops of his rival, yet as he well knew that the Greeks were much superior in valour, he did not doubt of victory. The two armies met, and drew up in order of battle near Memphis, where a bloody engagement ensued, in which, though the army of Apries behaved with the greatest resolution, they were at last overpowered by numbers, and utterly defeated, the king himself being taken prisoner. Amasis now took possession of the throne without opposition, and confined Apries in one of his palaces, but treated him with great care and respect. The people, however, were implacable, and Amasis therefore found himself obliged to deliver the prisoner into their hands. Apries was accordingly given up to those " who sought his life," and who no sooner had him in their power than they strangled him, and laid his body in the sepulchre of his ancestors.

During the reign of Amasis, Egypt is said to have been perfectly happy, and to have contained twenty thousand populous cities. That good order might be preserved amongst such vast numbers of people, Amasis enacted a law by which every Egyptian was bound once a year to inform the governor of his province by what means he gained his livelihood; and if he failed in this, he was liable to be put to death. The same punishment he decreed to those who could not give a satisfactory account of themselves. This monarch greatly favoured the Greeks, and married a woman of Grecian extract. To many Greek cities, as well as particular persons, he made considerable presents. He likewise gave permission to the Greeks in general to come into Egypt, and either settle in the city of Naucratis, or carry on their trade upon the sea coasts; granting them also temples, and places where they might erect temples, to their own deities. He likewise received a visit from Solon the celebrated Athenian lawgiver, and reduced the island of Cyprus under his subjection.

This prosperity, however, ended with the death of Amasis, or rather before it. The Egyptian monarch having somehow incensed Cambyses, king of Persia, the latter vowed the destruction of Amasis. In the mean time Phanes of Halicarnassus, commander of the Grecian auxiliaries in the pay of Amasis, received some private disgust, and leaving Egypt, set out for Persia. He was a wise and able general, well acquainted with every thing which related to Egypt, and held in great estimation by the Greeks resident in that country. Amasis became immediately sensible of his loss, and therefore sent after him a trusty eunuch in a fast-sailing galley. Phanes was accordingly overtaken in Lycia, but not brought back; for having made his guard drunk, he continued his journey to Persia, and presented himself before Cambyses as the latter was meditating the destruction of the Egyptian monarchy.

But Amasis had not the misfortune to behold the calamities of his country.[1] He died about 525 years before Christ, after a reign of forty-two years, and left the kingdom to his son Psammenitus, just as Cambyses was approaching the frontiers of the kingdom.

The new prince was scarcely seated upon the throne when the Persian host appeared. Psammenitus drew together what forces he could, in order to prevent the invader from entering the kingdom. Cambyses, however, immediately laid siege to Pelusium, and made himself master of the place by a stratagem. Having placed in the front of his army a great number of cats, dogs, and other animals which were deemed sacred by the Egyptians, he then attacked the city, and took it without opposition; the garrison, which consisted entirely of Egyptians, not daring to throw a dart or shoot an arrow against their enemies, lest their weapons should kill some of the sacred animals. Cambyses had scarcely taken possession of the city, when Psammenitus advanced against him with a numerous army. But before the engagement, the Greeks who served under Psammenitus, in order to show their indignation against their treacherous countryman Phanes, brought his children into the camp, killed them in the presence of their father and the two armies, and then drank their blood. Enraged at so cruel an act, the Persians advanced to the combat, which proved long and bloody; but at the close of the day the Egyptians, overpowered by numbers, gave way. Cambyses prevailed, and the national independence of Egypt was for ever lost. Those who escaped from the field fled to Memphis, where they were soon after guilty of an outrage for which they afterwards paid dear. Cambyses sent a herald to summon them, in a small vessel from Mitylene; but no sooner did they observe this craft coming into the port, than they flocked down to the shore, destroyed the boat, tore in pieces the herald and all the crew, and afterwards carried their mangled limbs into the city in a kind of barbarous triumph. Not long afterwards, Memphis was taken by assault, and given up to pillage; whilst Psammenitus fell into the hands of an inveterate enemy, enraged beyond measure at the cruelties committed upon the children of Phanes, the Persian herald, and the Mitylenian sailors. The conquerors, being still a barbarous race, carried everywhere destruction and death. Thebes was sacked, its finest monuments were demolished or laid in ruins, and the iconoclastic fury of the conquerors raged even more fiercely against the temples than the palaces of the land, which was thus made desolate.

The rapid success of the Persians struck such terror into the Libyans, Cyreneans, Barcæans, and other dependents or allies of the Egyptian monarchy, that they immediately submitted. Nothing now remained but to dispose of the captive king, and revenge on him and his subjects the cruelties which they had committed. This the merciless victor executed in the severest manner. On the tenth day after Memphis had been taken, Psammenitus and the chief of the Egyptian nobility were ignominiously sent into one of the suburbs of that city; and the king being there seated, saw his daughter coming along in the habit of a slave with a pitcher to fetch water from the Nile, and followed by the daughters of the first families in Egypt, all in the same miserable garb, with pitchers in their hands, drowned in tears, and loudly bemoaning their miserable situation. When the fathers observed their daughters in this distress, they all burst into tears, except Psammenitus, who only cast his eyes on the ground and kept them fixed there. After the young women came the son of Psammenitus, with two thousand of the young nobility, all of them with bits in their mouths and halters round their necks, who were led to execution. This was done to expiate the murder of the Persian herald and the Mitylenian sailors; for Cambyses caused ten Egyptians of the first rank to be publicly executed for every one of those who had been assassinated. Psammenitus himself was afterwards restored to his liberty, and had he not showed a desire of revenge, might perhaps have been entrusted with the government of Egypt; but being discovered hatching schemes against the conquerors, he was seized, convicted, and condemned to drink bull's blood.

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[1] " Son règne fut heureux et paisible," says Champollion; " le commerce reprit un grand essor, et les richesses affluaient en Egypte; non qu'elle fût forte par elle-même, non qu'elle eût reconquis par les armes son influence au dehors, mais parce que dans ce temps-là les rois de Babylone cessaient de menacer l'Egypte pour résister aux peuples de la Perse, réunis sous un seul chef, Cyrus, qui attaqua impétueusement l'Assyrie et en fit graduellement la conquête, terminée par la prise et l'asservissement de Babylone." (*Notice sur l'Histoire de l'Egypte.*)

The Egyptians, now reduced to the lowest degree of slavery, were placed at the mercy of satraps or governors appointed by the conquerors. Their country became a province of the Persian empire, and the body of Amasis, their late king, being taken out of the grave, and mangled in a shocking manner, was finally burnt. Never was conquest more complete, desolation more universal, or tyranny more fierce and unrelenting. It was the very frenzy of barbarous fanaticism let loose, like some evil spirit long kept in chains under darkness, to destroy the monuments of the proudest civilization which the world had ever yet seen, and which in some of its characteristics had far distanced all future rivalry.[1] In the moral chaos which ensued, the arts and sciences almost entirely disappeared from that very soil in which they had long flourished; and the learning of the Egyptians became merely a recollection or tradition of the past. But what was accounted by the superstitious portion of the people more grievous than all the rest, the sacred bull Apis was slain, and his priests were ignominiously scourged; treatment which inspired the whole nation with an unextinguishable hatred of the Persians. A similar spirit of vengeance dictated the attempt to seize the consecrated fane of Jupiter Ammon, situated in the great Oasis; an attempt which cost Cambyses half his army, and produced disaffection among the remainder. As long as the Persian empire subsisted, the Egyptians were never able to shake off the yoke. They revolted frequently, it is true, but in every instance they were ultimately overthrown with prodigious loss. The chiefs who headed these insurrections gained partial successes, and for a brief space even freed their country from servitude; but their generous efforts were soon exhausted against the constantly increasing power of the Persian empire, and the expected deliverance was not achieved.

But when Alexander (Iskander), at the head of an army of Greeks, overturned the dominion of the Persians in Asia, Egypt at length respired freely under this new and enlightened master; and if he had lived he would doubtless have raised it to something like its ancient renown. He founded the city of Alexandria, which he called after his own name, and destined to become the centre of the commerce of the world, for which, from its geographical position, it was eminently calculated; and he was meditating other plans equally enlarged and comprehensive, when all his projects were suddenly arrested by death.

Having thus arrived at the point where commences the history of the Greek rulers of Egypt, we shall, in order to connect that which precedes with what is to follow, exhibit a tabular view of the several Egyptian dynasties from the death of Mœris-Thothmosis III. to the accession of the first Ptolemy, the head of the Lagidæ. It is proper to observe here, however, that this arrangement of the dynasties, founded on the information contained in the writings of Herodotus and Diodorus, differs very materially from that of Manetho, which will be presented under a subsequent head; and that it has been adopted in this place solely with a view to the illustration of the narrative, to which it is more immediately applicable than the royal canon of Manetho.

Fifth Dynasty, 342 *Years.*

	Y.	B. C.
1. Sethos, Sethosis, Sesoosis, or Sesostris	33	1308
2. Rampses or Pheron	61	1275
3. Cetes, Proteus, or Ramesses	50	1214
4. Amenophis IV	40	1164
5. Rampsinites	42	1124
6. Cheops or Chemmis	50	1082
7. Cephrenes, Cephres, or Sesah	56	1032
8. Mycerimus or Cherinus	10	976
His death	342	966

Sixth Dynasty, 293 *Years.*

A chasm	151	966
1. Bocchoris or Asychis	44	815
2. Anysis	2	771
3. Sabacon or So,	50	769
Anysis again,	6	719
4. Sebecon or Sethos	40	713
Sennacherib invades Egypt		711
End of the period	293	673

Seventh Dynasty, 148 *Years.*

1. Twelve contemporary kings	15	673
2. Psammeticus I	39	658
3. Nechus or Pharaoh Necho	16	619
4. Psammis	6	603
5. Apries or Pharaoh Hophra	28	597
6. Amasis	44	569
Cyrus conquers Egypt		535
7. Psammenitus. First revolt of Egypt		525
	148	

Eighth Dynasty, Persian Kings, 112 *Years.*

1. Cambyses reduces Egypt, First Persian Administration,	38	525
2. Darius Hystaspes. Second revolt of Egypt	3	487
3. Xerxes reduces Egypt, Second Persian administration,	24	484
4. Artaxerxes Longimanus. Third Revolt	4	460
Reduces Egypt, Third Persian administration,	43	456
Herodotus visits Egypt		448
5. Darius Nothus. Fourth Revolt	112	413

Ninth Dynasty, Egyptian Kings, 81 *Years.*

1. Amyrtæus	6	413
2. Pausiris or Busiris	6	407
3. Psammeticus II	6	401
4. Nephereus	6	395
5. Acoris	14	389
6. Nectanebo	12	375
7. Tachus or Tachos	2	373
8. Nectanebo II	11	361
Ochus reduces Egypt, Fourth Persian administration,	18	
Alexander conquers Egypt	81	332

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[1] In a poetical "Address to the Mummy in Belzoni's Exhibition," which appeared about the time when that enterprising but unfortunate traveller exposed his Egyptian tomb and other curiosities to the view of the London public, and which has deservedly been admired for its picturesque vigour combined with richness and felicity of historical allusion, the fury which marked the whole career of the Persian conquest is indicated in the most graphic manner. Addressing the mummy, the poet asks—

Didst thou not hear the pother o'er thy head
  When the great Persian conqueror, Cambyses,
Marched armies o'er thy tomb with thundering tread,
  O'erthrew Osiris, Orus, Apis, Isis,
And shook the Pyramids with fear and wonder,
When the gigantic Memnon fell asunder?

On the demise of Alexander the Great the Greek generals divided amongst them his conquests, when Egypt, together with Libya, and that part of Arabia which borders on Egypt, were assigned to Ptolemy Lagus, as governor, under Alexander's son by Roxana, who was but newly born. But nothing was further from the intention of this governor than to hold these provinces in trust for another. He did not, however, assume the title of king until he found his authority too firmly established to be overthrown; nor did this happen until nineteen years after the death of Alexander, when Antigonus and Demetrius had unsuccessfully attempted the conquest of Egypt. Ptolemy then declared himself king, and became the head of the Greek dynasty which governed Egypt for nearly three centuries. From the time of his first establishment on the throne, Ptolemy, who had assumed the cognomen of *Soter*, reigned twenty years, which, added to the former nineteen, make up the thirty-nine years during which it is computed by historians that he reigned alone. In the thirty-ninth year of his reign he associated one of his sons, named Philadelphus, as his partner in the empire, at the same time declaring him successor to the throne, in prejudice of his eldest son, named Ceraunus; a preference which he was induced to give by his extravagant affection for Berenice, mother of Philadelphus. When the succession had been thus settled, Ceraunus immediately quitted the court, and fled into Syria, where he was received with open arms by Seleucus Nicator, whom, in order to evince his gratitude, he afterwards murdered.

The most remarkable transaction of this reign was the embellishing of the city of Alexandria, which Ptolemy made the capital of his new kingdom; and the establishment of the celebrated Alexandrian Library, in which were deposited all the treasures of ancient learning. (See the article ALEXANDRIA.) About 284 years before Christ, died Ptolemy Soter, in the forty-first year of his reign, and eighty-fourth of his age. He was the best as well as the most accomplished prince of his race, and he left behind him an example of prudence, justice, and munificence which few of his successors chose to imitate. Learned himself, he was a great patron and encourager of learning in others; and whilst he proved himself one of the most eminent philosophers of his age, he also invited to his court, and placed in the schools which he had established in Alexandria, all those who were then most distinguished for scientific acquirements. To him learning and philosophy owe numerous and deep obligations; and for nothing are they more indebted than the practical direction which he gave to the pursuits of science, by withdrawing the speculations of the learned from the entities and quiddities of metaphysics, and the barren subtilties of scholastic systems of disputation, in order to engage them in the more profitable studies of history, geometry, medicine, and philosophy. In this indeed consisted the true glory of his reign. The employment to which he devoted his accomplished mind, and the encouragement which he afforded to true learning, reflect greater honour upon the memory of Ptolemy Soter, than all the magnificence of the Serapeion, all the brilliant utility of the Pharos, or the success which crowned his arms and issued in the extension of his empire. Besides the provinces originally assigned to him, he acquired those of Cœlo-Syria, Ethiopia, Pamphylia, Lycia, Caria, and some of the Cyclades.

His successor, Ptolemy Philadelphus, added nothing to the extent of the empire; nor did he perform any thing worthy of notice except further embellishing the city of Alexandria, and entering into an alliance with the Romans. In his time Magas the governor of Libya and Cyrene revolted, and held these provinces as an independent prince, notwithstanding the utmost efforts of Ptolemy to reduce him to obedience. At last an accommodation took place; and a marriage was proposed between Berenice, the only daughter of Magas, and Ptolemy's eldest son. But before this treaty could be carried into effect, Magas died; and Apamea, the princess's mother, afterwards did all in her power to prevent the match. This, however, she was unable to effect, though her intrigues produced a destructive war of four years' continuance with Antiochus Theus king of Syria, and the enacting of a cruel tragedy in the family of that prince. Philadelphus conveyed the waters of the Nile into the deserts of Libya, finished the Pharos near the harbour of Alexandria, and laboured to improve the navigable canal which connected the capital with both the Red Sea and the Mediterranean. But he dishonoured himself by resenting the advice given to his father by Demetrius the librarian, who recommended to Lagus to allow the succession to proceed in the natural course, and to settle the crown on his eldest to the exclusion of his second son.

About 246 years before Christ, Ptolemy Philadelphus died, and was succeeded by his eldest son Ptolemy, who had been married to Berenice, the daughter of Magas, as above stated. In the beginning of his reign he found himself engaged in a war with Antiochus Theus king of Syria. In this, however, he proved victorious, and brought with him two thousand five hundred statues and pictures, amongst which were many of the ancient Egyptian idols, which had been carried away by Cambyses into Persia. These were restored by Ptolemy to their ancient temples, and in memory of this pious act the Egyptians conferred on him the surname of *Euergetes*, or the *Beneficent*. In the expedition against Theus he greatly enlarged his dominions, made himself master of several countries situated beyond Mount Taurus, and carried his arms to the confines of Bactria. An account of these conquests was drawn up by Ptolemy himself, and inscribed on a monument, to the following effect:

"Ptolemy Euergetes, having received from his father the sovereignty of Egypt, Libya, Syria, Phœnice, Cyprus, Lycia, Caria, and the other Cyclades, assembled a mighty army of cavalry and infantry, with a great fleet and elephants out of Trogloditia and Ethiopia, some of which had been taken by his father, and the rest by himself, and brought thence and trained up for war. With this great force he sailed into Asia, and having conquered all the provinces which are situated on this side of the Euphrates, Cilicia, Pamphylia, Ionia, the Hellespont, and Thrace, he crossed the river with all the forces of the conquered countries, and the kings of those nations, and reduced Mesopotamia, Babylonia, Susiana, Persia, Media, and all the country as far as Bactria."

On his return from this expedition, he passed through Jerusalem, where he offered many sacrifices to the God of Israel, and ever afterwards expressed great favour for the Jewish nation. At this time the Jews were tributaries of the Egyptian monarchs, and paid them annually twenty talents of silver. This tribute, however, Onias, then high priest, had for a long time neglected to pay, and the arrears in consequence now amounted to a very large sum. Soon after his return, therefore, Ptolemy sent one of his courtiers named Athenion to demand the money, and instructed him to acquaint the Jews that he would make war upon them in case of refusal. A young man, however, named Joseph, nephew of Onias, not only found means to avert the king's anger, but even got himself appointed receiver-general, and by his faithful discharge of that important trust continued in high favour with Ptolemy as long as he lived.

Having at last concluded a peace with Seleucus, the successor of Antiochus Theus king of Syria, Ptolemy Euergetes attempted the enlargement of his dominions to the south; and in this he was so successful that he made himself master of all the coasts of the Red Sea, both on the Arabian and Ethiopian shores, as far as the entrance of the Strait of Dira or Babelmandeb. On his return he was met by ambassadors from the Achæans, who came to implore his assistance against the Ætolians and Lacedæmonians. This the king readily promised; but the envoys having in the mean while engaged Antigonus king of Macedonia to support them, Ptolemy was so much offended that he sent powerful succours to Cleomenes king of Sparta, hoping thereby to humble both the Achæans and their new ally Antigonus. In this, however, he was disappointed; for Cleomenes, after having gained very considerable advantages over the enemy, was at last defeated in the battle of Sellasia, and obliged to take refuge in Ptolemy's dominions. He was received by the Egyptian monarch with the greatest kindness, and a yearly pension of twenty-four talents was assigned him, with a promise of restoring him to the Spartan throne; but before this could be accomplished, the king of Egypt died, in the twenty-seventh year of his reign, and was succeeded by his son Ptolemy Philopater.

At this period the Egyptian empire had attained to a great height of power; and if the succeeding monarchs had been careful to preserve what was transmitted to them by Euergetes, it is probable that Egypt might have been capable of holding the balance against Rome, and, after the destruction of Carthage, might have prevented that haughty city from becoming mistress of the world. But after the death of Ptolemy Euergetes, the Egyptian empire being governed only by weak or vicious monarchs, rapidly declined; and henceforth it makes no conspicuous figure in history. Ptolemy Philopater commenced his reign with the murder of his brother; after which he gave himself up to all manner of licentiousness, and the kingdom fell into a state of anarchy. Cleomenes the Spartan king still resided at court; and being now unable to bear the dissolute manners which prevailed there, he pressed Philopater to give him the assistance which had been promised for restoring him to the throne of Sparta. This he insisted upon the more, because he had received advice that Antigonus king of Macedonia was dead, that the Achæans were engaged in a war with the Etolians, and that the Lacedæmonians had joined the latter against the Achæans and Macedonians. Ptolemy, when afraid of his brother Magas, had indeed promised to assist the king of Sparta with a powerful fleet, hoping by this means to attach the latter to his own interest; but now when Magas no longer stood in the way, it was determined by the king, or rather his ministers, that Cleomenes should not be assisted, nor even allowed to quit the kingdom. Of the disorders which ensued in the government, Antiochus king of Syria, surnamed the Great, took advantage, and attempted to wrest from the hands of Ptolemy the provinces of Cœlo-Syria and of Palestine. But in this he was unsuccessful, and might easily have been driven altogether out of Syria, had not Ptolemy been too much occupied with his debaucheries to think of carrying on the war. The discontent occasioned by this negligence soon produced a civil war in his dominions; and the whole kingdom continued in the utmost confusion and disorder until his death, which happened in the seventeenth year of his reign and thirty-seventh of his age. A slave to his passions, addicted to cruelty, and incapable of governing, he at that early age sunk under a ruined constitution, amidst the universal scorn and contempt of mankind.

In this reign the Jews were inhumanly persecuted. The hatred of this people entertained by Philopater arose out of a remarkable occurrence. Whilst engaged in his Syrian expedition, the king of Egypt had attempted to enter the temple of Jerusalem; but he was prevented doing so by the Jews, a circumstance which filled him with the utmost rage against the whole nation. On his return to Alexandria, being resolved to make those who dwelt in that city feel the first effects of his vengeance, he published a decree, which he caused to be engraved on a pillar erected at the gate of his palace, excluding all those who refused to sacrifice to the gods worshipped by the king; by which means the Jews were debarred from suing for justice, or obtaining protection, when they happened to require it. By the favour of Alexander the Great, Ptolemy Soter, and Ptolemy Euergetes, the Jews at Alexandria had enjoyed the same privileges with the Macedonians. In that metropolis indeed the inhabitants were divided into three classes. In the first were the Macedonians, the original founders of the city, and the Jews; in the second were the mercenaries who had served under Alexander; and in the third the native Egyptians. By another decree, however, Ptolemy now ordained that the Jews should be degraded from the first rank, and enrolled among the native Egyptians; but that he might not seem to be an enemy to the whole nation, he declared that those who sacrificed to the gods of the Egyptians should enjoy their former privileges, and remain in the first class. Yet notwithstanding this tempting offer, only three hundred out of many thousand Jews who lived in Alexandria could be prevailed upon to abandon their religion in order to save themselves from slavery. Meanwhile, the apostates were excommunicated by their brethren; and this, being construed as done in opposition to the king's order, exasperated him so much that he resolved to extirpate the whole nation, beginning with the Jews who lived in Alexandria and other cities of Egypt, and proceeding thence even to Judea and Jerusalem itself. Accordingly he commanded the Jews who lived in any part of Egypt to be brought in chains to Alexandria, and there to be shut up in the Hippodrome; and having sent for the master of the elephants, he ordered that functionary to have five hundred of these animals in readiness against the next day, to be let loose upon the Jews. But when at length the elephants were let loose, instead of falling upon the Jews, they turned their rage against the spectators and soldiers, great numbers of whom were destroyed; and this elephantine retribution, together with some strange appearances which were at the same time observed in the air, so terrified the king, that he commanded the Jews to be immediately set at liberty, and restored them to their former privileges.

The death of Philopater was followed by a minority, his son and successor Ptolemy Epiphanes being only five years old at the period of his demise. This minority was chiefly remarkable for having afforded the Romans an opportunity of interfering in and powerfully influencing the affairs of Egypt. When, owing to the extreme youth of the Egyptian monarch, the kings of Syria and Macedonia had resolved to dismember and divide his dominions, the guardians of the young prince made application to Rome to interpose her authority in the cause of justice, and to prevent the aggrandisement of two grasping and unprincipled monarchs with the spoils of an unoffending country. It was always the policy of Rome to mask her ambitious views under the show of a regard to justice; and this application, which furnished the necessary pretence, whilst it held out hopes of future advantage, appeared too inviting to be refused. The request of the guardians was promptly granted, and Marcus Æmilius Lepidus set sail for Alexandria to assume the direction of affairs, whilst ambassadors were dispatched to Antiochus and Philip, to make known to them the line of policy which the republic had resolved to pursue. But the peace which Rome thus dictated terminated when Epiphanes took the sceptre into his own feeble hand. As he became corrupt, his subjects grew discontented; various conspiracies were formed against him; and although these were discovered and detected, he at length fell by the hands of an assassin, in the twenty-ninth year of his age, and the twenty-fourth of his reign.

Ptolemy Epiphanes was succeeded by Ptolemy Philometor, who was only six years old. In the beginning of this reign a war commenced with the king of Syria, who, in the preceding reign, had seized upon the provinces of Cœlo-Syria and Palestine. In the course of the war Philometor was either voluntarily delivered up to Antiochus, or taken prisoner; and the Alexandrians, despairing of his ever being able to recover his liberty, raised to the throne his younger brother, who took the name of Euergetes II., but was afterwards called Physcon, on account of the prominent abdominal rotundity which by his gluttony and sensual indulgence he had acquired. Physcon, however, was scarcely seated on the throne, when Antiochus Epiphanes, returning into Egypt, expelled him from that country, and restored the whole kingdom, except Pelusium, to Philometor. His design was to foment a war between the two brothers, that he might have an opportunity of seizing the kingdom for himself; and with this view he retained possession of the city of Pelusium, by which, as it formed the key of Egypt, he might at his pleasure enter the country. But Philometor, apprised of his design, invited Physcon to an accommodation, which was happily effected by their sister Cleopatra; and in virtue of the agreement then entered into, the brothers consented to reign jointly, and to oppose to the utmost of their power Antiochus, whom they considered as a common enemy. This family compact did not suit the views of the king of Syria, who invaded Egypt with a mighty army; but the Romans interfered, and prevented him from seizing on the country.

The two brothers were no sooner freed from the apprehensions of a foreign enemy than they began to quarrel with each other; and their differences soon reached such a height that the Roman senate interposed. But before the ambassadors employed to inquire into the merits of the cause could arrive in Egypt, Physcon had driven Philometor from the throne, and obliged him to quit the kingdom. On this the dethroned prince fled to Rome, where he was very kindly received by the senate, who immediately decreed his restoration. He was reconducted accordingly, and on the arrival of the ambassadors in Egypt, an accommodation between the two brothers was negociated. By this agreement Physcon was put in possession of Libya and Cyrene, and Philometor of all Egypt and the island of Cyprus; each of them being declared independent of the other in the dominion allotted to them. The treaty, as usual, was confirmed with oaths and sacrifices, and was broken almost as soon as made. Physcon was dissatisfied with his share of the dominions, and he therefore sent ambassadors to Rome to require that the island of Cyprus might be added to his other possessions. But this the ambassadors failed to obtain, and accordingly Physcon proceeded to Rome in person. His demand was evidently unjust, but the Romans, considering it as their interest to weaken the power of Egypt, without further ceremony adjudged to him the island in question.

Physcon set out from Rome along with two ambassadors; and having arrived in Greece on his way to Cyprus, proceeded to raise a number of mercenaries, with a design to sail immediately for that island and conquer it. But the Roman ambassadors having informed him that they were commanded to put him in possession of it by fair means, and not by force, he dismissed his army, and returned to Libya, whilst one of the ambassadors proceeded to Alexandria. Their design was to bring the two brothers to an interview on the frontiers of their dominions, and there to settle matters in an amicable manner. But the ambassador who went to Alexandria found Philometor averse to comply with the decree of the senate; and, in fact, he had recourse to so much evasion, that Physcon sent the other also to Alexandria, hoping that the joint persuasions of the two would induce Philometor to comply. But the king, after entertaining them at an immense charge for forty days, at last plainly refused to submit, and informed the ambassadors that he was resolved to adhere to the first treaty. Having received this answer, the Roman ambassadors departed, and were followed by others from the two brothers. The senate, however, not only confirmed the decree in favour of Physcon, but renounced their alliance with Philometor, and commanded his ambassador to leave the city in five days.

In the mean time the inhabitants of Cyrene having heard unfavourable accounts of Physcon's behaviour during the short time he reigned in Alexandria, conceived so strong an aversion to him, that it was resolved to exclude him from their country by force of arms. On receiving intelligence of this resolution, Physcon hastened with all his forces to Cyrene, where he overpowered his rebellious subjects, and established himself in the kingdom. But his vicious and tyrannical conduct soon estranged from him the minds of his subjects; and some of them, having entered into a conspiracy against him, fell upon him one night as he was returning to his palace, wounded him in several places, and left him for dead. This he laid to the charge of his brother Philometor, and, as soon as he had recovered, undertook another voyage to Rome, where he made his complaints to the senate, and showed them the scars of his wounds, accusing his brother of having employed the assassins from whom he had received them. Though Philometor was known to be a man of humane and mild disposition, and therefore unlikely to have been concerned in such an attempt, yet the senate, offended at his refusing to submit to their decree concerning the island of Cyprus, listened to this false accusation, and carried their prejudices so far as not only to refuse an audience to his ambassadors, but to order them to depart immediately from the city. At the same time they appointed five commissioners to conduct Physcon to Cyprus, and to put him in possession of that island; enjoining all their allies in those parts to supply him with forces for that purpose.

Physcon having by this means got together an army which appeared to be sufficient for the purpose, landed in Cyprus; but being there encountered by Philometor in person, he was entirely defeated, and obliged to shelter himself in a city called Lapitho, where he was closely besieged, and at last obliged to surrender. Every one now expected that Physcon would have been treated as he deserved; but instead of punishing, his brother restored him to the government of Libya and Cyrene, adding some other territories instead of the island of Cyprus, and promising him his daughter in marriage. Thus an end was put to the war between the two brothers; the Romans being ashamed any longer to oppose a prince who had given such a signal instance of justice and clemency.

On the death of Philometor, occasioned by wounds received in battle, Cleopatra the queen intended to secure the throne for her son. But some of the principal nobility having declared for Physcon, a civil war was about to ensue, when matters were compromised on condition that Physcon should marry Cleopatra, that he should reign jointly with her during his life, and that he should declare her son by Philometor heir to the crown. These terms were no sooner agreed to than Physcon married Cleopatra, and on the very day of the nuptials murdered her son in her arms. But this bloody deed was only a prelude to the cruelties which he afterwards practised on his subjects. He was no sooner seated on the throne as sole occupant than he put to death all those who had shown any concern for the murder of the young prince: he then wreaked his fury on the Jews, whom he treated more like slaves than subjects, on account of their having favoured the cause of Cleopatra; and even his own people were treated with little more ceremony. Numbers were every day put to death for the smallest faults, and often for no fault at all, but merely to gratify the inhuman temper of this tun-bellied despot. Towards the Alexandrians he acted with the greatest barbarity, indulging all the sanguinary caprices of the most wanton cruelty. In a short time, being wearied of his queen, who was his sister, he divorced her, and married her daughter, also called Cleopatra, whom he had previously ravished. In a word, his behaviour was so exceedingly wicked that it soon became quite intolerable to his subjects; and he was at length obliged to fly to the island of Cyprus with his new queen, and Memphitis, a son whom he had had by her mother.

After the flight of the king, the divorced queen was placed on the throne by the Alexandrians; but Physcon, fearing lest a son whom he had left behind should be appointed king, sent for him into Cyprus, and caused him to be murdered as soon as he landed. This barbarity so provoked the people against him, that they pulled down and dashed to pieces all the statues which had been erected to him at Alexandria. The indignant act of the people being attributed by the tyrant to the instigation of the queen, he resolved to revenge it, by putting to death the son whom he had by her. Accordingly, without the least remorse, he caused the young prince's throat to be cut; and having put his mangled limbs into a box, he sent them as a present to his mother Cleopatra. The messenger by whom this horrid present was conveyed was one of Physcon's guards; and the man had orders to wait until the arrival of the queen's birth-day, which was to be celebrated with extraordinary pomp, and in the midst of the general rejoicing to deliver the present. The horror and detestation occasioned by this unexampled piece of cruelty cannot be expressed. An army was soon raised, and the command of it given to Marsyas, whom the queen had appointed general, and enjoined to take all the necessary steps for the defence of the country. On the other hand, Physcon having hired a numerous body of mercenaries, sent them under the command of Hegelochus against the Egyptians. The two armies met on the frontiers of Egypt, and a bloody battle ensued; but at last the Egyptians were entirely defeated, and Marsyas was taken prisoner. Every one expected that the captive general would have been put to death with the greatest torments; but Physcon, perceiving that his cruelties only exasperated the people, resolved to try whether he might not regain their affections by lenity; and therefore, having pardoned Marsyas, he set him at liberty. In the mean time Cleopatra, distressed by this overthrow, demanded assistance from Demetrius king of Syria, who had married her eldest daughter by Philometor, at the same time promising him the crown of Egypt as his reward. Demetrius accepted the proposal without hesitation, marched with all his forces into Egypt, and laid siege to Pelusium. But as this prince was no less hated in Syria than Physcon was in Egypt, the people of Antioch, taking advantage of his absence, revolted against him, and were joined by most of the other cities in Syria. Demetrius was accordingly obliged to return; and Cleopatra, being now in no condition to oppose Physcon, fled to Ptolemais or St Jean d'Acre, where her daughter the queen of Syria at that time resided. Physcon was then restored to the throne of Egypt, which he enjoyed without further molestation till his death, which happened at Alexandria, in the twenty-ninth year of his reign, and sixty-seventh of his age.

Physcon was succeeded by Ptolemy Lathyrus, about a hundred and twenty-two years before Christ; but the latter had not reigned long when his mother, finding that he would not be entirely governed by her, stirred up the Alexandrians, who drove him from the throne, and placed on it his youngest brother Alexander. After this Lathyrus was obliged to content himself with the government of Cyprus, which he was still permitted to hold. But Ptolemy Alexander, finding that he was to have only the shadow of sovereignty, whilst his mother Cleopatra possessed all the power, stole away privately from Alexandria. The queen knowing well that the Alexandrians would never suffer her to reign alone, employed every artifice to bring back her son, who at last yielded to her entreaties; but soon afterwards understanding that she had hired assassins to dispatch him, he caused her to be murdered. The death of the queen was no sooner made known to the Alexandrians than, disdaining to be governed by a parricide, they drove out Alexander, and recalled Lathyrus.

The deposed prince for some time led a rambling life in the island of Cos; but having got together a few ships, he the next year attempted to return into Egypt, when, being met by Tyrrhus, admiral of Lathyrus, he was defeated, and obliged to fly to Myra in Lycia. From this place he steered his course towards Cyprus, hoping that the inhabitants would place him on the throne instead of his brother; but Chareas, another admiral of Lathyrus, having come up with him just as he was about to disembark, an engagement ensued, in which Alexander's fleet was dispersed, and he himself killed. During these disturbances, Appion king of Cyrenaica, the son of Ptolemy Physcon by a concubine, having maintained tranquillity in his dominions during a reign of twenty-one years, died, and by his will left his kingdom to the Romans; a bequest by which the Egyptian empire was still further reduced and circumscribed.

Lathyrus being now freed from all competitors, turned his arms against the city of Thebes, which had revolted against him, and declared itself independent. The king marched in person against the insurgents, and, having defeated them in a pitched battle, laid siege to the ancient metropolis of Egypt. The inhabitants, however, defended themselves with great resolution for three years; but at last they were obliged to submit, and the city was given up to be plundered by the soldiery, who everywhere left the most melancholy traces of their rapine and cruelty. This calamity completed the destruction of Thebes, which until that time, notwithstanding all it had suffered under the Persians, was a place of wealth and consequence; but by the barbarous and vindictive policy of Lathyrus, the venerable city was reduced to a heap of ruins. Its fate was indeed peculiarly hard. First Memphis, and then Alexandria, had arisen to obscure its ancient splendour, and to attract each into its own bosom the wealth and population of the country; nor is it to be wondered that the citizens of Thebes should have evinced a desire to recover some share of the distinction of which they had been gradually deprived, and to secure to the Egyptians a seat of government at a greater distance from the arms and intrigues of warlike neighbours. But they paid dear for the attempt to establish their independence, and the overthrow of Thebes, begun by the Persian, was completed by the Greek.

About eighty-one years before Christ, Ptolemy Lathyrus was succeeded by Alexander II., the son of the Ptolemy Alexander for whom Lathyrus had been expelled. This prince had met with many adventures. He was first sent by Cleopatra into the island of Cos, with a great sum of money, and all her jewels. But when Mithridates king of Pontus made himself master of that island, the inhabitants delivered up to him the young Egyptian prince, together with all the treasures. Mithridates gave him an education suitable to his birth; but Alexander, not thinking himself safe with a prince who had shed the blood of his own children, fled to the camp of Sylla the Roman dictator, who was then making war in Asia Minor. From that time he lived in the family of the Roman general, till the news of the death of Lathyrus reached Rome. Sylla then sent him to Egypt in order to take possession of the throne. But as the Alexandrians had before his arrival chosen Cleopatra as their sovereign, it was agreed, by way of compromise, that Ptolemy should marry this queen, and admit her as his partner in the throne. This was accordingly done; but it proved a fatal marriage to Cleopatra, for nineteen days thereafter the unhappy queen was murdered by her husband. Nor did the cruelty of the royal barbarian cease with the commission of this horrid crime. During the fifteen subsequent years he showed himself such a monster of wickedness, that a general insurrection at length broke out amongst his subjects, and he was obliged to fly to Pompey the Great, who was then carrying on the war against Mithridates king of Pontus. But Pompey having refused to concern himself in the matter, he retired to the city of Tyre, where he died some months afterwards.

While he remained at Tyre a sort of prisoner, Alexander sent ambassadors to Rome, in order, if possible, to move the senate in his favour. But having been seized with the illness of which he died, before the negotiation was concluded, he, by his last will, made over all his rights to the Roman people, declaring them heirs to his kingdom; not out of any affection to the republic, but with the view of raising disputes between the Romans and his rival Auletes, a son of Ptolemy Lathyrus, whom the Egyptians had placed on the throne. The will was brought to Rome, where it occasioned warm debates, some being for taking immediate possession of the kingdom, whilst others thought that no notice whatever should be taken of such a will, because Alexander had not the right to dispose of his dominions in prejudice of his successor, and to exclude from the crown those who were of the royal family of Egypt. Cicero, in particular, represented that such a notorious imposition would debase the majesty of the Roman people, and involve them in endless wars and disputes; that the fruitful fields of Egypt would be a strong temptation to the avarice of the people, who would insist on their being divided; and that by this means the sanguinary quarrels about the agrarian laws would be revived. These reasons had some weight with the senate; but what chiefly prevented them at this time from seizing on Egypt was, that they had lately taken possession of the kingdom of Bithynia in virtue of the will of Nicomedes, and of Cyrene and Libya in consequence of that made by Appion. They perceived that if they should, on a similar pretence, take possession of the kingdom of Egypt, this might expose their design of setting up a kind of universal monarchy, and cause a formidable combination to be formed against them.

Auletes, who now assumed and disgraced the title of Ptolemy, surpassed all the princes who went before him in the effeminacy of his manners. The surname of Auletes was given him because he valued himself on his skill in performing upon the flute, and was not ashamed even to contend for the prize in the public games. He took great pleasure in imitating the manners of the Bacchanals; he danced in a female dress, in the same measures which were used during the festivals of Bacchus; and he acquired a second surname descriptive of this particular accomplishment. As his title to the crown was disputable, the first care of Auletes was to get himself acknowledged by the Romans, and declared their ally; and this was obtained by applying to Julius Cæsar, who was then consul, and immensely in debt. Cæsar, glad of such an opportunity of raising money, made the Egyptian king pay dear for his alliance. Six thousand talents, a sum equal to about L.1,162,500 sterling, were paid partly to Cæsar himself, and partly to Pompey, whose interest was necessary for obtaining the consent of the people. Though the revenues of Egypt amounted to twice this sum, yet it was raised with great difficulty, and occasioned general discontent; and whilst the people were almost ready to take up arms, a decree passed at Rome for seizing the island of Cyprus. When the Alexandrians heard of the intentions of the republic, they pressed Auletes to demand that island as an ancient appendage of Egypt; and, in case of a refusal, to declare war against that haughty and imperious people, who, they now saw, though too late, aimed at nothing less than the sovereignty of the world. But the king having refused to comply with this request, his subjects, already provoked beyond measure at the taxes with which they were loaded, flew to arms, and surrounded the palace. The king, however, had the good fortune to escape their fury, and having immediately quitted Alexandria, set sail for Rome.

But on his arrival in the metropolis of the world he found that Cæsar, in whom he placed his greatest confidence, was then in Gaul. He was, however, received with great kindness by Pompey, who assigned him an apartment in his own house, and omitted nothing in his power to serve him. But notwithstanding the protection of so powerful a man, Auletes was forced to go from house to house soliciting the votes of the senators; and after he had spent immense treasures in procuring, or rather in purchasing, a strong party in the city, he was at last permitted to lay his complaints before the senate. It would have cost him less, and reflected more honour on his character, had he followed the advice given him by Cato, who, having met the fugitive prince at Cyprus, advised him to return to Egypt, and endeavour by more equitable conduct to regain the affections of his people, instead of repairing to Rome, where all the riches of Egypt would not be sufficient to satisfy the rapacity of the leading men. At the same time there arrived an embassy from the Alexandrians, consisting of a hundred citizens, who had been deputed to make the senate acquainted with the reason of their revolt.

When Auletes first set out for Rome, the Alexandrians, not knowing what had become of him, placed on the throne his daughter Berenice, and sent an embassy into Syria, to Antiochus Asiaticus, inviting him to come into Egypt to marry the queen, and to reign in partnership with her. Before the arrival of the ambassadors, however, Antiochus had died, upon which the same proposal was made to his brother Seleucus, who readily accepted it. This Seleucus is described by Strabo as monstrously deformed in body, and still more so in mind. The Egyptians nicknamed him Kybiosactes, or the Scullion; a sobriquet which seems to have fitted him entirely. Scarcely was he seated on the throne, when he gave a signal instance of his sordid and avaricious temper. Ptolemy Lagus had caused the body of Alexander the Great to be deposited in a sarcophagus of massive gold. This the royal Scullion seized upon; and thereby so provoked his wife Berenice that she caused him to be murdered. She then married Archelaus, high priest of Comana, in Pontus, who pretended to be the son of Mithridates the Great, but was, in fact, only the son of a general in the service of that illustrious monarch.

On hearing of these transactions, Auletes was not a little alarmed, especially when the ambassadors arrived, which he feared would overturn all the schemes in favour of which he had laboured and expended so much. The embassy was headed by Dion, a celebrated Academic philosopher, who had many powerful friends at Rome. But Ptolemy found means to get both him and most of his followers assassinated; and thus intimidated the rest to such a degree that they durst not execute their commission, nor, for some time, even demand justice for the murder of their colleagues. The report of so many murders, however, at last spread a general alarm. But Auletes, certain of the protection of Pompey, did not scruple to own himself the perpetrator of them; and though a prosecution was commenced against Ascitius, one of the assassins who had stabbed Dion, the chief of the embassy, and the crime was fully proved, yet the ruffian was acquitted by venal judges, who had all been bribed by Ptolemy. In a short time the senate decreed that the king of Egypt should be restored by force of arms; and all the great men in Rome were ambitious of this commission, which, they expected, would be attended with immense profit. Their contests on this occasion occupied a considerable time; and at last there was discovered a prophecy of the Sybil, which forbade the assisting an Egyptian monarch with an army. Ptolemy, therefore, wearied out with so long a delay, retired from Rome, where he had made himself generally odious, to the temple of Diana at Ephesus, there to await the decision of his fate. At this place he remained for a considerable time; but as he found that the senate came to no resolution, though he had solicited them by letters so to do, he at last, by Pompey's advice, applied to Gabinius, the proconsul of Syria, a man of most infamous character, and ready to undertake any thing for money. The application was successful; and, though it was contrary to an express law for any governor to go out of his province without positive orders from the senate and people of Rome, yet Gabinius ventured to transgress this law, upon condition of being well paid for his pains. As a recompense for his trouble, however, he demanded ten thousand talents; that is, about L.1,937,500 sterling. Glad to be restored on any terms, Ptolemy agreed to pay the sum demanded; but Gabinius refused to stir until he had received one half of it. This obliged the king to borrow it from a Roman knight called Caius Rabirius Posthumius, Pompey interposing his credit and authority for the payment of the principal sum and interest.

Gabinius now set out for Egypt, attended by the famous Mark Antony, who at this time served in the army under him. He was met by Archelaus, who since the departure of Auletes had reigned in Egypt jointly with Berenice, at the head of a numerous army; but the Egyptians were utterly defeated, and Archelaus taken prisoner in the first engagement. Gabinius might now have put an end to the war, but his avarice prompted him to dismiss Archelaus, on the latter paying a considerable ransom; after which, pretending that the captive had made his escape, fresh sums were demanded from Ptolemy for defraying the expenses of the war. For these sums Ptolemy was again obliged to apply to Rabirius, who lent him what money he wanted, on exorbitant interest; but at last Archelaus was defeated and killed, and thus Ptolemy again became master of all Egypt.

No sooner had Auletes regained possession of the throne, than he put to death his daughter Berenice, and oppressed his people by the most cruel exactions, in order to raise the money he had been obliged to borrow whilst in a state of exile. These oppressions and exactions the Egyptians bore patiently, being intimidated by the garrison which Gabinius had left in Alexandria. But notwithstanding the heavy taxes which Ptolemy laid on his people, it does not appear that he had any serious intention of paying his debts. Rabirius, who, as we have already observed, had lent him immense sums, finding that the king affected delays, undertook a voyage to Egypt in order to expostulate with him in person. But Ptolemy paid little regard to his expostulations, and excused himself on account of the bad state of his finances, at the same time offering to make Rabirius collector-general of his revenues, in order that, whilst thus employed, he might indemnify himself. The unfortunate creditor accepted the employment, in the hope of recovering his debt; but soon afterwards, upon some frivolous pretence or other, Ptolemy caused him and all his servants to be closely confined. This base conduct exasperated Pompey as much as Rabirius; for the former had been in a manner security for the debt, as the money had been lent at his request, and the business transacted at his country house near Alba. However, as Rabirius had reason to fear the worst, he seized the first opportunity of making his escape, glad to escape with life from a debtor at once so faithless and cruel. To complete his misfortunes, he was prosecuted at Rome as soon as he returned, first, for having enabled Ptolemy to corrupt the senate with sums lent him for that purpose; secondly, for having debased and dishonoured the character of a Roman knight, by farming the revenues, and becoming the servant of a foreign prince; and, thirdly, for having been an accomplice with Gabinius, and sharing with him the ten thousand talents which that proconsul had received for his Egyptian expedition. But, by the eloquence of Cicero, Rabirius was acquitted; and one of the best orations to be found in the writings of that illustrious Roman was composed on this occasion. Gabinius was also prosecuted; and, as Cicero spoke against him, he very narrowly escaped death. He was, however, condemned to perpetual banishment, after having been stripped of all he was worth; and he lived in exile until the time of the civil wars, when he was recalled by Cæsar, in whose service he lost his life.

Auletes enjoyed the throne of Egypt about four years after his restoration, and at his death left his children under the tuition of the Roman people. Among the infants thus left to the protection of the republic were Cleopatra, who afterwards became so famous, and her brother Ptolemy Dionysius. As soon as these princes became of age, they were placed on the throne, and associated in the government; but their union was of short continuance, and each being supported by a numerous party, their dissensions soon terminated in a civil war. In this contest the queen was beaten, and compelled to seek refuge in Syria. But not long after her misfortune Julius Cæsar appeared in Egypt: his victory at Pharsalia had given him Rome, he was now undisputed master of the republic, and he had come to Egypt to complete his conquest by quelling the intestine commotions which had distracted that kingdom. Cleopatra lost no time in repairing to Alexandria, and having managed to obtain a secret interview with the Roman general, speedily secured his powerful favour by her arts and caresses. This able but profligate soldier immediately restored her to power, and issued a decree in the name of the senate, which in fact existed only in his own person, ordaining that Ptolemy Dionysius and his sister Cleopatra should be acknowledged as joint sovereigns of Egypt. This arrangement, however, displeased the partizans of the young king, who had recourse to a stratagem, by which Cæsar and his attendants narrowly escaped destruction. A war soon afterwards ensued; Ptolemy was defeated and killed; and the power of the Romans was established by the right of conquest, no less than by the title of guardianship.

In order to satisfy the prejudices of the Egyptians, Cleopatra was now provided with a colleague; and her youngest brother, then not more than eleven years of age, was placed beside her on the throne. Such an appointment could not possibly serve as any real restraint on the authority of the queen, or as a limitation of her power, although this was no doubt the object of the people in requiring it; but notwithstanding that the control thus established was in a great measure nominal, the apparent check was removed by the murder of the unhappy boy, who fell a victim to the remorseless jealousy which at the period in question inflamed, whilst it dishonoured, the descendants of Ptolemy Lagus. But the term of the dynasty which this great man had founded was now approaching. The murder of Julius Cæsar, and the subsequent defeat of Mark Antony, raised the fortune of Octavianus above all rivalry or competition, and at length invested him with the purple, as the acknowledged head of the Roman empire. Cleopatra, whose charms had enslaved the triumvir to his ruin, escaped by a voluntary death from the vengeance of the conqueror. Suspecting that he intended to degrade her, by assigning her a place in the train of captives who were to adorn his triumphal ascent to the capitol, the favourite of Cæsar and of Antony spared herself this ignominy by means of the friendly poison of an asp. With Cleopatra ended the line of the Greek sovereigns, and the descendants of Ptolemy Lagus, the founder of the Greek dynasty of Egypt, after having governed that country for the space of two hundred and ninety years.

From this time Egypt became a province of the Roman empire, and its history merged in that of the mighty people by whose lieutenants it was henceforth governed. Occasionally disturbed by intestine insurrections, and sometimes a prey to foreign war, it was nevertheless maintained against both domestic and external foes, until the decline of the Roman power under the successors of Augustus rendered it necessary to abandon the extremities in order to defend the heart of the empire, and to withdraw the legions from distant provinces in order to protect from the inroads of barbarians the countries situated on the Danube and the Tiber. In the beginning of the second century, the indefatigable Hadrian spent two years in Egypt, and during this stay laboured with his accustomed perseverance to revive among the natives a love of letters, and a taste for the beauties of architecture. At a somewhat later period, Severus made a similar visit to the land of the Pharaohs and Ptolemies, and, like his illustrious but eccentric predecessor, exerted himself to relieve the burdens and ameliorate the condition of the people; at the same time encouraging every attempt made to repair the ancient monuments, to replenish the libraries of Alexandria with books, and the museums with instruments and works of art, and, above all, to withdraw studious or contemplative minds from the dangerous and absurd pursuits of magic and judicial astrology. During the reigns of Claudius and Aurelian, Egypt was slightly agitated in consequence of the pretensions of Zenobia, queen of Tadmor or Palmyra, who, as a descendant of the Ptolemies, declared herself sovereign of Egypt, marched her armies to the frontiers of that country, and even gained some advantages over the Romans; but her troops being firmly opposed by the legions, at length sustained a total defeat, when the queen herself was taken prisoner and carried captive to Rome. At a subsequent period the Emperor Probus visited Egypt, where, under his auspices, many considerable works were executed; the navigation of the Nile was improved; and temples, bridges, porticos, and palaces were constructed, chiefly by the hands of the soldiers, who acted as engineers, architects, and common labourers. But on the division of the empire by Diocletian, Egypt fell into a very distracted state; Achilleus at Alexandria, and the Blemmyes, a savage race of Ethiopians, having defied the arms of Rome. Resolved to punish the insurgents, the emperor opened the campaign with the siege of Alexandria; he cut off the aqueducts which supplied the city with water, and, notwithstanding a vigorous resistance, pushed his attack with so much steadiness and effect, that at the end of eight months the besieged submitted to the mercy of the conqueror. Busiris and Coptos were even more unfortunate than Alexandria. These proud cities, one distinguished for its great antiquity, and the other remarkable for its riches, acquired by the transit of the commerce of India, having continued their resistance to the last, were carried by assault and utterly destroyed.

The introduction of Christianity into Egypt was attended by many excesses on the part of the people, and even by some commotions which endangered the stability of the government. The adherents of the ancient faith, the worshippers of Ammon, of Knouphis, and of Ptha, naturally resisted the exposure of their idols, the desecration of their temples, and the destruction of their most sacred monuments; whilst, on the other hand, the ministers of Christianity, with a zeal which far outran the limits of discretion, wantonly insulted the opinions of the idolaters, whose ignorance they disdained to enlighten, and sometimes set at defiance the authority of the civil magistrate, when interposed for the preservation of the public peace. But after the conversion of Constantine the spirit of Christianity grew milder as its ascendency became more certain, and the power of the church was effectually exerted, in co-operation with the provincial rulers, for supporting the rights of the empire, and repelling the inroads of barbarians; nor was it until a new religion sprung up in Arabia, and gave birth to a dynasty of warlike fanatics claiming a direct descent from the new Prophet, that Egypt, wrested from the hands of its European conquerors, was forced to receive more arbitrary masters, and to submit to a severer yoke.[1] At this era, when the crescent arose in its first splendour over the cross, we terminate our retrospect of the ancient history of Egypt.

SECTION II.

HISTORY OF MODERN EGYPT.

New Religion and new Conquest.—Islamism.—Its genius and character.—Progress of the Moslemin arms.—Conquest of Egypt by Amru.—Library of Alexandria burned by order of the Caliph Omar.—State of the country during the contests for the Caliphate.—Independent government established.—Achmed Ebn-Tolun and his immediate successors.—Dynasty of the Fatemite Caliphs.—Moez.—Abu-el-Mansur Barar.—Al Hakem.—Al Taher.—Al Mostanser Billah.—Proceedings and Rebellion of Bassasiri.—Defeated and killed by Togrol Beg.—Declension of the Empire of the Caliphs.—Famine and pestilence.—Intestine divisions.—Extinction of the Fatemite Caliphs.—Aladad.—Landing of the Crusaders in Egypt.—Alliance entered into between them and Shawer, Vizir of Aladad.—Nuroddin, prince of Syria.—Progress of the Crusaders.—Salah-eddin or Saladin.—Appointed Vizir by his uncle Nuroddin.—Usurps the sovereignty of Egypt.—Rebellion.—Crusade under William of Sicily.—Panic and Flight of his Army.—Damascus, Aleppo, and other places besieged and taken by Saladin.—His triumphal entry into Cairo.—Contests with the Crusaders in Palestine.—Saladin defeated.—A fleet of European ships in the Red Sea destroyed.—Great battle on the Jordan, where the Christians were defeated with prodigious slaughter.—Tiberias, Ptolemais, and other places surrendered to the Sultan.—Jerusalem also taken after a brave defence.—Loss sustained by the Christians.—Siege of Ptolemais.—Crusade under the Emperor of Germany.—Progress of the siege.—Arrival of Philip II. and Richard Cœur de Lion in the camp before Ptolemais.—Surrender of the place.—Battle of Ascalon, and defeat of Saladin.—Truce of three years, &c.—Death of Saladin.—Crusaders defeated.—Successors of Saladin.—Rise of the Mamlukes.—The Borghites, who also assumed the name of Mamlukes.—Defeated and nearly exterminated by Sultan Selim.—Form of government given to Egypt by the Sultan.—Powers conferred on the Beys.—The Mamlukes recover their ascendency, owing to the neglect of Egypt by the Turks.—Ibrahim Bey.—Ali Bey.—Syrian campaign of Ali.—His death and character.—Mohammed Bey.—Siege of Jaffa.—Pyramid of Heads.—Fall of Acre.—Death of Mohammed.—Ibrahim and Murad Beys.—Their mutual jealousies and disputes.—They agree to share the supreme power between them.—The expedition of Hassan Pasha, and re-establishment of the authority of the Porte.—Plague.—Return of Murad and Ibrahim from exile.—French Invasion of Egypt.—Origin and objects of this enterprise.—Battle of the Pyramids.—Battle of the Nile.—Bonaparte's expedition to Syria.—Jaffa.—St Jean d'Acre.—Siege of the latter place; defeat and return of Bonaparte to Egypt.—Battle of Aboukir, and destruction of a Turkish army.—Departure of Napoleon from Egypt.—Desaix's campaign in Upper Egypt.—Convention of El Arisch.—Assassination of Kléber.—Landing of the British under Sir Ralph Abercromby.—Battle of Alexandria.—Subsequent operations.—Capitulations of Cairo and Alexandria.—Policy of Great Britain in regard to Egypt.—The Beys.—Hassan Pasha.—His treacherous conduct.—Massacre of the Beys at Aboukir.—Remonstrances of the English.—Departure of the Capitan Pasha.—Kusruf.—Affairs of Egypt.—Battle of Damanhour, and defeat of Yussuf Bey.—Mehemmed Ali.—His origin and early history.—Circumstances of his rise.—Mutiny of the Albanians.—Taher Pasha.—His fall.—Mehemmed Ali and the Mamlukes.—Ali Gezaïrli.—Defeated by the Albanians and Mamlukes at Chalakan.—Projects of Mehemmed.—He foments discord among the Beys, whom he at length attacks.—Albanians ordered to return to their own country.—Mehemmed disobeys the mandate of the Porte, and is proclaimed Pasha by the people and the troops.—A body of Mamlukes enticed into Cairo and massacred.—State of affairs.—Arrival of Saleh the Capitan Pasha.—The Albanians and the people again declare in favour of Ali.—His formal investiture as Viceroy of Egypt.—The Mamlukes.—British expedition of 1807.—Affairs of Rosetta and El Hamad.—Disastrous result of the expedition.—State of affairs after the evacuation of Egypt by the British.—Position of Ali.—Destruction of the Mamlukes resolved on.—Dissimulation and treachery of the Viceroy.—General massacre of the Mamlukes.—Details of the butchery at the Citadel of Cairo.—Conduct of Mehemmed Ali throughout the affair.—Subsequent measures to complete their extermination.—The extinction of the Mamlukes as a body.—War with the Wahabis.—The Viceroy proceeds to Arabia.—Wahabis defeated.—Peace concluded.—Regular troops.—Views of the Viceroy.—Mutiny of the Albanians.—Change of system adopted.—War with the Wahabis renewed.—Capture of Derayeh, and severities of Ibrahim.—History of the formation of the Egyptian regular army.—Labours of Colonel Sèves and others.—Expedition to Upper Egypt, Dongola, and Sennaar.—Army augmented.—Capture of Mecca.—Actual force of the Egyptian army.—Schools and Colleges.—Pay, clothing, and condition of the troops.—Campaigns in the Morea.—Egyptian navy.—Its actual strength.—War with Turkey.—Campaigns in Syria, and beyond Mount Taurus.—Battle of Koniah.—Intervention of Russia.—Conclusion of Peace.—Character and designs of Mehemmed Ali.

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[1] Russell's *Egypt*, pp. 91-95.

We come now to the birth of a new religion, and we also approach the era of a new conquest. Islamism, which originated in a free and warlike nation, breathed the fiercest intolerance, and enjoined the destruction of infidels. Unlike the founder of the Christian religion, who, being a simple preacher, exercised no power upon earth, Mahommed became a king, and having declared that the whole universe ought to be subjected to his sway, commanded his followers to employ the sabre to destroy the idolater and the infidel, an injunction which they were not slack in obeying. The idolaters of Arabia were soon converted or exterminated; the infidels in Asia, in Syria, and in Egypt were attacked and conquered. As soon as Islamism had triumphed at Mecca and Medina, it served as a rallying point to the different Arab tribes, who were all imbued with the fanatical spirit; and the result was, that a whole nation, actuated by one fierce impulse, precipitated itself upon its neighbours. The progress of the Arabs therefore was rapid and irresistible. Inflamed by fanaticism, their armies at once attacked the Roman empire and that of Persia. The latter was speedily subjugated; the Moslemins penetrated as far as the Oxus, obtained possession of innumerable treasures, destroyed the empire of Chosroes, and pushed their conquests beyond the limits of Persia. In Syria, the victories which they gained at Aiquadiah and Dyrmonk put them in possession of Damascus, Aleppo, Amasia, Cæsarea, and Jerusalem. By the capture of Pelusium and Alexandria they rendered themselves masters of Egypt, now wholly Coptic, and decidedly separated from Constantinople through heretical dissensions.

The conquest of this country was effected, in name of the Caliph Omar, by his able and politic general Amru Ebn-el-As. About the same time the famous library of Alexandria, which had been founded by the great Ptolemy, and which now formed the grand repository of ancient learning and science, fell a prey to the religious fanaticism of the conquerors. If, said the Caliph Omar, in ordering it to be consigned to the flames, if this library contains only what is in the Koran, it is useless; if it contains any thing else, it is dangerous. It must be confessed, that the spirit of destruction has seldom provided itself with a more convenient or comprehensive principle of self-justification. But this fact, and many others of the same nature, ought not to make us forget what we owe to the Arabian caliphs, the successors of Omar, who, so far from being actuated by such barbarous hostility to science, were constantly engaged in extending the sphere of human knowledge, and in embellishing society by the charms of their literature.[1]

The conquest of Amru, though it laid the foundation of the Saracen power in Egypt, still left that country in an unsettled state; whilst the frequent contentions for the honours of the caliphate, which ensued during the ninth century, occasionally afforded it opportunities of asserting and attempting to re-establish its independence.

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[1] Napoleon's *Memoirs*, vol. ii. EGYPT, *Religion*. It is nevertheless possible that the successors of Mahommed may have been at first apprehensive lest the Arabs should suffer themselves to be enervated by the arts and the sciences, which were carried to so high a pitch in Egypt, Syria, and the Lower Empire. They had before their eyes the decline of the empire of Constantine, owing partly to perpetual discussions, scholastic and theological; and it is probable that this spectacle had prejudiced them against most libraries, which, in fact, were principally filled with books of this kind. But whatever may have been the immediate cause of the act which conferred such unenviable distinction on the name of Omar, it is certain that the Arabs were, for five hundred years, the most enlightened nation of the world. It is to them we are indebted for our system of numeration, our organs, solar quadrants, pendulums, and watches; and nothing can be more elegant, ingenious, or moral, than the literature which flowed from the pens of the writers of Bagdad and Bassora. (*Memoirs*, ubi supra.)

But no sooner had the struggle for supreme power been terminated by arms or by treaty, than the land of Mizraim, the inheritance of the Pharaohs and the Ptolemies, was again compelled to receive the law from the conqueror. In the year 889, an independent government was established in Egypt by Achmed Ebn-Tolun, who had rebelled against Al Mokhadi, caliph of Bagdad; and it continued to be governed by him and his successors for twenty-seven years, when it was again reduced by Al Moktasi, who had succeeded to the caliphate. In about thirty years afterwards we find it again an independent state, united with Syria under Mahommed Ebn-Taj, who had been appointed governor of these provinces. But this government was also short lived; for in the year 968 Egypt was conquered by Jawhar, general of Moez Ledinillah, Fatemite caliph of Kairwan in Barbary.

No sooner had Moez received information of the success of his general, than he prepared to take possession of his new conquest. He ordered all the gold which he and his predecessors had amassed, to be cast into ingots, and conveyed on camels' backs into Egypt; and, in order to show his determination to abandon his dominions in Barbary, and to make Egypt the place of his residence, he caused the remains of the three former princes of his race to be removed from Kairwan, and deposited in a mosque erected for that purpose in Kahira, or the City of Victory, the Grand Cairo of latter times. In order the more effectually to establish himself in his new dominions, and to fortify his conquest by all the force of religion, he suppressed the usual prayers offered up in the mosques for the caliphs of Bagdad, and substituted his own name in their stead; and this was complied with not only in Egypt and in Syria, but even throughout all Arabia, the holy city of Mecca alone excepted. The unity of Islamism was thus interrupted, and a schism originated, which continued for upwards of two hundred years, and was productive of continual anathemas, and sometimes destructive wars between the caliphs of Bagdad and of Egypt. Having thus fully established himself in his conquest, Moez died in the forty-fifth year of his age, three years after he had left his dominions in Barbary, and was succeeded by his son Abu-el-Mansur Barar, surnamed Aziz-Billah.

The new caliph having ascended the throne at the age of twenty-one, committed the management of affairs entirely to the care of Jawhar, his father's general and prime minister; and in 978 the latter proceeded to drive out Al Aftekin, the emir of Damascus; but at the end of two months the Egyptian general, who had laid siege to that city, was obliged to raise it, on the approach of an army under the command of Al Hakem, which, not being strong enough to engage in battle, he could not prevent from effecting a junction with the forces of Al Aftekin. He therefore retreated with the utmost expedition towards Egypt; but being overtaken by the two confederate armies, he was soon reduced to the last extremity, and only permitted to resume his march on condition of passing under Al Aftekin's sword and Al Hakem's lance. To this humiliating condition Jawhar was obliged to submit; and on his arrival in Egypt he advised Al Aziz to undertake an expedition in person against the combined army under the command of Al Aftekin and Al Hakem. The caliph followed his advice; and having advanced against his enemies, overthrew them with great slaughter, at the same time making Al Aftekin prisoner. Jawhar was afterwards disgraced, and died A. D. 990, and of the Hegira 381. About this time, also, Al Aziz having received intelligence of the death of the prince of Aleppo, sent a formidable army to reduce that place. But Lulu, who had been appointed guardian to the prince's son, finding himself pressed by the Egyptians, demanded assistance from the Greek emperor, who accordingly ordered a body of troops to advance to his relief. Manjubekin, general of Al Aziz, being informed of their approach, immediately advanced to give them battle, and an obstinate engagement ensued, in which the Greeks were overthrown with great slaughter. Manjubekin then pushed on the siege of Aleppo; but meeting with more resistance than he had expected, and his provisions beginning to fail, he felt himself obliged to raise the siege. Enraged at this proceeding, the caliph threatened the general with vengeance, and commanded him to resume the siege. Manjubekin obeyed, and continued the siege for thirteen months, during which time the place was bravely defended by Lulu; but at last the Egyptians, hearing that a numerous army of Greeks was on its way to relieve the city, raised the siege, and fled with the utmost precipitation. The Greeks then took and plundered some of the cities possessed by Al Aziz in Syria; whilst Manjubekin made the best of his way to Damascus, where he set up for himself. Al Aziz, informed of this revolt, marched in person with a considerable army against the rebellious general; but being taken ill by the way, he expired, in the twenty-first year of his reign and forty-second of his age.

Al Aziz was succeeded by his son Abu-el-Mansur, surnamed Al Hakem, who, being only eleven years of age, was put under the tuition of a eunuch of approved integrity. This reign is only remarkable for the madness with which the caliph was seized towards its close. This first manifested itself by edicts alike absurd and tyrannical, and at length rose to such a height that he fancied himself a god, and no fewer than sixteen thousand persons were found to acknowledge him as such. They were mostly Dararians, a new sect which sprung up about this time, and were so called from their chief, Mohammed Ebn-Ismael, surnamed Darari, who is supposed to have inspired the mad caliph with this impious notion. Darari set up as a second Moses, and did not scruple to assert that Al Hakem was the creator of the universe; for which blasphemy he was stabbed in the caliph's chariot by the hand of a zealous Moslemin. The sect, however, did not expire with its author. A disciple of his named Hamza, being encouraged by the mad caliph, spread it far and wide throughout his dominions; all the Mahommedan fasts, festivals, and pilgrimages, including that to Mecca, were abolished; and the zealous Mahommedans became greatly alarmed, supposing that Al Hakem designed entirely to suppress the worship of the true God, and introduce his own in its stead. But from this apprehension they were delivered by the death of the caliph, who at the instigation of his own sister was assassinated, in the year 1020.

Al Hakem was succeeded by his son Al Taher, who reigned fifteen years, and left the throne to a son under seven years of age, named Al Mostanser-Billah. In the year 1041, a revolt happened in Syria; but Al Mostanser having sent a powerful army into that country, reduced the rebels, and considerably enlarged the Egyptian dominions in Syria. In 1054, an adventurer named Al Bassasiri, having quarrelled with the vizir of Al Kayem, caliph of Bagdad, fled to Egypt, and put himself under the protection of Al Mostanser, who thinking this a favourable opportunity for enlarging his dominions, supplied Bassasiri with money and troops, by which means he was enabled to possess himself of Arabian Irak, and to ravage that province to the very gates of Bagdad. Alarmed at the progress made by Bassasiri, Al Kayem applied for assistance to Togrol Beg, who possessing very extensive dominions in the East, immediately complied with this request, and soon arrived at Bagdad with a formidable army. But nothing of importance happened till the year 1058, when Bassasiri, having found means to excite Ibrahim the brother of Togrol Beg to revolt, the latter was obliged to employ all his force against him. This gave Bassasiri an opportunity of seizing on the city of Bagdad, where he caused Al Mostanser to be immediately proclaimed caliph. The imperial palace was also plundered, and the caliph himself detained a close prisoner. But this success was short lived. In the year 1059, Togrol Beg having defeated his brother Ibrahim, and taken him prisoner, caused him to be strangled with a bowstring. He then marched to Bagdad, which Bassasiri abandoned at his approach; upon which the caliph Al Kayem was delivered up and immediately restored to his dignity. Bassasiri again advanced against the city; but in a battle which took place between the army of Togrol Beg and that of Bassasiri, the latter was defeated and killed. Thus the hopes of Al Mostanser were entirely frustrated; and from this period we may date the declension of the Egyptian empire under the caliphs. They had made themselves masters of almost all Syria; but as soon as Bassasiri's defeat and death were known, Aleppo revolted, and several other places followed its example. Al Mostanser sent a powerful army against the rebels, but it was entirely defeated, and his general taken prisoner.

This disaster was soon followed by others still greater. In 1066 a famine raged over all Egypt and Syria, and multitudes of people died in Cairo from want of food. Nay, to such a degree of misery were the inhabitants reduced, not only in Cairo, but throughout all Egypt, that the carcasses of those who died were sold for food at an exorbitant price, and the most loathsome animals were greedily devoured by a famishing people. The famine, as usual, was followed by the plague; and this again by an invasion of the Turks under Abu Ali Al Hasan-Naserod'dawla, the general who had been sent against the rebel chief of Aleppo, and defeated by him. The caliph was besieged in his own palace; and being in no condition to make resistance, the unfortunate prince was obliged to buy himself off at the expense of every thing valuable left in his exhausted capital and treasury. This, however, did not prevent the merciless plunderers from ravaging all Lower Egypt from Cairo to Alexandria, and committing the most horrid excesses throughout the whole of that portion of the country.

These events happened in the years 1067 and 1068. In 1069 and 1070 there occurred two other revolts in Syria; so that this country was now almost entirely lost to Egypt. In 1095 the caliph Al Mostanser died, after a reign of sixty years, and was succeeded by his son Abul Kasem, surnamed Al Mostali. The most remarkable event of this prince's reign was his taking the city of Jerusalem from the Turks in 1098; but this success was of short duration, for the Holy City was the same year taken by the Crusaders.

From this time till the year 1164, the Egyptian history presents little else than a series of intestine broils and contests between the vizirs and prime ministers, who had in a great measure stripped the caliphs of their civil power, and left them nothing but a shadow of spiritual dignity. But these contests at last led to a revolution, by which the race of Fatemite caliphs was totally extinguished.

One Shawer, having overcome all his competitors, became vizir of Al Adad, or Aladad, the eleventh caliph of Egypt. But he had not been long in possession of office when Al Dargam, an officer of rank, endeavoured to deprive him of his dignity; upon which both parties had recourse to arms, and a battle ensued, in which Shawer was defeated, and obliged to throw himself on the protection of Nuroddin, prince of Syria. The latter having received the fugitive graciously, and promised to reinstate him in his office of vizir, Shawer, as an inducement to Nuroddin to assist him more powerfully, told him that the Crusaders had landed in Egypt, and made considerable progress in the conquest of that country; and added, that in the event of being reinstated in his office, he would pay Nuroddin annually the third part of the revenues of Egypt, and besides defray the whole expense of the expedition. Nuroddin bore an implacable hatred to the Christians, and the more readily undertook an expedition against them, that he was to be well paid for his holy zeal in defence of the true faith. He therefore sent an army into Egypt under the command of Shawer, assisted by a general named Asadoddin; and as Dargam had cut off many generals whom he imagined favourable to Shawer's interest, and had weakened the military force of the kingdom, he was easily overthrown by Asadoddin, who reinstated Shawer in the office of vizir. The faithless minister, however, no sooner saw himself established in office than he refused to fulfil his engagements with Nuroddin, and thus forced Asadoddin to seize on Pelusium and some other cities. Shawer then entered into an alliance with the Crusaders, and Asadoddin was besieged in Pelusium by the combined forces of the Christians and Infidels. But Nuroddin having invaded the Christian dominions in Syria, and taken a strong fortress called Harem, Shawer and his confederates hearkened to terms of accommodation, and Asadoddin was permitted to depart for Syria.

In the mean time, Nuroddin, having subdued the greater part of Syria and Mesopotamia, resolved to make the perfidious Shawer feel the weight of his resentment. He therefore sent Asadoddin back into Egypt with a force sufficient to compel Shawer to fulfil his engagements; but the vizir took care, before the arrival of Asadoddin, to acquit himself of the obligation he had come under, and thus for the present averted the threatened danger. But it was not long until he gave Nuroddin fresh occasion to send this general against him. That prince had now driven the Crusaders almost entirely out of Syria; but he was greatly alarmed at their progress in Egypt, and offended at the alliance which Shawer had concluded with them, and which he still persisted in observing. This treaty was also thought to be contrived on purpose to prevent Shawer from being able to fulfil his promise to Nuroddin, of sending him annually a third of the revenues of Egypt. Nuroddin, therefore, in 1166, again dispatched Asadoddin into Egypt with a sufficient force, attended by his nephew Salah-eddin, or Saladin, who afterwards became so celebrated. The invaders entered the kingdom without opposition, and having totally defeated Shawer and the Crusaders, made themselves masters of Alexandria, and overran all Upper Egypt. Saladin was left with a considerable garrison in Alexandria; but after the departure of Asadoddin the Crusaders laid siege to that city, and the Syrian general was obliged to return to its relief. But the losses he had sustained in his expedition induced him to agree to a treaty with Shawer, by which he engaged to evacuate Egypt upon being paid a sum of money. No sooner had Asadoddin withdrawn, however, than Shawer entered into a fresh treaty with the Franks, by which he was to attack Nuroddin in his own dominions, whilst engaged in quelling a revolt which effectually prevented his sending more forces into Egypt. This treaty so enraged the Syrian prince, that he resolved to suspend for a time his other ambitious projects, and exert his whole strength in the conquest of Egypt.

By this time, however, the Crusaders had reduced Pelusium, and made considerable progress in Egypt, as well as in some other countries, through the divisions which reigned amongst the Mahommedan princes. Their conquests were marked by barbarities of which Infidels might well have been ashamed. Christians as well as Mahommedans were put to the sword; their prisoners were sold as slaves; and the towns which they captured were given up to be pillaged by a licentious soldiery. From Pelusium they marched to Cairo, which was then in no posture of defence, and in the utmost confusion on account of the divisions which prevailed in it. But as soon as he heard of their approach, the vizir caused the ancient quarter of the town to be set on fire, whilst the inhabitants retired into the other districts; and he also prevailed upon the caliph to solicit the assistance of Nuroddin, which, in truth, the latter was much inclined of himself to grant, as it afforded him a fair opportunity both for driving the Crusaders out of Egypt, and for seizing the kingdom to himself. With this view he had already raised an army of 60,000 horse, and on receiving Aladad's message he instantly gave them orders to march. The Crusaders had now arrived before Cairo, and so closely invested that place, that neither Shawer nor the caliph were aware of the approach of the Moslemin army which was hastening to their relief. The vizir, therefore, finding it impossible to hold out for any length of time, had recourse to his old expedient of treaties and promises; he sent the enemy 100,000 dinars, and promised them 900,000 more, if they would agree to raise the siege; terms which, as they dreaded the approach of Asadoddin, were very readily accepted by the Crusaders. The army of Nuroddin now approached the capital by forced marches, and were everywhere received with demonstrations of joy. On his arrival at Cairo, Asadoddin was invited by Aladad to the royal palace, where he was entertained in the most splendid manner; nor were Saladin and the other principal officers less magnificently treated. Shawer, also, conscious of his perfidious conduct, was not less assiduous in his attentions. But as he was believed to have formed a scheme for having the general and his principal officers seized and murdered during an entertainment, his head was struck off, and Asadoddin was made vizir in his stead. The latter did not, however, long enjoy his new dignity; for he died some months after his instalment into office, and was succeeded by the illustrious nephew of Nuroddin.

Saladin, the new vizir, was the youngest of all the grandees who had aspired to that office, and he had already given signal proofs of his valour and conduct. The circumstances which determined the caliph to give him the preference over so many competitors are not known; but it is certain that some of them were highly displeased with his promotion, and even publicly declared that they would not obey him. In order, therefore, to gain over to his interest these disappointed aspirants, Saladin found it necessary to distribute amongst them part of the treasures left by his uncle; and by means of this powerful instrument of corruption he soon governed Egypt without control, as had been customary with the vizirs before his time. Soon after his instalment into office, he also defeated and dispersed the negro guards of the royal palace, who had opposed his election; and having placed a strong garrison in the castle or citadel of Cairo, his power became firmly established.

For some time there subsisted between Nuroddin and Saladin a good understanding, which contributed in no small degree to raise the credit of the latter with the Egyptians. But in 1169 Nuroddin sent him orders to omit the name of Aladad, the caliph of Egypt, in the public prayers, and to substitute that of the caliph of Bagdad in its stead. This was not only a bold, but a dangerous attempt, as it might produce a revolt in favour of Aladad; and even if it did not, it afforded Saladin an opportunity of engrossing what small remnant of power had been left to the caliph. But Aladad was not sensible of the disgrace intended him; for when Nuroddin's orders were received, he lay on his death-bed, past all hopes of recovery. On his demise, Saladin seized all his wealth and effects, consisting of jewels of prodigious size, sumptuous furniture, a library containing a hundred thousand volumes, and many other valuable possessions. He caused his family to be closely confined in the most retired part of the palace, and either manumitted his slaves, kept them for his own use, or disposed of them to others.

Saladin had now arrived at the highest pitch of wealth, power, and grandeur. He was, however, obliged to act with great circumspection towards Nuroddin, who still continued to treat him as his vassal, and insisted on the most implicit obedience to his commands. Saladin relied chiefly for counsel on his father Ayub, a consummate politician, who, ambitious of seeing his son raised to the throne of Egypt, advised him to continue stedfast in his resolutions, and, whilst he amused Nuroddin with feigned submissions, to take every method in his power to secure to himself the possession of so valuable a kingdom. Nuroddin himself, however, was too great a master in the art of dissimulation to be easily imposed on; and though he pretended to be pleased with Saladin's conduct, he was all the while busily occupied in raising a powerful army, with which he intended the following year to invade Egypt. But whilst he was meditating this expedition, he was seized at Damascus with a distemper which put an end to his life, in the year 1173.

Though thus freed from the apprehension of so formidable an enemy, Saladin durst not yet venture to assume the title of sovereign, more especially when he saw the successor of Nuroddin at the head of a powerful army, and not less desirous than able to dispossess him. His first care, therefore, was to secure to himself an asylum in case he should be obliged to abandon Egypt; and having accomplished this object by the conquest of a considerable portion of Arabia Felix, he assumed the title of sultan or sovereign of Egypt, and was acknowledged as such by the greater part of the states. The zeal of the Egyptians for the Fatemite caliphs, however, soon produced a rebellion. The governor of a city in Upper Egypt having assembled an army of blacks, and marched into the lower country, was there joined by great numbers of other Egyptians; but Saladin dispatched his brother Malek against the insurgents, who were entirely defeated and dispersed. This, however, did not prevent another insurrection under an impostor, who pretended to be a son of the last Fatemite caliph, and who had collected a body of 100,000 men; but before they had time to do much damage, they were surprised by the sultan's forces, and entirely defeated, with the loss of nearly three fourths of their whole number.

About this time Saladin gained a considerable advantage over the Crusaders under the command of William II. king of Sicily. That prince having invaded Egypt with a numerous army, supported by a powerful fleet, had invested Alexandria both by sea and land. Saladin flew to the relief of a place the preservation of which was of so much importance to the success of his future plans, and he had mustered a force which he deemed sufficient to justify him in risking a battle; but before he had time to make the necessary dispositions, the Crusaders, seized with a sudden panic, fled with the utmost precipitation, leaving all their military engines, stores, and baggage behind them.

In the year 1175, the inhabitants of Damascus, jealous of the minister who had the tuition of the reigning prince, and governed all with an absolute sway, entreated Saladin to assume the sovereignty of that city and its dependencies; and the application was no sooner made than the sultan set out with the utmost celerity to

Damascus, at the head of a chosen detachment of seven hundred horse. Having settled affairs in that city, he appointed his brother Saif Al Islam governor, and set out for Hems, which he immediately invested. Having also made himself master of this place, he then proceeded to Hamah, which soon surrendered; but the citadel held out for some time. Saladin pretended that he accepted the sovereignty of Damascus and the other places he had conquered, only as deputy to Almalek-el-Saleh, the successor of Nuroddin, who was then under age; and that he was desirous of sending Azzoddin, who commanded in the citadel, with a letter to Aleppo, where the young prince resided. This so pleased Azzoddin that he took the oath of fidelity to Saladin, and immediately set out with the sultan's letter. But he had not been long at Aleppo before he was thrown into prison by the minister's orders; upon which his brother, who had been appointed governor of the citadel of Hamah in his absence, delivered it up to Saladin. The sultan then marched to Aleppo with a design to reduce it; but being vigorously repulsed in several attacks, he was at last obliged to abandon the enterprise. At the same time, Kamschlegin, Almalek's minister, hired the chief of the Batanists, or Assassins, to murder the sultan, and several attempts were in consequence made on his life; but happily for Saladin all of them miscarried.

After raising the siege of Aleppo, Saladin returned to Hems, which the Crusaders had invested. On his approach, however, they thought proper to retire; and the sultan then made himself master of the castle, which before he had not been able to reduce. This was soon followed by the reduction of Baalbec. And these rapid conquests so alarmed the ministers of Almalek, that, entering into a combination with some of the neighbouring princes, they raised a formidable army, with which they hoped to crush the sultan at once. Saladin, however, dreading the event of a war, offered to cede to Almalek, Hems and Hamah, and to govern Damascus only as his lieutenant. But these terms were rejected, and a battle ensued, in which the allied army were utterly defeated, and the shattered remains of it shut up in the city of Aleppo. This produced a treaty, by which Saladin was left undisputed master of Syria, excepting only the city of Aleppo and the territory belonging to it.

In 1176, Saladin having returned from the conquest of Syria, made his triumphal entry into Cairo; and having allowed his troops some time for repose, he began to encompass the city with a wall of great extent, which however he did not live to complete. Next year he led a numerous army into Palestine to operate against the Crusaders. But here his usual good fortune deserted him. His army was entirely defeated; forty thousand of his best troops were left dead on the field; and the rest, having no towns in which they could find shelter, betook themselves to the desert between Palestine and Egypt, where the greater part of them perished from want of water. Even Saladin himself seemed to have been intimidated by this disaster: for in a letter to his brother he stated that he was more than once in the most imminent danger; and that God, as he apprehended, had delivered him from peril, in order to reserve him for the execution of some grand and important design.

In the year 1182, the sultan, at the head of a formidable army, set out on an expedition to Syria, amidst the acclamations of the people. He was, however, repulsed with loss both before Aleppo and Almasel, after having spent much time and labour in besieging these places. In the mean time a powerful fleet of European ships appeared in the Red Sea, and threatened the cities of Mecca and Medina. The news of this armament no sooner reached Cairo, than Abubekr, Saladin's brother, who had been left viceroy in the sultan's absence, caused another to be fitted out with all speed, under the command of Lulu, a brave and experienced officer, who sailed in quest of the enemy. A dreadful engagement ensued, but after an obstinate resistance the Christians were defeated, and the prisoners butchered in cold blood. This proved so severe a blow to the Europeans that they never again ventured to attempt any thing in this quarter.

In 1183 Saladin continued to extend his conquests. The city of Amida in Mesopotamia surrendered after a siege of eight days; and Aleppo, which he now attacked with better success than formerly, also capitulated. After the conquest of Aleppo, Saladin took three other cities, and then marched against his old enemies the Crusaders. Having sent out a party to reconnoitre the enemy, they fell in with a considerable detachment of Christians, whom they easily defeated, taking about a hundred prisoners, with the loss of only a single man on their side. Animated by this first instance of success, the sultan drew up his forces in order of battle, and advanced against the Crusaders, who had assembled their whole army at Sephoris in Galilee. On viewing the sultan's troops, however, and perceiving that they were greatly superior in strength to what had at first been apprehended, the Christian leaders declined an engagement, nor could Saladin, with all his skill and address, force them to accept battle. But though it was found impossible to bring the Crusaders to a decisive engagement, Saladin found means to harass them greatly, and destroyed great numbers of their men; he also carried off many prisoners, dismantled three of their strongest cities, laid waste their territories, and concluded the campaign with the capture of another strong town. For three years Saladin continued to gain ground on the Crusaders, yet without obtaining any decisive advantage; but in 1187 the fortune of war turned completely against the soldiers of the Cross.

The Christians in fact now found themselves obliged to venture a battle, on account of the ravages which the sultan committed on their territories, and the encroachments which he daily made on all sides. Both armies therefore resolved to exert their utmost efforts, and a fierce and bloody battle ensued. Night prevented victory from declaring for either side; but the fight was renewed with equal obstinacy next day, and the contest still remained undecided. On the third day the sultan's men, finding themselves surrounded by the enemy on all sides but one, and on that also hemmed in by the river Jordan, so that all retreat was cut off, fought with the courage of despair, and at last gained a complete victory. Vast numbers of the Christians perished on this bloody field. A large body indeed succeeded in retiring to the top of a neighbouring hill covered with wood; but Saladin's troops having surrounded the hill, set fire to the wood, and obliged them to surrender at discretion. Some of the captives were butchered as soon as they had delivered themselves into the hands of the enemy; and others, amongst whom were Lusignan the king of Jerusalem himself, Arnold prince of Alshabek and Alkarak, the masters of the Templars and Hospitallers, and almost the whole body of the latter, were thrown into irons. So great was the consternation which this sad reverse produced amongst the Christians, that one of Saladin's men is said to have taken thirty of them prisoners, and tied them together with the cord of his tent, to prevent them from making their escape. The masters of the Templars and Hospitallers, with the knights acting under them, were brought into Saladin's presence, when he instantly ordered them to be cut in pieces. He called these warlike monks assassins or batanists; and he had been accustomed to pay fifty dinars for the head of every Templar or Hospitaller which was brought him. After the engagement Saladin seated himself in a magnificent tent, and placing the king of Jerusalem on his right hand, and Arnold prince of Alkarak on his left, he drank to the former, who was at that time ready to expire from thirst, and at the same time offered him a cup of snow water, which was thankfully received. The king then drank to the prince of Alkarak, who sat near him. But Saladin interrupted him with some warmth: "I will not," said he, "suffer this cursed rogue to drink; for that, according to the laudable and generous custom of the Arabs, would secure to him his life." Then turning towards the prince, he reproached him with having undertaken the expedition whilst in alliance with himself, and also with having intercepted an Egyptian caravan in the time of profound peace, and massacred the people of whom it was composed. But notwithstanding this, the sultan offered to grant him his life if he would embrace Mahommedanism. The disgraceful condition was however rejected, and the sultan, with one stroke of his scimitar, cut off the prince's head. This summary proceeding naturally alarmed the king of Jerusalem; but Saladin assured him he had nothing to fear, and that Arnold had brought his fate on himself by his want of common honesty.

The Crusaders being thus totally defeated and dispersed, Saladin next laid siege to Tiberias, which in a short time capitulated. He then marched towards Acca or Ptolemais, which likewise surrendered after a short siege. Here he found four thousand Mahommedan prisoners in chains, whom he immediately released; and as the inhabitants carried on a very extensive trade, he also discovered there not only vast sums of money, but likewise a great variety of valuable merchandise, all of which he seized and applied to his own use. About the same time his brother Almalek attacked and took a very strong fortress in the neighbourhood; after which the sultan divided his army into three bodies, that he might with the greater facility overrun the territories of the Christians, and thus in a short time made himself master of Neapolis, Cæsarea, Sephoris, and other cities in the neighbourhood of Ptolemais. His next conquest was Joppa, which was taken by assault after a vigorous resistance. Saladin then marched in person against Tebrien, a strong fortress in the neighbourhood of Sidon, which was also taken by assault after a siege of six days, razed to the ground, and the garrison put to the sword. From Tebrien the victorious sultan proceeded to Sidon itself, which surrendered almost on the first summons. Berytus was next invested, and yielded to the conqueror in seven days.

Saladin, proceeding with his conquests, made himself master of Ascalon after a siege of fourteen days, and then invested the city of Jerusalem. The garrison was numerous, and made an obstinate defence; but Saladin having at last made a breach in the walls by sapping, the besieged desired to capitulate. This was at first refused; but a strong representation having been made by the Christian ambassador, who threatened that if an honourable capitulation was refused them, the garrison would kill their wives and children, massacre their prisoners, commit their property to the flames, and then sally out and sell their lives as dearly as possible, Saladin immediately called a council of war, at which the general officers to a man declared it as their opinion that it would be most prudent to allow the Christians to depart unmolested. They judged according to the maxim which recommends that a bridge of gold should be made for a flying or a desperate enemy. The sultan therefore allowed the garrison to march out freely with their wives, children, and effects, upon receiving ten dinars from every man capable of paying that sum, five from every woman, and two from every young person under age; whilst for the poorer class who were unable to pay any thing, the rest of the inhabitants contributed the sum of thirty thousand dinars.

Most of the inhabitants of Jerusalem were escorted by a detachment of Saladin's troops to Tyre; and soon afterwards he advanced with his army against that place. As the port was blockaded by a squadron of five men of war, Saladin imagined that he might easily become master of it; but in this he found himself mistaken; for one morning at day-break a Christian fleet fell upon his squadron, and so entirely defeated it that not a single vessel succeeded in effecting its escape. About the same time Saladin himself was vigorously repulsed by land; and after calling a council of war, it was thought proper to raise the siege.

In 1188, Saladin, though his conquests were not so rapid and considerable as they had hitherto been, continued still superior to his enemies. He reduced the city of Laodicea and some other places, besides many strong castles; but he met also with several repulses. At length he took the road to Antioch; and having reduced all the fortresses, many of them deemed impregnable, which lay in his way, he intimidated Bohemond prince of Antioch so much that the latter desired a truce for seven or eight months; a request which, on account of the prodigious fatigues his men had undergone, and the circumstance of his auxiliaries now demanding leave to return home, Saladin was forced to comply with.

The heavy losses they had sustained, however, proved in some respects an advantage to the Christians, as they were thus obliged to lay aside those animosities which had proved the ruin of their affairs, and to act with more concert and unanimity. The brave men who had defended Jerusalem, and most of the other fortresses taken by Saladin, having retreated to Tyre, formed there a very numerous body; a circumstance which proved the means of preserving that city, and also of re-establishing their affairs. Accordingly, having received powerful reinforcements from Europe, they were enabled, in 1189, to take the field with thirty thousand foot and two thousand horse. Their first attempt was upon Alexandretta, whence they dislodged a strong body of Mahommedans, and then made themselves masters of the place with but little loss. They next laid siege to Ptolemais; but Saladin, as soon as he received intelligence of the fact, lost no time in marching to the relief of that place. After several skirmishes a general engagement followed, in which the soldan was defeated with the loss of ten thousand men. This enabled the Christians to carry on the siege with greater vigour; but so little acquainted were they with the methods of attacking strong places, that Ptolemais was enabled for two years to resist all their efforts, and was at last reduced rather by famine than by active warfare or military force.

This year the sultan was greatly alarmed on receiving intelligence that the emperor of Germany was advancing to Constantinople with an army of two hundred and sixty thousand men, in order to assist the other Crusaders. This prodigious armament, however, came at last to nothing. The multitude was so reduced by sickness, famine, and fatigue, that scarcely a thousand men reached the camp before Ptolemais. But the siege of that city was continued, though without success on the part of the Christians. They were repulsed in all their attacks; their engines were burnt with naphtha; and the besieged received supplies of provisions in spite of the utmost efforts of the besiegers, at the same time that famine and pestilence raged in the Christian camp, sometimes carrying off two hundred persons a day. But in 1191 the Christians received powerful succours from Europe. Philip II. of France, and Richard I. of England, surnamed *Cœur-de-Lion*, arrived in the camp before Ptolemais. The latter was esteemed the bravest and most enterprising of all the chiefs of the Crusade; and the spirits of the soldiers were greatly elated by the thoughts of acting under such an experienced commander. Soon after his arrival the English sunk a Mahommedan ship of large size, having on board upwards of six hundred soldiers, and a great quantity of arms and provisions, which was proceeding from Berytus to Ptolemais. Of the soldiers and the sailors who navigated this vessel, only a single person escaped, who, being taken prisoner by the English, was dispatched to the sultan with the news of the disaster. But the besieged still defended themselves with great resolution; and the king of England happening to fall sick, the operations of the besiegers were considerably delayed. On his recovery, however, the attacks were renewed with such fury that the place was every moment in imminent danger of being taken by assault. But although Saladin was informed of the condition to which it was reduced, and although it formed his principal magazine of arms, he found it impossible to march to its relief; and the inhabitants were therefore under the necessity of surrendering the place. One of the terms of the capitulation was, that the Crusaders should receive a very considerable sum of money from Saladin, upon the condition of their delivering up the Mahommedan prisoners they had in their hands; but Saladin refused to ratify this article, and, in consequence of his refusal, three thousand of those unfortunate men were slaughtered at once by orders of the king of England.

After the reduction of Ptolemais, Richard, now appointed generalissimo of the Crusaders, took the road to Ascalon, in order to besiege that place; after which he intended to make an attempt to recover Jerusalem. Saladin proposed to intercept him on his advance, and with this view placed himself in the way with an army of three hundred thousand men. On this occasion was fought one of the greatest battles of that age, or indeed of any other. After a terrible conflict, Saladin was totally defeated, with the loss of forty thousand men; and Ascalon soon afterwards fell into the hands of the Crusaders. Other sieges were subsequently undertaken with success, and Richard even approached within sight of Jerusalem; but by reason of the weakened state of his army, and the dissensions which prevailed in it, he found himself under the necessity of concluding a truce with the sultan. In the year 1192 this was accordingly agreed to, for the term of three years, three months, three weeks, three days, and three hours; and soon after it was concluded the king of England set out on his return to his own dominions.

In 1193 Saladin died, to the inexpressible grief of all true Moslemins, who held him in the utmost veneration. His dominions in Syria and Palestine were parcelled out amongst his children and relations in petty principalities. His son Othman succeeded to the throne of Egypt; but although he possessed the ambition, he wanted the enterprising genius of his father; and indeed Saladin had no successor capable of rivalling, far less eclipsing his renown. But Alcamel, to whom the sceptre devolved about the beginning of the thirteenth century, shed a lustre on his reign by repulsing the Crusaders, who for the fifth time had invaded the kingdom of the sultans. Damietta had yielded to the arms of the Christians; and, elated with their success, they advanced up the Nile, doubtless meditating the entire conquest of the country, when a general action took place, which in its issue proved disastrous, and compelled the invaders to accept a treaty, the conditions of which were more honourable to the generosity of the Moslemin conquerors than to the ability of the Christian commanders. Alcamel died at Damascus in 1238, and one of his sons, by name Aladel, was raised to the throne. But another claimant appeared in Nojmoddin, an elder brother of the deceased prince, and a bloody contest would probably have ensued, had not the young prince in the meanwhile disappeared or died. This circumstance led to the peaceable accession of Nojmoddin, who, like his predecessor, soon acquired great influence with the chiefs of the Crusade; whilst Richard, earl of Cornwall, perceiving that the sultan of Egypt possessed more power than the Syrian lords of Karak and Damascus, concluded an alliance with him, and thereby insured protection to the numerous Christian pilgrims when wending their weary way to the holy sepulchre.

Whilst affairs were thus unsettled, Nojmoddin entered Syria, resolved, with the aid of the wild tribes who roamed through the adjoining desert, to make himself master of Damascus. A battle crowned his enterprise with success, and opened a path to still more signal advantages, when Louis the Ninth of France landed at Damietta with a new host of Crusaders, and in the absence of the sultan made considerable progress, taking several towns, and forcing the inhabitants to fly into the upper part of the country. Nojmoddin, then engaged in the siege of Emessa, hastened to the relief of his subjects; but, overpowered by fatigue and anxiety, his strength failed, and he died by the way, leaving the government to his son, an inexperienced youth. Nojmoddin, however, left one who was able and willing to avenge him. Apprehending no serious opposition, the Crusaders, with their habitual want of precaution, pushed recklessly into the interior, when, to their extreme surprise, they suddenly found themselves in presence of a formidable army, raised by the exertions of the sultan's widow, the celebrated Shagir Aldor. A battle was inevitable; and Louis, compelled to fight at a disadvantage, was defeated and taken prisoner; whilst his followers, after enduring the greatest privations, were compelled to throw themselves on the compassion of the natives whose fields they had desolated, whose houses they had plundered, and whose hearths they had profaned.

The period at which we have now arrived is remarkable for the accession to power of a race of slaves, who, transformed into soldiers, became alike celebrated for their military qualities, and formidable by their exactions, to the country over which they domineered. It will be at once understood that we allude to the Mamlukes. The origin of this celebrated military caste dates from the time of Saladin. As a usurper, the sultan naturally put little confidence in the native troops; and hence, distrusting the fidelity of his subjects, he was led to place around his person a guard of foreigners, composed chiefly of slaves purchased or made captives in the provinces bordering on the western shores of the Caspian. Under succeeding sultans the power of these armed attendants was increased by new privileges; and in a short time they, like the celebrated pretorian bands at Rome, acquired or usurped the entire disposal of the sovereign authority. In the year 1250 the reigning sultan, Malek-al-Salek, was dethroned and slain by these mercenaries; in consequence of which crime the Mamlukes became sole masters of Egypt, and chose a sultan out of their own number. This was Ibeg, who, having been named regent during the minority of the young prince, married the queen-mother upon the death of that boy, and finally, supported by his companions in arms, stepped into the vacant throne.

The Mamlukes having obtained possession of the government, and neither understanding nor valuing any thing except the art of war, every species of learning soon decayed in Egypt, and barbarism in some measure resumed its ancient empire. Nor was their ascendency of long duration, notwithstanding their martial abilities. The fact is, that originally they formed but a small part of the standing forces of Egypt; and as a numerous army was necessary in a country where, according to the fundamental maxim of government, every native must be a slave, they were at first at a loss how to act, being justly suspicious of the other portions of the regular force. But at length they resolved to purchase Christian slaves, and educate them in the same way as they themselves had formerly been; and these were commonly brought from Circassia, where the people, though they professed Christianity, made no scruple of selling their children. When they had completed their military education, these soldiers were disposed of throughout the fortresses erected in the country to keep down the inhabitants; and because in their language a fort was denominated *borge*, the new militia received the name of *Borgites* or garrison-troops. By this expedient the Mamlukes hoped to secure themselves in the sovereignty; but the result proved that they were mistaken in their calculations. The old Mamlukes having become proud, insolent, and lazy, the Borgites took advantage of their degeneracy, rose upon their masters, deprived them of the government, and about the year 1382 transferred it to one of their own number, by name Barcok, under whom the Mamluke dynasty, properly so called, was brought to an end, after having endured about a hundred and twenty years.

The Borgites, as well as their former masters, now assumed the name of Mamlukes, and became famous for their valour and ferocity of conduct. They were almost perpetually engaged in wars either foreign or domestic; and their dominion lasted till the year 1517, when they were attacked by Sultan Selim. The Mamlukes defended themselves with incredible valour; but being overpowered by numbers, they were defeated in every engagement. The same year the city of Cairo was taken, after great slaughter, and the Borgite sultan was obliged to fly. But having collected all his force, he ventured a decisive battle, in which he was defeated, the most romantic efforts of valour proving unavailing against the innumerable multitude which composed the Turkish army. A great number of his troops perished on the field; and the unhappy prince himself, seeing all hope utterly gone, took shelter in a marsh, whence he was dragged by his pursuers, and soon afterwards put to death. Nor did the vengeance of the conqueror stop here. Having erected a throne on the banks of the Nile, he caused the prisoners, amounting to upwards of thirty thousand men, to be brought before him, when he ordered them to be beheaded in his presence, and their bodies to be thrown into the river. With the death of Tuman Bey, and the wholesale butchery which followed it, ended the glory, and almost the existence, of the Mamlukes, who were now everywhere hunted out and cut in pieces.

But notwithstanding these barbarous proceedings, Selim did not attempt the total extermination of the Mamlukes, though this would have been quite agreeable to the maxims of Turkish policy. He seems to have considered, that if he should establish a pasha in Egypt, with the same powers with which those of other parts were invested, such a lieutenant or viceroy would, by reason of the distance from the capital, be under strong temptations to revolt. He therefore devised a new form of government, according to which, the power being distributed amongst the different members of the state, an equilibrium might be established, and the dependence of the whole upon himself might thereby be secured. With this view he chose a divan, or council of regency, consisting of the pasha or viceroy, and the chiefs of the seven military corps. To the former, who was to be in all cases president, it belonged to notify to the council the orders of the Porte, to transmit the tribute to Constantinople, and to provide for the safety of government, both external and internal; whilst, on the other hand, the members of the council had a right to reject the orders of the pasha, or even to depose him, provided they could assign sufficient reasons for so doing; and all civil and political ordinances required to be ratified by them. From the Mamluke Beys, who presided over the provinces, were chosen the Sheikh-el-Belled, or governor of Cairo; the Janizary Aga, or commander of the janizaries; the Defterdar, or accountant-general; the Emir-el-Hadgee, or conductor of the caravan to Mecca; the Emir-el-Saïd, or governor of Upper Egypt; and the Sheikh-el-Bekheri, or governor of the scherifs. He then formed the whole body into a sort of republic; and with this view issued an edict, setting forth that a republican government was granted to the twenty-four sangiacs or governors of provinces. These were, 1. That the sovereignty of the Porte should be acknowledged by the republic, and, in token of obedience, its lieutenant should be received as the representative of the sultan; but if the said lieutenant should attempt to infringe any of its privileges, the republic might suspend him from his authority, and send to the Sublime Porte a complaint against him: 2. That in time of war the republic should provide twelve thousand troops at its own expense, to be commanded by a sangiac or sangiacs; 3. That the republic should raise annually, and send to the Sublime Porte, the sum of 560,000 aslany (afterwards augmented to 800,000, or about L.100,000), accompanied by a sangiac, who should receive an acknowledgment for the same: 4. That the same sum should be raised for the use of Medina and Kiaba or Mecca: 5. That the janizaries should not exceed fourteen thousand in time of peace, though this number might be increased in time of war: 6. That to the sultan's granaries should be sent annually a million measures of corn, 600,000 of wheat, and 400,000 of barley: 7. That, on fulfilling these articles, the republic should have a free government over all Egypt, independently of the sultan's lieutenant, but on condition of executing the laws of the country, with the advice of the moollah: 8. That the republic should be in possession of the mint as heretofore, but on condition that it should be under the inspection of the sultan's lieutenant, in order that the coin might not be adulterated: and, 9. That the republic should elect a Sheikh-el-Belled out of the number of Beys, to be confirmed by the sultan's lieutenant; and that the said Sheikh-el-Belled should be the sultan's lieutenant, and esteemed as the head of the republic. It was further provided, that if the sultan's lieutenant should be guilty of oppression, or exceed the bounds of his authority, the Sheikh-el-Belled should represent the grievance to the Porte; and in case the peace of the republic should be disturbed by foreign enemies, the sultan guaranteed it his protection free of all expense.

Thus the power of the Mamlukes, which conquest and massacre had broken, was in some measure re-established by the arbitrary will or caprice of the conqueror; and it continued to increase until at last the Turkish dominion over Egypt became little better than a species of feudal superiority, recognised in principle, but disregarded in practice. But in order to understand how this transference of authority was produced, it is necessary to attend to the manner in which the race of Mamlukes was continued and multiplied in Egypt. This was not in the ordinary way, by marriage or descent; on the contrary, during all the time the Mamlukes maintained a footing in Egypt, few of them left subsisting issue, and almost all their children perished in the first or second descent. The means by which they were perpetuated and multiplied were the same by which they were originally established, namely, by slaves brought from the country whence they originally came. From the time of the Moguls this commerce continued on the banks of the Cuban and Phasis, in the same manner as it is carried on in Africa, by wars amongst the hostile tribes, and the misery or avarice of the inhabitants, who sold their children to strangers. The slaves thus procured were first brought to Constantinople, and afterwards dispersed throughout the empire, where they were purchased by the wealthy. When the Turks subdued Egypt they should undoubtedly have prohibited this dangerous traffic; and their omitting to do so in a great measure dispossessed them of their conquest, a consummation which a series of great political errors had otherwise been long preparing. In fact, the Porte had, for a considerable time, neglected the affairs of this province, and, in order to restrain the pashas, had suffered the divan to extend its power till the chiefs of the janizaries and ayahs were left without control. The soldiers themselves, having become citizens by the marriages which they had contracted, were no longer the creatures of Constantinople; and a change introduced into their discipline still more increased these disorders. At first the seven military corps had but one common treasury; and though the society was rich, individuals, not having any thing at their own disposal, could effect nothing. But the chiefs, finding their power diminished by this arrangement, had interest enough to get it abolished, and to obtain permission to possess distinct property, lands, and villages. As these lands and villages, however, depended on the Mamluke governors, it was necessary to conciliate them, in order to prevent their exactions. From that moment the Beys acquired an ascendency over the soldiers, who till then had treated them with disdain; and this ascendency continued to increase, as their government secured to them the possession of considerable riches, which they employed chiefly in creating friends and multiplying dependents. They increased the number of their slaves; and after emancipating them, employed all their interest to obtain various employments, and procure advancement in the army. These upstarts, retaining for their patrons the superstitious veneration common in the East, formed factions implicitly devoted to their will, and were ready at all times to execute their commands.

Accordingly, about the year 1746, Ibrahim, one of the kiayas or commanders of the janizaries, rendered himself in reality master of Egypt, having managed matters so well, that of the twenty-four Beys or Sangiacs, eight were members of his own household. His influence too was augmented by always leaving vacancies in order to draw the emoluments himself, whilst the officers and soldiers of his corps were attached to his interest; and his power was completed by gaining over to his interest Rodohan, the most powerful of all the chiefs. Thus the pasha became altogether unable to oppose him, and the orders of the sultan were much less respected than those of Ibrahim. On his death in 1757, his family, that is, his enfranchised slaves, continued to rule in a despotic manner. But having quarrelled amongst themselves, Rodohan and several other chiefs fell in the contests which ensued, and the utmost anarchy and confusion prevailed.

In 1766, while matters still continued in this state, Ali Bey, who had been a principal actor in the disturbances, gained a decided superiority over his rivals, and, under the successive titles of Emir-el-Hadgee, and Sheikh-el-Belled, he rendered himself absolute master of Egypt. The birth of Ali Bey, like that of the Mamlukes in general, is extremely uncertain. It is commonly believed that he was born among the Abazans, a people of Mount Caucasus, who, next to the Circassians, are most valued by the Turks as slaves; and that having been brought to a public sale at Cairo, he was purchased by two Jews, brothers, named Isaac and Yussuf, who presented him to Ibrahim Kiaya. At this time he is supposed to have been about thirteen or fourteen years old; and he was employed by his patron in offices similar to those of the pages belonging to European princes. The usual education of Mamlukes was also given him. He was taught to manage a horse adroitly; to fire a carbine or pistol with a sure aim; and to throw the djereed, a kind of dart or javelin used in the diversions of the country. He was also instructed in the exercise of the sabre, and taught a little reading and writing. In all feats of activity he discovered such fire and impetuosity, that he obtained the surname of Djendali or Madman; and as he grew up he discovered an ambition proportioned to the activity displayed in his youth, but which served to moderate and restrain the ardour of his disposition. About the age of eighteen or twenty he received his freedom, and his kind patron also promoted him to the rank of kiachef or governor of a district, and at last elected him one of the twenty-four Beys, at once the tyrants and oppressors of the unhappy Fellahs.

The death of Ibrahim in 1757 afforded him an opportunity of satisfying his ambition; and he now engaged in every scheme connected with the promotion or disgrace of the chiefs, and had a principal share in the ruin of Rodohan Kiaya, as already mentioned. The post of Rodohan was quickly filled by another competitor for his dangerous office, who, however, did not long enjoy his elevation; and in 1762 Ali Bey, who was then styled Sheikh-el-Belled, having caused Abderrahman, the real possessor of the office, to be exiled, managed to get himself elected in his stead. But he soon shared the fate of the rest, and was condemned to retire to Gaza. This place, however, being then under the dominion of a Turkish pasha, proved by no means either agreeable to or safe for Ali, who accordingly betook himself to another asylum, where he remained concealed until 1766, when his friends at Cairo procured his recal. On this he appeared suddenly in that city, killed four of the Beys who were inimical to his designs, banished the rest, and assumed the whole power. Still, however, his ambition was not satisfied. Indulging the loftiest aspirations of ambition, he determined to throw off his dependence on the Porte, and to declare himself sultan of Egypt. With this view he expelled the pasha, refused to pay the accustomed tribute, and, in the year 1768, proceeded to coin money in his own name. The Porte being at that time on the eve of a war with Russia, had not leisure to attend to the proceedings of Ali; so that the rebel chief had leisure and opportunity for forwarding his enterprise. His first expedition was directed against an Arabian prince named Hammam, under pretence that the latter had concealed a treasure entrusted to him by Ibrahim Kiaya, and that he had afforded protection to rebels. The command of the expedition he entrusted to his favourite Mohammed Bey, by whom the unfortunate prince was destroyed, and his territories despoiled. Ali next set about executing a plan which had been proposed to him by a young Venetian merchant, for rendering Djidda, the port of Mecca, an emporium for all the commerce of India; and he even imagined that he would succeed in causing the Europeans to abandon the passage to the East Indies by the Cape of Good Hope. With this view he fitted out some vessels at Suez; and having manned them with Mamlukes, commanded Hassan Bey to sail with the squadron for Djidda, and attack it, whilst a body of cavalry under Mohammed Bey advanced against the town. Both these operations were executed to his wish, and Ali became quite intoxicated with his success. Nothing but ideas of conquest now occupied his mind; and without considering the disproportion between his own force and that of the Grand Signior, he never once doubted that he would be able to maintain himself against all the power of the Porte. And circumstances, it must be owned, were at this time favourable to his designs. Sheikh Daher was in rebellion against the Porte in Syria, and the pasha of Damascus had so exasperated the people by his extortions that they were ready for revolt. Having therefore made the necessary preparations, Ali, in 1770, dispatched about five hundred Mamlukes to take possession of Gaza, and thus to secure an entrance into Palestine. When Osman, pasha of Damascus, heard of the invasion, he prepared for war with the utmost diligence; whilst the troops of Ali Bey were, it is said, ready to fly at the first attack. But they were relieved from their embarrassment by Sheikh Daher, who hastened to their assistance; and Osman, dreading to encounter both, fled without offering the least resistance, thus leaving the enemy masters of Palestine. About the end of February 1771 the army of Ali Bey was put in motion. Its numbers have been variously represented, but it is probable that, including camp followers, a very numerous class in the East, it exceeded forty thousand men. This force, or rather armed multitude, commanded by Mohammed Bey, the friend of Ali, took the road to Acre, leaving wherever they passed frightful traces of their rapacity and want of discipline. At Acre a junction was formed with the troops of Sheikh Daher, consisting of fifteen hundred Safadins; Sheikh Daher's subjects being so called from Safad, a village of Galilee, originally under his jurisdiction. These were on horseback, and accompanied by twelve hundred Motualis cavalry under the command of Sheikh Nasif, and about a thousand Moggrebin infantry. Thus they proceeded towards Damascus, whilst Osman prepared to oppose them by another army equally numerous and ill regulated.

The military operations in Syria in the year 1771 have been described by Volney. The combined army of Ali Bey and Sheikh Daher marched to Damascus. The pashas waited for them; they approached, and, on the 6th of June, a decisive action took place. The Mamlukes and Safadins rushed on the Turks with such fury, that, terrified at their onset, the latter immediately took to flight, and the pashas were not the last in endeavouring to make their escape. The allies became masters of the country, and took possession of the city without opposition, there being neither walls nor soldiers to defend it. The castle alone resisted. Its ruined fortifications had not a single cannon, much less gunners; but it was surrounded by a muddy ditch, and behind the ruins were posted a few musketeers, who alone were sufficient to check this army of cavalry. As the besieged, however, were already conquered by their fears, they capitulated on the third day; and the place was to be surrendered next morning, when at daybreak an extraordinary revolution took place.

This was the defection of Mohammed Bey himself, whom Osman had gained over in a conference during the night. At the moment, therefore, when the signal of surrender was expected, this treacherous commander sounded a retreat, and turned towards Egypt with all his cavalry, flying with as great precipitation as if he had been pursued by a victorious army. Mohammed continued his march with such celerity that the report of his arrival in Egypt reached Cairo only six hours before himself. Thus Ali Bey found all his expectations of conquest disappointed, and a traitor whom he durst not punish at the head of his forces. A sudden reverse of fortune now took place. Several vessels laden with corn for Sheikh Daher were taken by a Russian privateer; and Mohammed Bey, whom he designed to put to death, not only made his escape, but was so well attended that he could not be attacked. As his followers continued to increase daily in number, Mohammed soon became sufficiently strong to march towards Cairo; and in April 1772, having defeated the troops of Ali in a rencounter, he entered the city sword in hand, whilst the latter had scarcely time to make his escape with eight hundred Mamlukes. Ali proceeded to Syria, which he reached with difficulty, and immediately joined Sheikh Daher with the troops which accompanied him in his flight. The Turks under Osman were at that time besieging Sidon, but they raised the siege on the approach of the allied army, consisting of about seven thousand cavalry. Though the Turkish army was at least three times this number, the allies did not hesitate to attack them; and having gained a complete victory, their affairs now began to wear a more favourable aspect.

In the beginning of 1773, Jaffa, a place which had revolted, capitulated, and Ali Bey began to think of returning to Cairo. For this purpose Sheikh Daher promised to furnish him with fresh succours; and the Russians, with whom he had now contracted an alliance, made him a similar promise. But Ali ruined every thing by his own folly and impatience. Deceived by an astrologer, who pretended that the auspicious moment indicated by the stars had just arrived, and also misled by false information insidiously conveyed to him by the agents of Mahommed, who caused letters to be written to him urging his immediate return to Cairo, he set out with his Mamlukes and about fifteen hundred Safadins sent him by Daher, without waiting for further aid; but he had no sooner entered the desert which separates Gaza from Egypt, than he was attacked by a body of a thousand chosen Mamlukes who were waiting his arrival. They were commanded by a young Bey named Murad, who being enamoured of the wife of Ali Bey, had obtained a promise of the lady from Mohammed, in case he should bring him her husband's head. As soon as Murad perceived the dust which announced the approach of Ali Bey's army, he rushed upon the advancing force, defeated it, and took Ali Bey himself prisoner, after wounding him in the forehead with a sabre. Being conducted to the presence of Mohammed Bey, Ali was treated by the latter with every appearance of respect, and a magnificent tent was ordered to be erected for him; but in three days thereafter he was found dead, of his wounds, as was given out, though some affirm, perhaps with good reason, that he was poisoned.

After the death of Ali, Mohammed Bey became undisputed master of Egypt; but to the people this change of despots proved to be one from bad to worse. At first he pretended to defend the rights of the sultan; he remitted the usual tribute to Constantinople, and he took the customary oath of unlimited obedience; after which he solicited permission to make war against Sheikh Daher, the ally of Ali Bey. This request, although springing out of personal animosity, was nevertheless granted, and Mohammed made diligent preparations for war. Having procured a considerable train of artillery, he provided foreign gunners, whom he placed under the orders of an Englishman named Robinson; and, having completed the necessary preparations, he, in the month of February 1776, appeared in Syria with an army equal in number to that which he had formerly commanded when in the service of Ali Bey. Daher's forces, unable to cope with so formidable a body, abandoned Gaza, which Mohammed immediately took possession of, and then marched towards Jaffa, the ancient Joppa, situated on a part of the coast the general level of which is very little above that of the sea. The city is built on an eminence in the form of a cone, and about a hundred and thirty feet in height. The houses distributed on the declivity rise above one another like the steps of an amphitheatre; and on the summit is a small citadel, which commands the town; whilst the bottom of the hill is surrounded by a wall without a rampart, of twelve or fourteen feet in height and two or three feet in thickness, but without a ditch, and environed by gardens. The city was defended by five or six hundred Safadins and as many inhabitants, who had only a few brass cannon, twenty-four pounders, without carriages, which they mounted as well as they could on timbers prepared in a hurry.

Mohammed, finding he must have recourse to force, formed his camp before the town, in the most irregular and disorderly manner possible. Batteries were now erected upon a rising ground at the distance of about two hundred yards from the town, and the bombardment commenced. A wall only three feet thick, and without a rampart, was soon breached even by the ill-served artillery of Mohammed, and the Mamlukes advanced on foot to the assault; but the besieged coolly waiting till they arrived at the empty space between the city and wall, assailed them from the terraces and windows of the houses with such a shower of bullets, that the assailants retired, under a persuasion that the breach was utterly impracticable. Murad Bey brought them several times back to the attack, but all his efforts were vain. Six weeks passed in this manner; and Mohammed, distracted with rage, anxiety, and despair, had thoughts of abandoning the enterprise. But fortunately for him, the besieged, whose numbers were diminished by the repeated attacks, became weary of defending the cause of Daher; and some persons having begun to treat with the enemy, it was at length proposed to abandon the place, upon the Egyptians giving hostages. Conditions were agreed upon, and the treaty was on the point of being concluded, when, in the midst of the security which this circumstance occasioned, some Mamlukes entered the town. Numbers followed their example, and attempted to plunder; the inhabitants defended themselves, and the attack recommenced. The whole army then rushed into the town, which suffered all the horrors of a successful assault; men, women, and children, young and old, were indiscriminately cut in pieces; and Mohammed, equally mean and barbarous, caused a pyramid, formed of the heads of these unfortunate sufferers, to be raised as a monument of his inglorious victory.

This disaster everywhere diffused the greatest terror and consternation. Sheikh Daher fled, and Mohammed soon afterwards became master of Acre, where he behaved with his usual cruelty, and abandoned the city to pillage. The French merchants claimed an exemption, which was obtained with the utmost difficulty, and, but for a fortunate accident, would have been of little consequence. Being informed that the treasures of Ibrahim, the kiaya of Daher, had been deposited in that place, Mohammed immediately demanded them, threatening the merchants with death if they were not instantly delivered up; and a day was appointed for making the search; but before it arrived the tyrant had caught a malignant fever, of which he died after a short illness. When his death became known, the army, aware of the vengeance it had provoked, and being now without a head, made a precipitate and tumultuous retreat. This event occurred in the summer of 1776. Sheikh Daher continued his rebellion for some time, but he was at last entirely defeated, and his head sent to Constantinople by Hassan, the Turkish capitan-pasha or high admiral.

As soon as the news of Mohammed's death reached Egypt, Murad Bey hastened to Cairo in order to dispute the sovereignty with Ibrahim Bey, who had been entrusted with the government on the departure of Murad for Syria. Preparations for war were in consequence made on both sides; but at last, finding that the contest would be attended with equal difficulty and uncertainty, they came to an accommodation, by which it was agreed that Ibrahim should retain the title of Sheikh-el-Belled, and that the power which neither was inclined to relinquish should be divided between them. But the Beys and other chiefs who had been promoted by Ali Bey, perceiving their own importance totally annihilated by this duumvirate, resolved to shake off the yoke, and therefore united in a league for supporting what they were pleased to term the house of Ali Bey. This combination was managed with so much silence and dexterity, that both Murad and Ibrahim were obliged to abandon Cairo. In a short time, however, having collected reinforcements, they returned and defeated their enemies; but notwithstanding this success, they were unable altogether to suppress the party which had been formed against them. A new combination was formed among the Beys, five of whom were sentenced to banishment in the Delta. They pretended to comply with this order, but took the road through the desert of the Pyramids, and, though they were pursued for three days, arrived safe at Minieh, a village situated on the Nile, forty leagues above Cairo. Here they took up their residence, and being masters of the river, soon reduced Cairo to distress by intercepting its provisions. A new expedition, therefore, became necessary, and Ibrahim took the command upon himself. In the month of October 1783 he set out with an army of three thousand cavalry, and the two armies soon came in sight of each other; but Ibrahim thought proper to terminate the affair by negociation. This gave great offence to Murad, who, suspecting some design against himself, immediately left Cairo. A war between the two sovereign colleagues seemed now inevitable, and the armies continued for twenty-five days in sight of each other, being only separated by the river. But negociations were at length opened; and the five exiled Beys, finding themselves abandoned by Murad, took to flight. They were however pursued and brought back to Cairo, and peace appeared to be re-established on a better footing than heretofore; but the jealousy of the two rivals having produced new intrigues, Murad was once more obliged to leave Cairo in 1784. He encamped, however, at the very gates of the city; and Ibrahim, dreading his power, or overawed by his boldness, found himself obliged in his turn to retire to the desert, where he remained till March 1785. A new treaty was then entered into, by which the rivals agreed to share the supreme power between them; an arrangement which certainly afforded but little prospect of lengthened tranquillity.

Matters were in this situation, when, in 1786, the Porte, having concluded a peace with Russia, resolved to reduce Egypt once more to a state of subjection and obedience. With this view, Hassan Pasha, famous for his exploits in the Morea and in Cyprus, was dispatched by the sultan at the head of a force amounting to twenty-five thousand men. Having effected a landing at Alexandria in the month of July, Hassan made instant preparations for advancing towards Cairo. But he was met near Mentorbes by Murad at the head of his Mamlukes, and a furious battle immediately ensued. The victory, however, remained with Hassan. The ground being still soft from the effects of the inundation, the Mamlukes, whose horses sunk in the mud, were unable to charge with their accustomed impetuosity, and the Turkish infantry thus gained a decided advantage. Had it not been for this fortunate circumstance, Hassan might have been shorn of some of his laurels in contending with that superb cavalry, by far the finest and most enterprising in all the East. As it was, Cairo opened its gates to the victorious pasha, who, after appointing a governor, continued his march in pursuit of the Beys into the Saïd. But finding the power of these chiefs still in some measure unbroken, and experiencing great difficulties in subsisting his army in the face of an active and vigilant enemy, Hassan was induced, in the course of the following year, to accede to a treaty, by which the Beys were left in full possession of the country from Barbieh to the confines of Nubia, upon condition of their relinquishing all claims to the territory below the place just mentioned. By this arrangement, he freed Lower Egypt from the exactions of the Mamlukes, and secured to the inhabitants of that part of the country the benefit of something like a settled government. He also applied himself to lighten their burdens, to redress their grievances, and to fortify Cairo so as to enable it to hold out against any sudden inroad of the disaffected Beys; and his whole conduct indeed was alike distinguished for wisdom and moderation. But, in 1790, the plague appeared in its most virulent type; and after committing frightful ravages amongst the lower classes, who in all countries, and particularly in Egypt, are the first victims of a pestilence, it put an end to the life of Hassan Pasha. By this event the authority which had kept the Mamlukes in check was annihilated; and, after a short interval, during which an attempt was made to confirm the authority of the Porte, Murad and Ibrahim returned from exile, and once more assumed the sovereign power, in defiance of all the menaces of the divan.

But the domestic contentions by which Egypt had so long been distracted were now to be succeeded by foreign invasion. From an exaggerated notion of the importance of the British dominions in the East, which were regarded as a source of inexhaustible wealth to this country, the possession of Egypt, the channel through which the commerce of India anciently flowed into Europe, had long been viewed by the statesmen of France as a most desirable acquisition for that country. Various arguments, some of them plausible enough, were accordingly advanced in support of this conclusion. In particular, it had been contended that the communication between India and the southern parts of Europe, by the channel of the Red Sea, was the shortest, the safest, and the most economical; that the Nile might be connected with the Arabian Gulf by means of a canal cut across the isthmus of Suez; that, independently of the commerce of India, the country on the eastern shores of the Red Sea abounded in spices, perfumes, and other valuable products; that Africa had gold dust and ivory to give in exchange for the more bulky commodities of Europe; and therefore that Egypt, if occupied by one of the maritime powers of the Mediterranean, would prove a more valuable possession than all the British territories in India. From the time of Leibnitz, who addressed to Louis XIV. a memorial recommending the occupation of Egypt for the purpose of destroying the maritime and commercial ascendency of the Dutch, the speculation which he had in some measure originated continued to find favour with the statesmen of France; and when the naval pre-eminence of Britain, which a series of unexampled triumphs had placed on a firm basis, put an end to all hope of disputing with her the empire of the ocean, or again establishing a footing in India by means of armies transported by fleets, the project of seizing upon Egypt began to be anxiously discussed and seriously meditated. Nor was this scheme viewed merely in connection with objects of commercial enterprise, or even the extension of the colonial possessions of France. To the bold and ardent minds that now predominated in the French councils, it promised other and still more important advantages. The subjugation of Egypt by a nation whose territory bordered on the Mediterranean was considered as the most effectual blow which could be struck against the power of Turkey; whilst, by occupying that country with a powerful military force, and, as a necessary consequence, adding to it the possession of Syria, a position would be obtained from which the British possessions in India might be threatened, and perhaps in due time attacked. Ideas the most gigantesque were formed, and to men flushed with the confidence inspired by victory all things seemed possible.

It is not certainly known with whom originated the project of sending an expedition at this time to Egypt, and various persons have claimed or received the merit of the suggestion. It is beyond all doubt, however, that the ardent mind of Napoleon entered into the scheme with characteristic energy,[1] and that the executive directory acquiesced in it with a readiness which perhaps arose as much from policy as conviction. The young soldier of Italy had already become too great for a republic. In a country which had recently witnessed so many revolutions, and where all distinctions are so liable to be eclipsed by military glory, the man who had dictated to Austria the preliminaries of Leoben could not but be an object of dread to a feeble and unpopular government; and hence it is at least a reasonable presumption, that the immediate advantage of removing to a safe distance a dangerous army and a still more dangerous military chief, weighed fully as much with the executive directory as any of the speculations to which we have alluded.

But be this as it may, an expedition was fitted out with all possible secrecy, and on the 18th May 1798 it sailed from Toulon. The squadron consisted of thirteen sail of the line, six frigates, and a dozen brigs, sloops, and cutters, having on board about forty thousand men of all arms, under the command of Napoleon, who had been named general-in-chief of the army of the East. After doubling Cape Corso and Cape Bonara, the expedition arrived on the 10th of June before Malta, which, through the degeneracy of the knights, surrendered almost without resistance; and having left a garrison in the island, it next steered for the coast of Egypt, which, after narrowly escaping an encounter with the British fleet under Lord Nelson, it reached on the 1st of July. The troops were immediately landed near Alexandria, and on the evening of the 5th that place was carried by assault. The general-in-chief then passed several days in laying down the principles on which the city was to be fortified; and, in a short time, a complete system of works, capable of a long defence, was formed under the able superintendence of the principal French engineers.

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[1] Napoleon has himself explained the views with which this expedition was undertaken. "There were three objects," says he, "in the expedition to Egypt: 1*st*, To establish a French colony on the Nile, which would prosper without slaves, and serve France instead of the republic of St Domingo and of all the sugar islands; 2*dly*, To open a market for our manufactures in Africa, Arabia, and Syria, and to supply our commerce with all the productions of those vast countries; 3*dly*, Setting out from Egypt as from a place of arms, to lead an army of 60,000 men to the Indus, to excite the Mahrattas and oppressed people of those extensive regions to insurrection. Sixty thousand men, half Europeans, and half recruits from the burning climates of the equator and the tropics, carried by 10,000 horses and 50,000 camels, having with them provisions for fifty or sixty days, water for five or six days, and a train of artillery of a hundred and fifty field-pieces, with double supplies of ammunition, would have reached the Indus in four months. Since the invention of shipping the ocean has ceased to be an obstacle, and the desert is no longer an impediment to an army possessed of camels and dromedaries in abundance. The first two objects were fulfilled, and, notwithstanding the loss of Admiral Brueys' squadron at Alexandria, the intrigue by which Kléber was induced to sign the convention of El-Arisch, the landing of from 30,000 to 35,000 English commanded by Abercromby at Aboukir and Cosseir, the third object would have been attained; a French army would have reached the Indus in the winter of 1801-1802, had not the command of the army devolved, in consequence of the murder of Kléber, on a man who, although abounding in courage, talents for business, and good-will, was of a disposition wholly unfit for any military command." (*Memoirs*, vol. ii. part 2, p. 205.)

Having given the necessary directions, and made suitable preparations, Napoleon left Alexandria to advance against the Mamlukes, who had resolved to dispute his passage towards Cairo; at the same time repeating to Admiral Brueys, who commanded the French squadron, the order previously given to enter the port of Alexandria, or, in case he should consider that impossible, to proceed to Corfu or Toulon. The first encounter with the Mamlukes took place at Shebreis on the 13th July. Here they waited the approach of the French army, which was drawn up so that each division formed a square, with the baggage in the centre; and they soon spread over the whole plain, outflanking the wings, and seeking on all sides a weak point to enable them to break the French line; but finding it everywhere equally formidable, and being opposed with a double fire from front and flank, they were compelled to retire with loss, after having made several fruitless attempts to charge. The French army then continued its advance, and was approaching Cairo, when information reached the general-in-chief that the Mamlukes, combined with the troops of that city, and with a considerable number of Arabs, janizaries, and spahis, were waiting for them between the Nile and the Pyramids covering Ghizeh, where they boasted that the success of the invaders would terminate. Napoleon halted a day at Omedinar, to afford the troops some repose, and enable them to get their arms in readiness, and to prepare for battle. On the 21st, at one in the morning, the army marched from Omedinar, and at ten perceived Embabeh, and the enemy in line. Their right was supported on the Nile, where they had traced out a large entrenched camp, lined with forty pieces of cannon, and defended by about twenty thousand infantry, consisting of janizaries, spahis, and militia from Cairo. On this entrenched camp the Mamluke cavalry, amounting to between nine and ten thousand horse, rested its right, and extended its left in the direction of the Pyramids, crossing the road to Ghizeh; whilst two or three thousand Arabs maintained the extreme left, and occupied the space between the Mamlukes and the Pyramids. These dispositions were formidable. But Napoleon, discerning that the intrenched camp was merely sketched out, and that the cannon were mounted on field carriages, and consequently immoveable, concluded that the infantry would not quit the intrenched camp, or that if they came forth it would be without artillery. On these data he made his dispositions for battle; resolving to prolong his right, and to follow the movement of that wing with his whole army, at the same time passing out of the range of the guns of the intrenched camp. Murad Bey, who commanded in chief, quickly divined the purpose of his antagonist; and comprehending at once that the fortune of the day depended on preventing the French from executing this movement, and availing himself of his numerous cavalry to attack them on their march, he advanced at the head of about two thirds of his horse, amounting to between six and seven thousand, and fell upon General Desaix, who was moving forward by the extremity of the French right. The charge was made with such rapidity that Desaix was for a moment compromised, and the squares appeared to be falling into confusion. But as the head of the corps of Mamlukes was not numerous, and the mass did not arrive for some minutes, the delay was sufficient to enable Desaix to complete the formation of the squares, and to receive the charge with coolness. Regnier supported Desaix on the left, whilst Napoleon, marching on the main body of the Mamlukes, placed himself between the Nile and Regnier. The Mamlukes were received with discharges of grape and musketry, and some of the bravest died almost on the bayonets of Desaix's division; but the mass, by an instinct natural to horse, turned round the squares, and this frustrated the charge. In the midst of the fire, the dust, and the smoke, part of the Mamlukes regained the intrenched camp, against which the divisions of Bon and Menou immediately advanced, whilst General Rampon with two battalions occupied a defile between Ghizeh and the camps. The most horrible confusion now prevailed at Embabeh. The cavalry had thrown itself upon the infantry, which, seeing the Mamlukes beaten, rushed into the djerms, caiques, and other boats, in order to pass the Nile; then the Mamlukes, perceiving that their retreat was in the wrong direction, attempted to regain the Ghizeh road, but were driven back by Rampon's battalions on the intrenched camp, where many of them fell. But many more were drowned in attempting to pass the Nile; and the intrenchments, artillery, pontoons, and baggage, all became the prize of the conquerors. Of this army of above sixty thousand men, not more than two thousand five hundred horse escaped with Murad Bey. Ibrahim fled into the eastern parts of the Delta, whilst Murad, with the remnant of his Mamlukes, retreated into the desert beyond Sakbara.[1]

But this victory was speedily counterbalanced by a signal overthrow which the French experienced at sea. Admiral Brueys, neglecting or disregarding the orders given by Napoleon to enter the port of Alexandria, had moored his squadron, for defending the entrance of Aboukir Bay, in a line of battle, flanked by numerous gun-boats, four frigates, and a battery of guns and mortars on an island in their van. But this position, though strong, had a defect of which the quick eye of Nelson enabled him to take decisive advantage. On the 1st of August this great commander appeared off the mouth of the Nile with a squadron equal in force to that of the enemy, and instantly directed his course towards him. The French ships were at single anchor, with springs on their cables, and riding with their heads to wind, which was from the north-west. On this circumstance the plan of attack was formed. About half the British ships got between the enemy and the shore, either by cutting through their line or sailing round the head of it; and the rest attacked on the outside. All dropped their anchors close alongside of their opponents; and by this disposition some of the French line were doubled on, whilst all engaged on the land side were taken unprepared. The battle began about six in the evening, and was long and obstinately contested. After it had lasted several hours, the L'Orient of 120 guns, which carried the French admiral's flag, blew up with a terrible explosion, but not until the six headmost ships had surrendered. Next morning at daylight the action recommenced; but, with the exception of two sail of the line and two frigates which escaped, the other ships were either taken or destroyed. Never indeed was victory more complete. Of thirteen sail of the line, nine were captured and two destroyed, the Timoleon having shared the same fate as the L'Orient. The loss on the part of the French was necessarily great. Upwards of 5200 perished, and 3105, including wounded, were sent ashore by cartel. The British loss in killed and wounded amounted to 895. Westcott was the only captain who fell.

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[1] It was at the commencement of the battle of the Pyramids that Napoleon addressed to his soldiers the words which afterwards became so famous: "From the tops of these Pyramids forty centuries look upon you."

After Cairo had surrendered to the French, Bonaparte formed his army into three divisions, one of which, commanded by General Desaix, was sent into Upper Egypt in pursuit of the Mamlukes; another was left for the defence of Cairo; and at the head of the third he marched in person in pursuit of Ibrahim Bey, who had taken his route towards Syria with a rich caravan. In order to render abortive the designs of Bonaparte, Britain formed an alliance with the Porte; and the chief preparations for carrying the concerted plan into effect were made in Syria, under the direction of Djezzar, pasha of Acre. The frontiers of Egypt towards Syria were to be attacked by an army from Asia Minor; and this operation was to be seconded by making a strong diversion towards the mouths of the Nile, and by various attacks in Upper Egypt with the remains of Murad Bey's cavalry. Sir Sidney Smith left Portsmouth to superintend the execution of this extensive plan, and to afford every assistance in his power by means of the maritime force under his command. In the mean time, the harbour of Alexandria was blockaded by a force of four sail of the line and five frigates, under the command of Sir Samuel Hood; it having been found impracticable to burn or destroy the French fleet of transports, without the assistance of a land force sufficient to attack Alexandria.

In order to destroy the preparations of the Djezzar Pasha, and disconcert the plans of Sir Sidney Smith, General Bonaparte resolved to leave Egypt and march into Syria; and although the result of the expedition proved disastrous to the French interest, yet Bonaparte perhaps never undertook an enterprise with more rational expectations of ultimate success. The town of Jaffa, the ancient Joppa, was obstinately defended, but at last yielded to the superiority of European tactics. From this place the French general marched with his army in three divisions against St Jean d'Acre, to which he immediately laid siege. But the pasha was powerfully encouraged to make an obstinate resistance, by Sir Sidney Smith, who appeared off Acre with the Tigre and Theseus seventy-fours, and some smaller vessels; and in order to animate him still more, he sent a French engineer of distinguished merit, through whose means Sir Sidney had himself been enabled to effect his escape from the Temple. But although the fortress had been repaired by Colonel Philippeaux, the engineer alluded to, yet it is more than probable that it could not have long held out against the skill and intrepidity of Napoleon, had not his heavy artillery, and siege equipage of every kind, been intercepted by the British, whilst on their way from Jaffa. After a protracted and bloody siege of sixty-one days continuance, during which the French had repeatedly mounted the breach, and been on the very eve of succeeding in their attempts, having in the last assault effected a lodgment in a tower within the body of the place, Napoleon was obliged to abandon all hope of reducing Acre, the garrison of which had been strongly reinforced, and, after sacrificing his heavy artillery, to commence his retreat towards Egypt. The siege began on the 20th of March, and was raised in the night between the 20th and 21st of May 1799. The French army retreated by Kantura, Cæsarea, Jaffa, and Gaza; then crossed the desert, and stopped at El-Arisch, where Bonaparte left a garrison; and reached Cairo on the 14th of June, twenty-six days after breaking up from before Acre, having been much harassed in their retreat by the Syrians. The loss sustained by the French army during the four months of the Syrian expedition is estimated at seven hundred men who died of disease, five hundred killed in the different actions, and about eighteen hundred wounded; in all two thousand nine hundred men *hors de combat*. But even this is probably below the truth.

During the absence of General Bonaparte in Syria, no method had been left unattempted in order to ruin the interest of the French in Egypt, and kindle a rebellion in that country; and to a certain extent these efforts had been successful; but the presence of Bonaparte speedily restored tranquillity. His army had no doubt suffered severely in its retrograde march from Syria; but with such zeal and activity did he direct his attention towards its organization, that in the short period of three weeks it was in a condition to resume active operations, a though, according to the accounts then current, it had been completely buried in the burning sands of the desert. After affording the Turks all the assistance in his power, Sir Sidney Smith, on the 12th of June 1799, set sail from the bay of Acre, and proceeded first to Beruta on the same coast, whence he shaped his course to Lamica road in the island of Cyprus, in order to refit his little squadron. Having effected this object, he left Cyprus for Constantinople, in order there to concert measures with the Porte for expelling the French from Egypt. But in the meanwhile an event occurred which served for the time to confirm their ascendency. When Napoleon set out on the expedition to Syria, he left Desaix, with his division, to prosecute the war against the Mamlukes; but Murad, having retired before him as far as Syene or Assouan, baffled all the attempts of the French general to bring him to action, whilst he cut off detached parties, hung on the flanks and rear of the invaders, and intercepted their supplies. Accordingly, on his return from Syria, Napoleon, having re-established the shattered discipline of his troops, was preparing to march against Murad, who had ventured down into the province of Fayoum, when he found himself suddenly called upon to confront another and apparently more formidable enemy.

On the 14th of July, the general-in-chief received intelligence from Alexandria that a Turkish fleet of from a hundred and twenty to a hundred and fifty sail had come to anchor in the bay of Aboukir, landed a body of troops on the shore of the peninsula, and carried the fort of Aboukir by assault. He accordingly issued directions to his officers to move towards the point threatened; and the first rendezvous of the army was appointed at Rhamanieh, on the left bank of the Nile. The advanced guard under Murat took the route to Ghizeh, followed by the divisions of Lannes and of Bon; Kléber's division marched from Damietta; Regnier, who was in Sharkieh, received orders to march on Rhamanieh, after leaving a column of six hundred men to protect his communication; and the whole, including Menou's moveable column, together with the park of artillery and the staff, moved on to Rhamanieh, which Napoleon reached on the 20th of July. The general-in-chief was in hopes that he would be able to destroy the army which had landed at Aboukir before that of Syria, raised during the two months which had elapsed since he quitted that country, could arrive before Cairo; and these hopes were completely realized. After the French army broke up from its position at the village of Birket, which had been fixed as the centre of its movements, it assembled near the Wells, between Alexandria and Aboukir; and Bonaparte fixed his head-quarters at the former place. The Turkish army amounted to about eighteen thousand men, and was receiving daily reinforcements; but it had no cavalry. It had taken up a position on the peninsula of Aboukir, which it was now engaged in fortifying by means of two lines of entrenchments; one joining the redoubt in front of the village to the sea, and the other three quarters of a league in advance, having the right supported by a sand-hill commanding Lake Maadieh, and the left extending to the Mediterranean, so that it could march thence either on Alexandria or Rosetta. Concluding, from the nature of these fortifications, that the Turkish army wished to make this point its centre of operations, Napoleon made his dispositions accordingly. Having set out from Alexandria on the 24th, he proceeded to the Wells, about half way across the isthmus, where he encamped, and was there joined by all the troops which were at Birket. By the mistake of a company of sappers the Turks now learned, for the first time, that the general-in-chief and the French army were opposite them, and accordingly passed the whole night in making their final dispositions to receive the attack which they knew to be inevitable. The plan of the French general was to attack instantly, and either to gain possession of the whole peninsula, or at least to oblige the first line of the enemy to fall back on the second, by which means the French would be enabled to occupy the position of the first line, and to overwhelm the Turkish army, thus hemmed in, with bombs, howitzer-shells, and balls, of which there were immense supplies in Alexandria. Accordingly, Lannes, with eighteen hundred men, moved against the left of the enemy; Destaing, with a like number of troops, prepared to attack the right; and Murat, with all the cavalry and a light battery, divided into three corps, remained opposite the centre, ready to act according to circumstances. The skirmishers on both wings soon engaged with those of the enemy, and in a short time the battle became general. The Turks, however, maintained the combat with success, until Murat, having penetrated their centre at the head of his cavalry, wheeled his left to the rear of their right, and his right to the rear of their left, thus cutting off the communication between the first and second lines. The first line now fell into complete disorder, and rushed tumultuously towards the second, consisting of about nine thousand men; but being encountered by the French cavalry in the midst of the plain, their right was driven into the sea, and their left into Lake Maadieh, whilst the columns of Lannes and Destaing advanced at the charge and vigorously pursued them. An unprecedented spectacle was now exhibited. To escape from the French cavalry and infantry, the fugitives threw themselves into the water, and were almost all drowned, scarcely a hundred men out of ten thousand having succeeded in getting on board the vessels. The French now advanced to the attack of the second line, and Lannes forced the entrenchments at the point of their junction with the lake, at the same time making a lodgment in the first houses of the village of Aboukir. Mustapha Pasha, who was in the redoubt, then made a sortie, debouching with a strong body, and separating the French right from the left, which he took in flank at the same time that he placed himself in rear of the right; but his attack was checked by the general-in-chief, who forced him to give ground, and enabled Lannes to continue his movement. Finding themselves thus cut off, the Turks instantly fell into the most frightful disorder, and, as General Destaing was advancing at the charge against the intrenchments on the right, they tried to regain the fort; but, like the first line, the second was now encountered by Murat's cavalry, and had it not been for the village, which afforded shelter to those who had time to reach it, not a man of them would have escaped. As it was, three or four thousand Turks were driven into the sea, and Mustapha, with his whole staff, and from twelve to fifteen hundred men were surrounded and made prisoners. The French loss amounted to near three hundred men. Sir Sidney Smith was a spectator of this dreadful overthrow, having arrived in Aboukir, and landed during the action: he narrowly escaped being taken, and reached his ship with great difficulty.[1]

The Turks had still left three or four thousand men, who occupied the fort, and barricaded themselves in the village. But as it was not thought possible to force the enemy in the houses which he occupied without great loss, protected as he was by the fort, a position was taken, and the most advantageous points were fixed on for placing heavy cannon, to raze the enemy's defences without risk of further loss. General Menou conducted the siege with vigour and address, and after bombarding the fort for eight days, until it exhibited nothing but a heap of ruins, the son of the pasha and two thousand men laid down their arms, and became prisoners of war. In the fort the French found eighteen hundred men killed, and three hundred wounded.

On the 26th, Napoleon returned to Alexandria, where he first learned, as is said, from some English newspapers, the reverses experienced by the French, particularly in Italy and on the Rhine; as also the violent commotions which were agitating the interior of France. This determined him to abandon the East and return to Europe, in order to be in readiness to profit by events, and to take advantage of that fortune in which he already placed unbounded confidence. Berthier alone was entrusted with the secret intentions of the general-in-chief, and proved himself worthy of this confidence. Meanwhile, Admiral Ganthéaume was ordered to get ready two frigates with the utmost expedition, but without being informed as to their destination; and Napoleon brought with him Generals Lannes, Marmont, Murat, and Andréossi, together with Monge and Berthollet of the Institute; whilst Bessières and his guides received sealed notes, which were not to be opened till a certain day and a certain hour, at a particular point of the sea-shore, and which were found to contain orders for immediate embarkation. Another sealed packet, which was to be opened on the day after the frigates had sailed, contained the nomination of General Kléber to the chief command, and of Desaix to that of Upper Egypt.[2]

The departure of General Bonaparte appears to have revived the courage of Murad Bey, and inspired him with a determination to attempt something against the French.

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[1] In describing "cette glorieuse journée," a writer in the *Dictionaire Historique*, says, "La déroute est complète; l'ennemi, dans le plus grand désordre, et frappé de terreur, trouve partout les baïonnettes et la mort. Dix mille hommes se précipitent dans la mer; ils y sont fusillés et mitraillés." (Vol. i. p. 10.)

[2] Napoleon has been severely censured for his desertion, as it is called, of his companions in arms. But his own answer appears to be quite decisive. "Napoleon," says he, "returned to France, 1*st*, Because his instructions authorized him to do so; he had carte-blanche in all respects: 2*dly*, Because his presence was necessary to the republic: 3*dly*, Because the army of the East, which was victorious and numerous, could not, for a long time, have any enemy to contend with; and because the first object of the expedition was accomplished: the second could not be attained so long as the frontiers of the republic should be menaced, and anarchy should prevail in the interior." (*Memoirs*, vol. ii. part 2, p. 212.) If Kléber had not been assassinated, and if Menou, than whom a less military man never commanded, had not been at the head of the French army, Napoleon would probably have been spared the reproach of deserting this army from a foresight of coming misfortunes. It is evident, indeed, that when he left Egypt in August 1799, he thought that country secured to France, and hoped one day to be able to realize the second object of the expedition. Kléber had under his command 28,000 men, of whom 25,000 were in a condition to take the field; and there can be little doubt, we think, that, at the head of such a force, *he* would have been able to maintain himself in the country.

But his enterprise proved unfortunate. Having descended the Nile as far as El-Ganayur, he was repulsed by a division of the army of Upper Egypt, under the command of General Morand; and being overtaken in his flight, his camp was surprised at Samahout, a great number of Mamlukes were entirely cut off, two hundred camels with spoils, a hundred horses, and a prodigious quantity of military implements, fell into the hands of the republicans; and it was with the utmost difficulty that the bey himself effected his escape. Thus signally defeated, Murad wandered through the inhospitable deserts of Upper Egypt in search of an asylum and the means of subsistence. But as he had proved an indefatigable enemy to the French, and was dreaded even in his misfortunes, Desaix resolved if possible to exterminate him; and for this purpose he caused two columns of infantry mounted on dromedaries to be immediately organised, the one commanded by himself in person, and the other by Adjutant-general Boyer. On the 19th of October, after a forced march of three days, these moveable columns overtook Murad in the desert of Sediman, and a combat immediately ensued. The Mamlukes, animated with the hopes of gaining possession of the dromedaries, fought with determined valour. But their attack was met with such vigour on the part of the French, that they were soon put to flight, and pursued back to the deserts by their indefatigable antagonists.

On the 24th of September, a Turkish fleet of eighteen vessels came to anchor before Damietta, and was so rapidly increased by constant reinforcements, that towards the end of the subsequent month it amounted to fifty-three vessels. This fleet was commanded by Sir Sidney Smith, whose flag was hoisted on board of the Tigre. On the 1st of November, four thousand Turks having effected a landing, were attacked by General Verdier at the head of only a thousand men, and, notwithstanding their great superiority of numbers, were defeated with a loss of three hundred men killed, eight hundred prisoners, including Ismael Bey, the second in command, thirty-two stand of colours, and five pieces of cannon. After a number of other affairs, which were fought with various success, the French seemed willing to evacuate Egypt upon certain conditions; and in December, General Kléber, upon whom the chief command had devolved, made proposals of peace to the grand vizir. These were communicated to Sir Sidney Smith, and it was at length arranged that a conference should be held on board the Tigre, then at anchor in the bay of Acre. Kléber appointed as commissioners on the part of the French, General Desaix and M. Poussielgue, who, towards the end of December, embarked for the capital of Syria; but a gale of wind, which drove the Tigre to sea, prevented the ship, for eighteen days, from returning to the bay. The commissioners then made and received certain propositions in writing, after which they were landed; and on the 24th of January 1800, these terms, having been reduced into form, were mutually signed at El-Arisch. By this convention[1] it was stipulated that the French army, with all its stores, artillery, and baggage, along with the ships of war and transports at Alexandria, should be permitted to return to France unmolested by the allied powers. But Vice-admiral Lord Keith, who commanded in chief in the Mediterranean, refused to ratify the treaty entered into at El-Arisch; and the French, considering themselves as deceived and insulted, indignantly recommenced hostilities, and gained several advantages over the Turks. The British government, however, becoming sensible of the advantage of clearing Egypt of the enemy without bloodshed, at length agreed to accede to the convention. But it was now too late. Kléber, indignant at the deception practised on him, had turned upon the Turks at Heliopolis, routed the army of the grand vizir with great slaughter, and driven the remains of it into the desert of Syria; and Menou, who, on Kléber's assassination,[2] had succeeded to the chief command, encouraged by the hopes of receiving fresh supplies and reinforcements from Europe, and considering that the French had made themselves masters of all the strong posts throughout Egypt, resolved to retain possession of the country at every hazard, and to defend his positions against any force which might be brought to oppose him. Accordingly, after driving the wrecks of the grand vizir's army from Gaza, where they had endeavoured to rally, and also threatening Syria with another inroad, he strongly fortified Alexandria, Damietta, and Rosetta, and not only completed the lines which had been commenced at Aboukir, but made several important additions, and put every place into such a state of defence as enabled it to bid defiance to any attack upon the part of the Turks.

In the mean time Great Britain was not idle. Having organized an army destined to invade Egypt and compel the French to evacuate that country, the command of it was entrusted to Sir Ralph Abercromby, who had distinguished himself both in the West Indies and in Holland. In the beginning of March 1801 he appeared off Aboukir Bay; but the weather having proved unfavourable, the disembarkation of the troops did not commence until the morning of the 8th. Meanwhile the French having marched from Alexandria, took up a position on the heights of Aboukir, to oppose the landing of the British forces; but, by the admirable arrangements of the navy, the disembarkation was effected in spite of all opposition, and the enemy were dislodged from the sand-hills which commanded the landing place, by the troops gallantly charging up the heights the instant they were formed on the beach. The action lasted two hours; but the French having only about four thousand men to oppose nearly three times that number, were at length obliged to sound a retreat. The loss of the French on this occasion was estimated at three thousand, and that of the British at fifteen hundred men, in killed, wounded, and prisoners. A portion of the army then moved forward, and on the 13th a sharp encounter took place, in which, owing partly to ignorance of the country and the delusion created by the mirage, several British regiments, including the 92d, suffered severely. But the battle which in a great measure decided the fate of Egypt took place on the 21st of March, about four miles from Alexandria. It began at daybreak, by a false attack on the left of the British; but the efforts of the French were chiefly directed against the right of their opponents, which they attempted to turn, and at one time had nearly succeeded. Being at length repulsed, however, they next attacked the centre, though with less vivacity, and were here also defeated. None of these attacks was made with sufficient continuity, or in a manner which deserved success, being rather partial onsets than vigorous, decided, and sustained efforts directed to the accomplishment of a definite object. Having failed in his ill-directed attempts to penetrate the British line, Menou at length retired upon Alexandria, leaving the field of battle in possession of his adversaries. About two hundred prisoners fell into the hands of the British; but as the latter were much inferior in cavalry to the enemy, whose retreat was also covered by cannon planted on the opposite heights, they were unable to pursue their advantage. The loss of the British was very considerable, but the most irreparable part of it consisted in that of the commander-in-chief, who was mortally wounded, and died on the 28th. He was succeeded by General Hutchinson, the second in command, to whom was committed the completion of the conquest of Egypt.

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[1] Napoleon affirms that "intriguing persons had made Kléber sign" the "capitulation" of El-Arisch (*Memoirs*, vol. ii. part 2, p. 214); and it is certain that the French officers generally were sick of the war in the East, and desirous to return to Europe. But as to the assertion that Kléber negociated with the allies merely to gain time, and that he never intended to accede to the convention; an assertion which has been reiterated in a great number of works, from the Travels of Dr Clarke to the Memoirs of Bourrienne; it betrays an entire ignorance of facts. Kléber had actually signed the capitulation, and was preparing to execute it on the part of the French, when a notice arrived from Sir Sidney Smith that hostilities were to be continued in consequence of Lord Keith's rejection of the treaty. This prompt intimation, alike honourable to Sir Sidney and worthy of the British character, was duly appreciated by the French, when it became known to them that the Turks, apprised of the admiral's refusal to ratify, intended to take advantage of Kléber's ignorance, and to attack him whilst resting on his arms, in reliance on the faith of the treaty. The low morality of the Osmanlees led them to regard the meditated act of treachery as perfectly allowable; and accordingly they never forgave Sir Sidney for his generous integrity, considering him as one who had sacrificed their interests, if not betrayed their cause.

[2] This gallant and experienced officer was treacherously assassinated by a janizary, whilst presenting a memorial for his perusal. Suspicion at first fell on Menou, who, as a difference subsisted between him and Kléber, was supposed to have hired the assassin; but the dying assertions of the murderer clearly established the injustice of this suspicion. If not impelled by mere fanaticism, the assassin was most probably hired by the grand vizir; and the abominable treachery which the Turks are known to have contemplated, after Lord Keith's refusal to execute the convention of El-Arisch, serves to countenance this supposition. The assassin himself was impaled alive, his right hand was burned off, and his body was left to be devoured by birds of prey. Three sheikhs who were privy to his designs, but did not divulge them, were also beheaded.

The new commander-in-chief having invested Alexandria, at length proceeded against the French, whom he attacked on the 19th of May, near Rhamanieh, and forced to retire towards Cairo. He had under his command four thousand British troops, with an equal number of Turks under the capitan pasha. He then directed his march towards Cairo, from which the army of the grand vizir was at this time distant only four leagues, and where the main strength of the French army had now assembled. With nine thousand chosen troops, the grand vizir, assisted by some British officers then in his camp, gained an advantage over a body of from four to five thousand French; Damietta soon fell into the hands of the allies; and the successor of Murad Bey, who had died of plague, having declared in favour of the British, joined General Hutchinson with fifteen hundred cavalry. Belliard, who commanded in Cairo, satisfied that without reinforcements from Europe the war could not be prosecuted with any prospect of success, now proposed terms of capitulation; and, on the 27th of June, a convention was accordingly concluded, by which the French agreed to evacuate Cairo, on condition of being sent to France, with their arms, cannon, baggage, and colours, without being made prisoners of war. But Alexandria, which was strictly blockaded by General Coote, still held out; and Menou had somewhat hastily expressed a determination to bury himself in the ruins rather then surrender. Such vows, however, being generally made with a tacit mental reservation, are seldom observed with literal fidelity. A regular bombardment was commenced by the ships in the harbour, and the batteries on land;[1] the defences began to give way; a practicable breach was made; and the besiegers were about to make preparations for the assault, when Menou, who evidently waited for the moment when he might yield without dishonour, signified his readiness to listen to terms. A convention was accordingly entered into, and on the 2d of September the garrison capitulated on nearly the same conditions which had been granted to General Belliard at Cairo.

It is not a little remarkable in itself, and may serve to illustrate the wisdom with which the affairs of this country were then managed, that after the campaign of 1801, which cost Britain several millions sterling, ten thousand of her best soldiers, and the commander-in-chief of her army, General Belliard at Cairo, and General Menou at Alexandria, obtained almost the same capitulation which Kléber, twenty months before (24th January 1800), had signed at El-Arisch; in other words, all these sacrifices had been made to bring about the same result which, but for the inexplicable opposition of Lord Keith, Sir Sidney Smith would have effected without the expenditure of a guinea or the loss of a single life. If ever glory was barren, therefore, that which the British had gathered in the expulsion of the French deserves such a qualifying epithet. But, however this may be, Egypt, after having been for more than two years the theatre of almost incessant conflicts, was once more reduced under the government of Turkey, and obliged to acknowledge the authority of the Ottoman Porte; a result, we may add, which proved as evanescent as all the other objects of British policy regarding that country.

It would indeed be difficult to give any satisfactory account of the views which Great Britain at this period entertained regarding Egypt. Her policy was too vacillating to be reconciled with any fixed principle of action.

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[1] When General Hutchinson marched for Cairo, leaving General Coote to blockade Alexandria, the latter officer, wishing to strengthen his position, and shorten the line of the blockade, had recourse to an expedient which wisdom and humanity must alike condemn. In the pocket of General Roiz, who had been killed in the action of the 21st of March, there was found a letter written by Menou, expressing an apprehension that the British would cut the embankment along which was carried the canal of Alexandria, and thereby admit the waters of the sea into Lake Mareotis. From this moment the project unhappily suggested in this letter became a favourite object with the army. By securing the left and part of the front, the duty would be lessened, the French cut off from the interior, and a new scene of operations opened: these were the military advantages which the execution of this project would ensure, and the army thought of nothing else. But there were nevertheless grave objections to the measure. The mischief it might do was incalculable; the Arabs could give no information where the sea, if once let in, could be checked; and the ruin of Alexandria might probably be the consequence. Besides, it was argued that the inundation, whilst it covered the British left, would also secure the French front, except from a new landing. But every consideration yielded to the supposed urgency of the service, which superseded all remoter considerations; and the measure was determined on. To comprehend the precise nature of the operation, however, it is necessary to attend to the natural formation of the country. To the south and westward of Alexandria extends a valley, running in the latter direction upwards of forty miles, and forming the bed of the ancient Lake Mareotis. Of this hollow space a large portion was under the level of the sea, which, therefore, was only prevented flowing into it by the dike or embankment along which runs part of the canal from the Nile to Alexandria. General Coote accordingly directed four cuts of six yards in width, and ten yards asunder, to be made in this embankment; and his orders were executed with the zeal and alacrity generally displayed in the work of authorized destruction. When the fascines which protected the workmen were removed, the water rushed in with a fall of nearly seven feet, and with such force that the portions of the dike intervening between the cuts were all washed away; yet although the whole breach widened to the extent of a hundred yards, it was nearly a month before the valley filled and the water found its level. Thus a work which formed the pride as it had ever been the peculiar care of Egypt, which it had required the labour of ages to construct and consolidate, and which all former invaders, however barbarous, had spared, was in a few hours destroyed by the ruthless hands of British soldiers. (Stewart's *Military Service of the Highland Regiments*, vol. i. p. 482, 2d edition.)

At first she seemed disposed to establish her power in that country; then she renounced all idea of such an establishment; her ambassador at Constantinople applauded the destruction of the Mamlukes; then hopes were held out by her to the Beys, and whilst she neglected to apprise them of the danger which impended over them, she sought to save them when their ruin was inevitable. But the Beys merited different treatment. They had resolutely opposed the French from the first moment of the invasion, and by the heavy losses which they had sustained in this unequal contest, their power was so far reduced as to leave them in some measure at the mercy of the Turks. In assisting to expel the French from Egypt they had thoughtlessly sacrificed their own means of self-defence. But this circumstance gave them an undoubted claim to the protection of the British, whose allies they had been in the contest; and their claim was distinctly recognized by General Hutchinson, who interposed in their behalf, and exerted himself to procure for them the most favourable terms. The Capitan Pasha, however, had vowed their destruction, and, as usual with Turks, he set about the accomplishment of his object by means of dissimulation and treachery.

Pretending to enter into the views of General Hutchinson, who insisted that their rights and dignities should be restored to the Mamlukes, on condition of their paying the usual tribute to the sultan, Hassan reinstated Ibrahim Bey, who was now at the head of their affairs (Murad having fallen a victim to the plague), in his former office of Sheikh-el-Belled; he also lavished favours and caresses on the other chiefs, and sought by every means to gratify their pride, and, above all, to allay their suspicions. In this he was but too successful. Hassan enacted his part so well, and seemed so sincere in his professions, that these rough soldiers, forgetting all the lessons of former experience, suffered themselves to be led as it were blindfold into the snare which had been so artfully prepared for them. Accordingly, having so far attained his object, the Capitan Pasha invited the principal Beys of the house of Murad, including Osman Bey Tambourgi, Osman Bey Bardissi, Murad Bey Soghayr, and several others, to visit his camp at Aboukir. After some hesitation, they resolved to accept of Hassan's proffered hospitality, and repaired to Aboukir, where they were received with every mark of honour and distinction. Their tents were placed in the demilune formed by the encampment of the troops, and pleasure and amusement were the order of the day. The time passed in paying visits of ceremony, and in military promenades, and already a month had elapsed without their receiving from the Capitan Pasha so much as even a hint of his intentions respecting them, or of the object of his invitation. This long silence alarmed them, and they expressed their fears to General Hutchinson; but that officer, never suspecting the atrocity which Hassan was meditating, assured them of the friendly dispositions of the pasha, and the good intentions of the Porte, towards them. This assurance, however, was not sufficient to quiet their fears; their distrust increased every instant; and several had resolved to quit the camp without taking leave of the pasha, and to return to Cairo.

But the crisis was at hand. Whilst matters were in this state, the Capitan Pasha and the Beys were invited to an entertainment to be given at Alexandria on the occasion of General Hutchinson's resigning the command to Lord Cavan, prior to his departure from Egypt. On the morning of the day appointed for the festival the pasha had the Beys to breakfast in his tent; and, after the repast, the whole party embarked on board some boats which had been provided for the occasion. The pasha went in his own cutter with the Beys and some of their Mamlukes, whilst the other boats were appropriated to the officers of his suite. When they had proceeded to a short distance, the Capitan Pasha perceived a light skiff rapidly approaching: "There," said he to the Beys, "are doubtless dispatches for me from Constantinople." Anon the skiff came alongside, and a packet was handed to the pasha, which he immediately broke open, and, on pretence of reading his dispatches more at leisure, stepped on board the small boat, which immediately dropped astern. Meanwhile the other boats proceeded on their course, the skiff following at a great distance; when, on entering the lake of Aboukir, the Beys suddenly discovered before them three large sloops filled with soldiers armed and ready for action. They now saw that they had been betrayed, and accordingly prepared to defend themselves. Mohammed Bey Manfoukh drew his sabre, and the rest followed his example; the sloops opened their fire, and these brave men fought like lions against the Turkish soldiers; but in this unequal contest valour proved unavailing against numbers; and discharges of artillery and musketry hurled destruction amongst the boats. Osman Bey Tambourgi, Murad Bey, Osman Bey el Achkar, Ibrahim Kiaya Sennary, and several Mamlukes, were killed; whilst Osman Bey Bardissi and Ibrahim Bey Hussein were severely wounded. Those who escaped the massacre were taken prisoners, and carried on board the ship of the Turkish vice-admiral, where they were compelled to swear on the Koran that they would not demand to be given up to the British, and would remain in the hands of the Turks.

When the news of this catastrophe reached Alexandria, General Hutchinson dispatched General Stuart to the Capitan Pasha to reproach him with his abominable treachery; and at the same time the British army left its camp, and formed in order of battle opposite the Turks. The resentment of the troops knew no bounds, and they burned to avenge so sanguinary a violation of the laws of hospitality. But the Capitan Pasha, alarmed at this demonstration, lost no time in complying with the demands of the British general; the prisoners and the wounded were landed and conveyed to Alexandria; and to those who had fallen the British army rendered the honours of military sepulture.[1] The pasha then sent Isâk Bey, his interpreter and confidant, to endeavour to pacify the British general, who had been greatly exasperated at the treachery of the Turk, and who, in a conversation which ensued with the envoy, described the conduct of his master in the only language fitted to characterize its atrocity.

As soon as the objects of his expedition had been attained, Hassan, not chusing to winter in the open road of Aboukir, made the necessary preparations for embarking the troops under his command, and having broken up his camp, set sail for Constantinople. After his departure, Mohammed Kusruf, his favourite slave, who had been appointed pasha of Cairo, repaired to the capital in order to assume the reins of government. A Georgian by birth, this minion of fortune had owed his elevation to his plausible manners and artful flatteries; but, from want of prudence and knowledge of mankind, he soon showed himself unequal to the station to which he had been raised, and his inexperience proved the cause of his subsequent misfortunes. As soon as he had taken possession of his pashalik, Kusruf commenced military operations against the Mamlukes, who, having rallied under Osman Bey Bardissi, had retired into Upper Egypt, their usual asylum, where they set the pasha at defiance. Having failed to induce them to return and fix their residence in the capital, the latter dispatched into the Saïd a corps of six thousand Albanians under the command of Taher, their chief, assisted by the celebrated Mehemmed Ali, then beginning to rise into power, with orders to seize Elfi Bey, and to dislodge the Mamlukes. But this expedition proved abortive. Taher returned without effecting any thing of consequence, and all attempts at negociation proved equally unavailing. Emboldened by this failure, the Mamlukes descended into the province of Fayoum, which they plundered, and extending their ravages into the provinces of Minyeh and Benisouef, they at the same time threatened the capital itself. In these circumstances, Yussuf Bey, kiaya of Kursuf, having assembled a considerable force, and been joined by Taher with his Albanians, received orders to proceed against the Mamlukes, and directed his march upon Damanhour, where part of them had encamped under the command of Osman Bey Bardissi. A battle ensued in the neighbourhood of this place; the Mamlukes, with their usual impetuosity, charged the left flank of the Turks, which had been left uncovered; the Turkish infantry, broken by the shock, fell into irretrievable disorder, and the sabres of the Mamlukes soon completed their overthrow. The first charge decided the victory. The Turks were miserably defeated, with the loss of about five thousand men killed and wounded; whilst the success of the Beys cost them only between sixty and seventy men. But the latter neglected to profit by their victory, and instead of pushing directly for the capital, which was in no condition to oppose them, they allowed the viceroy time to rally the fugitives, and to place Cairo in a tolerable state of defence.

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[1] Mengin, *Histoire de l'Egypte sous le Gouvernement de Mohammed-Aly*, vol. i. pp. 13–16. *Zeitschrift für Kunst und Gesch. des Krieg.* January and February 1831. *Abrégé de l'Histoire des Mamlouks, Bulletin des Sciences Militaires*, vol. x. p. 219.

The troops of Taher Pasha and of Mehemmed Ali, by reason of their distance from the scene of action, had not taken part in the battle of Damanhour, which in fact had been fought by the Turks with only a part of their force, and before the Albanians could join. This, however, did not prevent Yussuf, who had escaped the sabres of the Mamlukes, from attributing the loss of the battle to the cowardice or disaffection of Mehemmed Ali, who, as he alleged, had treacherously kept back his troops; and although the accusation appears to have been groundless, it was not on that account disregarded by Kusruf, who had already seen cause to dread the commanding talents and aspiring character of this remarkable person, and who, accordingly, resolved to avail himself of the pretext thus offered in order to effect his destruction. An attempt was accordingly made to bring him to trial for neglect of duty; but ere this could be effected, there broke out a revolt, which soon became a revolution, and which in its ulterior consequences has exercised the most powerful influence upon the destinies of Egypt. Before proceeding, however, to notice the circumstances attending this memorable revolt, headed by Taher Pasha, we shall interrupt the progress of the narrative for a little, and, in order that the connection of events may be preserved, take a retrospective survey of the origin, early fortunes, and gradual rise to distinction, of the remarkable individual who has so deeply impressed the great lineaments of his character upon the history of Egypt.

Mehemmed Ali, viceroy of Egypt, is a native of Cavalla, an obscure village in Rumelia, a district of Albania. Having lost his father in early life, he entered the service of the governor of his native town, under whom he appears to have received that species of training which qualifies a man to rise in such a country as Turkey, where energy, intrepidity, and expertness in the use of arms, are considered as the most valuable accomplishments. He commenced his career as a subordinate tax-gatherer, an office to which his activity had recommended him; and, in the discharge of his duty, he soon gave proofs of that decision of character and of those resources of mind for which he afterwards became so distinguished, exacting the money he was ordered to raise with most impartial rigour, and not sparing the blood nor even the lives of the unhappy peasantry over whom his fiscal jurisdiction extended, when they attempted, as sometimes happened, to resist his demands. It has been said that the youth is father to the man; and, upon the same principle, the Rumeliot tax-gatherer may be described as father to the future pasha and viceroy. On one occasion, the inhabitants of a village having refused payment of the tax imposed on them, at first threatened, then resisted, and at last broke out into open revolt. Alarmed at this unusual boldness, and dreading the effect of the example, the governor sent for Mehemmed, who at once undertook to reduce them to obedience. Having assembled a few men, whom he hastily armed, the young collector accordingly proceeded at their head to the refractory village, where, having announced that he was charged with a secret mission, he entered a mosque, and summoned the principal inhabitants to meet him in the house of prayer. Not suspecting any violence, the heads of the village obeyed his summons; but no sooner had they come within the walls than he ordered them to be bound hand and foot, and immediately set off with his captives for Cavalla, pursued by the villagers, whom, however, he overawed by threatening, in case they made any attack, to put their friends to instant death. This vigorous proceeding, evincing a characteristic union of conduct and firmness, procured for him the rank of Bulukbashi, and a rich wife, a relative of his patron the governor. He next became a dealer in tobacco and other merchandise, a business which he is understood to have followed with considerable success; and as mercantile pursuits are not held in Turkey to be incompatible with military duties, Mehemmed, ever careful not to neglect the latter, gradually worked his way up to that degree of consideration which gained him the command of the contingent of troops furnished by his native district to the army with which Turkey was then preparing to defend Egypt against the French. In 1798, Bimbashi or Major Mehemmed Ali reached Egypt with his contingent of three hundred Albanians, and from the day of his landing in that country his rise was uniform and constant. This command, which opened the field of future greatness to Ali, has been attributed by some to the fact of his having married a rich wife, just as the fortunes of Bonaparte have, by a similar class of reasoners, been ascribed to the accident which, in the same year, led to his union with the widow of General Beauharnois.

Not long after his arrival in Egypt, the Rumeliot tax-gatherer and tobacconist, by his gallant conduct on the field of battle, attracted the particular notice of the pasha, who recommended him to Kusruf, the governor of Cairo. This was his first step towards advancement in that country where he was destined ere long to establish an undisputed supremacy of power. After the massacre of the Mamlukes at Aboukir, he became a general of division in the army of Yussuf Bey, and was marching at the head of his division towards Damanhour, when the precipitation of Yussuf brought on the battle with the insurgent Mamluke chiefs, which terminated so fatally for the Turks. Yussuf, as we have already seen, attributed his miserable defeat to the alleged misconduct or disaffection of Mehemmed, whom he accused of having purposely delayed the advance of his division; and the charge, whether groundless or not, was entertained by Kusruf, now pasha of Egypt, who accordingly resolved to expel the young Albanian general from that country. But he little knew the character of the person with whom he had to deal. The pay of the troops being considerably in arrear, they applied for redress to the pasha, who referred them to the defterdar, or minister of finance ; but the latter being in no condition to satisfy their demands, told them to go to Mehemmed Ali, who, in his turn, assured them that he had not received a piastre for the liquidation of their claims, and at the same time encouraged them to persevere in their demand for payment. Meanwhile the viceroy sent orders to Mehemmed to appear before him in the night ; but the latter, not unacquainted with the object of such private interviews, returned an answer stating that he would appear on broad day in the midst of his troops. The danger of the viceroy now became imminent. The soldiers demanded their arrears in an audacious tone, accompanied with menaces, which Kusruf, reckoning on his means of repression, had the imprudence to despise ; a revolt immediately broke out ; the artillery opened on the mutineers, who replied by volleys of musketry directed against the palace of the viceroy ; and a fierce conflict ensued. The soldiers of Ali, who had been cantoned in the environs of the capital, now joined the insurgents, and the battle became general. At this moment, Taher Pasha, chief of the Albanians, went to present himself before the viceroy, and to offer to become mediator between him and the exasperated troops. But Kusruf refused to see him, and sent him orders to return to his residence, without concerning himself about what was passing. Taher, however, chose to follow a different course. Repulsed by the viceroy, he now openly took part with the mutineers ; and having, partly by force and partly by stratagem, obtained possession of the citadel, he attacked the palace, whence the viceroy was soon forced to fly with his wife and one or two attendants to Mansoura. In short, the revolt speedily became a revolution, and the vice-regal power passed from the hands of Kusruf to those of Taher Pasha.

But the power which the Albanian chief had acquired by mutiny was soon lost by misconduct. Taher governed only twenty-two days, during which brief space he committed all sorts of injustice and cruelty, and in particular caused two Coptic intendants and a merchant of Damascus to be decapitated. His career was cut short by two Turkish bimbashis, who anticipated the wishes of the Porte, which, on receiving intelligence of what had occurred in Egypt, dispatched a couple of capidgis-bashis for the head of Taher. The Mamlukes, seconded by Mehemmed Ali, now entered Cairo, and having formed an alliance with the Albanians, the government reverted into the hands of their chiefs, Ibrahim Bey and Osman Bey Bardissi, in conjunction with Mehemmed. The new allies then marched an army against Kusruf Pasha ; besieged and took Damietta, into which the viceroy had thrown himself with his adherents ; and having made the latter prisoner, conducted him back to Cairo. Meanwhile the Porte observing Egypt about to slip a second time through its fingers, lost no time in dispatching a new pasha, Ali Gezaïrli, to assume the direction of affairs ; but as soon as the intelligence of his arrival reached the confederate chiefs, they quitted Damietta, marched against the intruder, and soon forced him to take refuge within the walls of Alexandria. Whilst matters were in this state, discord arose between the Mamlukes and Albanians. The latter demanded their pay, which had fallen into arrear, from Osman Bey Bardissi, and not receiving any satisfactory answer, they quitted the camp at Damanhour, and returned to Cairo under the conduct of Mehemmed Ali. Osman Bey Bardissi made the same movement with his Mamlukes, and returned to Cairo, where he resumed the direction of affairs. Profiting by this disunion, Ali Gezaïrli summoned the rebels to submit to his authority ; and, to his great surprise, the summons was obeyed. Full of hope, and conceiving he had now the ball at his feet, Ali set out for Cairo at the head of a considerable force, instead of an escort merely, as had been agreed on. But the Mamlukes and Albanians, apprised of his design, took up a position at Chalakan, near the Nile, where they awaited the arrival of the pasha. Ali here attempted to negociate, and even tried to draw over to his side some of the commanders of the confederate insurgents ; but these men, aware that they had gone too far to recede, treated his advances with disdain ; and the Mamlukes having charged with their usual impetuosity, overthrew the pasha's force in an instant, and put to death Ali himself, whom they overtook in his flight from the field of battle.

As the undisputed ascendency of the Mamlukes might in the end have proved fatal to designs which Mehemmed Ali was now cherishing, the wily Albanian, who knew that he was an object of dread and suspicion both to Turks and Mamlukes, contrived to embroil Bardissi, the Hotspur of the Beys, with some of his associates, and to fan the flame of that discord which he had artfully kindled. These impetuous and headstrong men fell into the snare which had been laid for them ; they went to war amongst themselves, and sought to exterminate one another, whilst Mehemmed took care to keep alive the disunion by which he was so soon to profit. At length, on the 12th of March 1804, he threw off the mask, attacked Bardissi and Ibrahim in their palaces, whence these brave men cleared a passage with their swords ; and recognized Kusruf, whom he took out of prison in the citadel, as pasha of Egypt, intending, no doubt, to use the latter as an instrument for promoting his own ends. But shortly afterwards he again expelled the unfortunate viceroy, who was promptly replaced by Kurschid Pasha. Meanwhile the Beys having taken refuge in Upper Egypt, commenced war against the Turks and Albanians ; and Elfi Bey, who had been for some time in England, having by this time returned, joined his brethren in arms ; but his counsels, though they served to delay, could not avert the fate which now impended over the Mamlukes. An order issued by the Porte for the return of the Albanians to their own country, brought on the crisis which had been long prepared. Mehemmed, whose designs were in a great measure matured, disobeyed the mandate, upon the pretext that his services were still necessary to repress the audacity and insubordination of the Mamlukes. The people of Cairo rose, and the sheikhs and ulemas having proclaimed Mehemmed Ali their pasha, demanded his confirmation of the Porte, which was granted. The Mamlukes were now summoned to submit to the new governor ; and as they hesitated or refused, a snare was laid for them which proved fatal to many of their numbers. Some sheikhs and Albanian captains with whom the governor maintained a secret understanding, having opened a communication with the Mamluke chiefs, promised to deliver up to them the gates of Cairo on the day of the festival of the inundation of the Nile. Accordingly, on the 18th of August 1805, a large party of Beys, who were devastating the environs of the city, penetrated into the suburbs, and, meeting with no resistance, entered Cairo itself, where all appeared equally tranquil. Nothing was heard but the sound of their martial instruments, whilst the terrified inhabitants, having shut themselves up in their houses, left the streets completely deserted. Dividing their numbers into two parties, they advanced resolutely, anticipating only a triumph ; when, all of a sudden, as soon as they had become entangled in the narrow streets of the city, a rattling fire of musketry opened upon them from the houses in which their enemies were concealed, and whence destruction showered upon their ranks. Recovering from the astonishment created by this unexpected reception, they rushed towards the gates of the city; but these having been shut immediately after their entrance, all retreat was cut off, and, with the exception of a small party who by some means contrived to make their escape, the whole perished under the musketry of an unseen enemy.

Ibrahim and Bardissi, more distrustful than their associates, had not participated in the imprudence to which so many of their number had fallen victims; and having retired into Upper Egypt, the ordinary refuge of the conquered, they defeated the troops of the pasha, and prevented the collection of the imposts; whilst Elfi, the most powerful of the Beys, reigned in Fayoum, Ghizeh, and part of Lower Egypt. Mehemmed Ali at the head of a body of troops followed their movements as far as the confines of the province of Kelouhyeh; but finding all his efforts unavailing against so active and enterprising an enemy, he returned to Cairo. The contest between Ali and the Mamlukes continued to be carried on with various fortune, though, upon the whole, to the advantage of the new governor; when the policy of England, the hatred of Kurschid towards the pasha, the influence of the gold of Elfi Bey at Constantinople, and the suspicions entertained of Mehemmed, determined the Porte to re-establish the government of the Mamlukes. Accordingly, on the 1st of July 1806, Saleh, capitan pasha, arrived at Alexandria with 3000 men of the Nizam-jedid, and ordered Mehemmed to quit Egypt for the pashalik of Salonica. A capidgi-bashi was also dispatched to Cairo to command the attendance of Ali at Alexandria, where, it was pretended, he would be formally invested with his new government. But the Rumeliot peasant was not the man to fall into so obvious a snare. Having worked his way to the eminent station which he then occupied with only five hundred men at his disposal, it was not likely that he would descend from the vantage-ground on which he stood, when surrounded by fifteen hundred resolute Albanians, ready to die in his defence. Accordingly he appealed both to the attachment of the people of Cairo, and to the affection of the Albanians; nor did he appeal in vain. The former declared loudly in his favour; and the latter, drawing their sabres, swore to conquer or die along with him. "Cairo," said he, "is to be publicly sold; whoever will give most blows of the sabre will win it, and remain master." In this coin his Albanians were quite prepared to pay down the price of the Egyptian capital upon the shortest notice. But no actual collision took place. Elfi Bey, who had promised fifteen hundred purses (L.30,000 sterling) to the grand vizir, failed to perform his engagement; dissensions broke out between him and the other Beys, who dreaded lest the protection of England should render him too powerful; and the Porte, finding itself on the eve of a war with Russia, was in no condition to engage in a contest in Egypt. Saleh accordingly received instructions to treat with the pasha upon the principle of recognizing his power; and shortly afterwards Mehemmed Ali received from the Porte his formal investiture as viceroy of Egypt. Seeing all his hopes thus frustrated, Bardissi died of grief at Monfalou, Elfi Bey soon followed him to the tomb, and his troops having disbanded, part of them entered the service of the viceroy, whose force was further increased by a battery of ten pieces of English artillery served by European cannoniers.[1]

The remains of the Mamlukes, who, as usual, had taken shelter in Upper Egypt, did not now exceed two thousand five hundred horsemen, exclusively of the Arabs their allies; and the viceroy was preparing to proceed against them, in the hope of effecting their extermination, when he received dispatches from Constantinople, announcing the commencement of hostilities between Great Britain and the Ottoman Porte, and soon afterwards found himself called to contend with a new enemy. The English ministry having resolved to send a second expedition to Egypt, a body of about five thousand men from Sicily landed near Alexandria on the 17th and 18th of March 1807, the whole being under the command of Major-General Mackenzie Fraser. The object of this ill-fated expedition was to unite with the Beys, and, by their assistance, to prevent Egypt from falling again into the hands of the French, whose ambassador at Constantinople was understood to exercise a predominating influence in the politics of the Divan. But whatever may have been the views entertained by the British government, nothing short of the most profound ignorance of the state of Egypt, the broken and dispirited condition of the Mamlukes, and the actual amount of the Turkish forces in that country, can account for their sending out such a handful of men, whom, if their calculations had been founded on the slightest knowledge, they must have been sensible they were exposing to almost certain destruction. The disembarkation of the troops was completed on the 18th, and Alexandria, after a trifling resistance, surrendered on the 20th of March. A strong detachment under Generals Wauchope and Meade was then sent to take possession of the fort and heights of Abou-Mandour, on the left bank of the Nile, above Rosetta, and afterwards to occupy Rosetta itself. The first part of this service was accomplished without opposition; and the second proved a miserable failure. Having imprudently carried his detachment into the streets of Rosetta, which are only a few feet wide, with high, flat-roofed houses on either side, pierced by windows like loop-holes, and forming a better defence to a weak enemy than a walled town, Wauchope, who had been allowed to enter without interruption, was suddenly assailed with vollies of musketry from every part, whilst the troops were unable to return a single shot with any effect, and, after an unavailing struggle, were forced to retire with the loss of nearly three hundred officers and soldiers killed and wounded. General Wauchope paid for his temerity with his life, and General Meade was wounded. This repulse disconcerted the whole enterprise, and the troops retired to Aboukir, whence they were ordered to Alexandria. But the general being still anxious, if possible, to get possession of Rosetta, he resolved to make a second and more methodical attempt to carry that town. Batteries were accordingly constructed; a line was taken up between the Nile and the gate of Alexandria; a chain of posts was established between Lake Etko and El Hamad; and when all was ready the batteries opened against the town. But their fire made little or no impression on the heavy and strong masses of building; the Turks and Albanians gave themselves no concern about the fate of the inhabitants, who were the principal sufferers; and as the houses contained scarcely any furniture, all attempts to set the town on fire proved abortive. At this period much was expected from the co-operation of the Mamlukes, who, it was thought, would descend from Upper Egypt and keep the Turks and Albanians in check; but, like all the other calculations connected with the expedition, this proceeded upon utter ignorance of the real state of affairs, and was destined to encounter speedy and severe disappointment. The enemy daily increasing in numbers and boldness, surrounded and cut off the post at El Hamad, which had been placed beyond the reach of support; the others, being similarly circumstanced, speedily shared the same fate; and no alternative remained but to retire to Alexandria, in the face of a victorious enemy, with a powerful cavalry, of which he boldly but ineffectually endeavoured to avail himself. The retreat was ably covered by Colonel, now Lieutenant-General Sir John Oswald, with the remains of the 35th and 78th regiments, whose firm front and steady fire checked the advance of the enemy, particularly at Etko, where he suffered a sharp repulse, and discontinued all further attacks. The troops remained at Alexandria until the 22d of September, when the whole embarked for Sicily. In this wretchedly-planned and worse-conducted expedition, which tarnished the glory of the British arms on the very ground where six years before they had triumphed over the veteran soldiers of France, the loss was necessarily great; and the prisoners were treated with every species of contempt and barbarity, whilst no less than four hundred and fifty heads of their comrades who had fallen were publicly exposed at Cairo.[1]

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[1] *Abrégé de l'Histoire des Mamlouks. Bulletin des Sciences Milit.* tom. x. p. 222. *Zeitschrift für Kunst und Gesch. des Krieg.* 1831.

The evacuation of Egypt by the English proved a stunning blow to the Mamlukes, who, seeing all hope of regaining their former ascendency at an end, sunk into a state of extreme discouragement, and sought to forget their misfortunes by abandoning themselves to miserable and degrading pleasures. Their military ardour seemed in a great measure quenched; they had no longer any success against their enemies, yet their pride prevented them from making a tender of submission. They felt that resistance was hopeless, yet they shrunk from any acknowledgment of the weakness of which they were but too conscious. Matters were in this state when Mehemmed, moved only by considerations of policy, resolved upon their final destruction. Menaced at once by the Bedouins and the Mamlukes, he could not advance a step in any direction without danger. His people, incessantly pillaged and ransomed, were ready to break out into open revolt; whilst, to add to his embarrassments, the Porte, seconded by all true Moslemins, pressed him to march against the Wahabis, who had seized upon the holy cities of Mecca and Medina, and put to scorn the armies of Persia and Turkey. He saw that he might beat the Mamlukes, but he could not destroy them as long as they could retire to the desert and live at the expense of the inhabitants; and, on the other hand, whilst he was no stranger to the motive which induced the Porte to urge him to engage in an expedition against the fierce sectaries of the Arabian desert, which, it was confidently hoped, would end in his destruction, he was convinced that a refusal on his part to march against the enemies of the true faith, and to attempt the deliverance of the holy cities, would for ever ruin him in the opinion of all good believers. In these circumstances, and impelled by the most powerful motives, he resolved to prepare the way for the distant enterprise prescribed to him, by exterminating the enemy at his doors.[2]

But in order to succeed in his object, it was necessary to draw the Mamlukes to some place whence flight might be impossible; and in laying the snare the utmost caution and prudence were requisite, as a single false step, or the slightest precipitation, on his part, would have alarmed the suspicions of his intended victims, and baffled the whole scheme. Mehemmed accordingly commenced by gaining over to his side Selahin Elfi, whom he appointed commandant of Ghizeh, and loaded with valuable presents. The Mamlukes could not resist the effects of this example; all of them sighed after Cairo, and wished to exchange their wandering and comfortless mode of life for the pleasures of the capital. The aged Ibrahim warned them of the fate which awaited them, if, without due precaution, they placed themselves in the power of the perfidious pasha; and the projects of the latter were several times baffled by the cautious and experienced Bey. But the profound dissimulation and artful management of Mehemmed ultimately prevailed over the admonitions of the veteran chief; and, about the beginning of 1811, the greater part of the Beys, with their suites, repaired to Cairo. Here they celebrated in festivities the remembrance of their ancient power, and appeared even to brave the pasha himself, who, having assembled an army to march against the Wahabis, was preparing to review it previously to its departure. At length the first of March arrived. This was the day named for the investiture of Toussoun, the viceroy's favourite son, upon whom the Porte had conferred the dignity of pasha of two tails, and who had been appointed by his father to the command of the army destined to serve in Arabia. Four persons only were admitted into the secret. At the time appointed, all the grandees, military chiefs, and Mamlukes, arrayed in their splendid uniforms, proceeded to the citadel, and were ushered into the hall of audience, where they offered their congratulations to the pasha, who received them with great apparent affability. When the ceremony had concluded, the signal for departure was made by the viceroy, and the column, in the midst of which were the Mamlukes mounted on their superb chargers, descended by a narrow road cut out of the rock, and leading from the citadel to the gate of El Azab and the square of Roumeyleh. As soon as the head of the column had entered Cairo, the gate of El-Azab was shut, and the chief of the Albanians, Saleh-Koch, apprized his soldiers in a few words that the pasha commanded them to exterminate the Mamlukes. Without uttering a single word the Albanians immediately ascended the steep sides of the road, which they promptly lined; and scarcely had this moment apprized the Mamlukes of the danger which menaced them, when a terrible fire was directed against them from the ramparts of the citadel, as well as from the heights which commanded the road. Confined in this gulf, into which there now rained a deluge of fire, the Mamlukes sprung from their horses, which became unmanageable; tore away the lower garments which impeded their movements; and attempted, in their turn, to mount the rocky acclivities on either side of the road. But all their efforts were unavailing. Half-naked, with their sabres in their hands, they clambered up the heights, and died frantic with rage and despair at not being able to reach their enemies.

Scarcely had the column begun to defile from the citadel when the pasha's movements betrayed his anxiety; and on hearing the first discharges of musketry his agitation redoubled, his visage became deadly pale, and his lips quivered. It was indeed a terrible moment. He knew the value of his enemies; success might be doubtful; his orders might not be well executed; the frantic energy of despair might overthrow all his combinations. He was in the very crisis of his fate; his own existence and that of his family depended on the issue of the combat, which he had so treacherously commenced; and no safety remained for him except in the complete execution of the general massacre which he had planned, not only in Cairo, but throughout all Egypt. Whilst matters remained in suspense, therefore, a thousand appalling apprehensions appear to have arisen in his agitated mind. At length heads, the usual signal of victory, were brought, and laid at his feet. But the sight of these bloody trophies, though it appears to have somewhat abated his terrors, did not restore serenity to his countenance. In a little time Mendrici, one of the pasha's physicians, entered his apartment, and warmly congratulated him on the success of his enterprise. "The affair is finished," said the Genoese, with an air of gaiety; "this is a day of rejoicing for your highness." Mehemmed made no answer to the heartless remark of the Italian, but looking around in a dark and suspicious manner, seemed apprehensive lest some Mamluke, escaped from the carnage, should come to avenge upon him the slaughter of his comrades. Twenty-three Beys and more than a thousand Mamlukes were the victims of this bloody day. Having finished their task of butchery, the Albanians entered Cairo in triumph, and, under the pretext of searching for Mamlukes, penetrated into the houses and committed all sorts of excesses. For two days the city was abandoned to pillage, and not less than five hundred houses were sacked by the licentious soldiery. At length Mehemmed descended from the citadel with an escort, and, preceded by executioners, traversed the city, where he re-established order, and received the felicitations of the sheikhs and the ulemas, over the bloody corpses of his enemies.[1]

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[1] Stewart's *Military Service of the Highland Regiments*, vol. ii. p. 274, 277. Mengin, *Hist. de l'Egypte*, tom. i. p. 280, 281.

[2] Mengin. Russell. *Bulletin des Sciences Milit.* ubi supra. *Zeitschrift*, &c. 1831.

Such was the tragical scene which formed as it were the denouement of the complicated drama of intrigue, dissimulation, treachery, and cruelty in which Mehemmed had all along been the principal performer; and thus was in a great measure attained the object to which all his actions had constantly tended, namely, the destruction of the Mamlukes. The remains of this unfortunate militia, pursued by the viceroy's troops, passed the Cataracts, and threw themselves into Nubia; but being quickly followed, they were overtaken in their retreat, and again defeated with great loss. Their repeated misfortunes, however, seem at length to have restored to them somewhat of their original energy; for, issuing from the deserts, they afterwards appeared in Dongola, and took possession of the country, of which, however, they were only able to occupy a part. Ibrahim, the oldest of the Beys, died at the age of eighty-four. But the Mamlukes, though now reduced to a small number, had not yet exhausted the hatred of Mehemmed. His son Ismaël, in carrying his arms into the interior of Africa, attacked them once more in 1820, and compelled them to abandon their new country. This was the finishing blow. The few who had escaped so many casualties dispersed, and from this time the Mamlukes as a body ceased to exist. Originally formed in the middle ages, this intrepid cavalry ever afterwards entertained for infantry the contempt which that arm then merited; and its fall is principally to be ascribed to the circumstance that, whilst infantry had been greatly improved in discipline and stability, it had neglected to make any corresponding change either in its organization or manner of fighting. Hence the French infantry wrested Egypt from its hands, and the Albanian infantry completed its ruin. Still, considered merely as a body of horse, the Mamlukes continued to the last to maintain the reputation which they had originally acquired, as at once the finest and most daring cavalry which the world had ever seen.

The massacre of the Mamlukes, and the measures subsequently adopted for completing their destruction, having effectually secured the viceroy against all danger from the enemies whom he most dreaded, he now found himself at liberty to devote his attention to the state of affairs in Arabia. Thither Toussoun Pasha had, as already stated, been sent to command the army destined to act against the Wahabis;[2] and the campaign, though somewhat inauspiciously commenced, had already been attended with some success. After the battle of Safra, Toussoun had been compelled to retire to Iambo; but having received reinforcements from Egypt, he resumed the offensive, and advanced towards Medina, of which he soon made himself master. Having dispatched one of his officers to Constantinople with the keys of Medina, and large presents of money, jewels, and coffee for the sultan, Mehemmed set out in person for Arabia; and having crossed the Red Sea, he proceeded to Djidda, where he was received with the utmost kindness and hospitality by the Scherif Ghaleb, in return for which the latter was arrested by order of the pasha, deprived of his office, and sent as a prisoner to Cairo, probably from a suspicion of entertaining treasonable designs. But whatever may have been the cause, the palace of the scherif was plundered of immense treasures, part of which were applied to the support of the army, and part also transmitted in the shape of presents to the sultan. When the latter, however, came to understand how these had been acquired, he dispatched a capidji with a firman ordaining the viceroy to restore the property to the rightful owner. From Djidda, Mehemmed proceeded to Mecca, in order to pay his devotions at the shrine of the Prophet; and having thus acquired the character of Hadji, he assumed the command of the army, which, under Toussoun, had recently experienced some reverses, His presence in the camp restored discipline and confidence among the troops; disorder ceased, their spirits revived, and, anticipating victory under such a leader, they longed for an opportunity of revenging their losses, and obliterating the recollection of their defeats. Nor did it suit the views of the viceroy to baulk their wishes in this respect. As soon as he found himself in a condition to take the field, he concentrated his forces, and marched against the Wahabis, whom he routed and put to flight. The main body of the Turkish army then entered the country of the Nedjd, whilst Toussoun, at the head of a division, marched on El-Rass, which he took by a stratagem, but was afterwards obliged to evacuate from want of provisions. The Wahabis, finding that the fortune of war had thus turned against them, now made proposals of peace; and, with a view to a negociation, an armistice was agreed to. But as it soon became evident that their principal object was to gain time, Toussoun, who, in the interval, had received reinforcements and supplies of all kinds from Medina, resolved to march against the enemy and to give them battle. This brought the latter to their senses; a negociation was opened, and as Mehemmed had urgent reasons for treating, peace was speedily concluded between him and Abdallah-ebn-Souhoud, chief of the Wahabis; after which the pasha immediately took his departure for Egypt, where his presence had become necessary. In the depths of the Arabian desert he had received intelligence of the return of Napoleon from Elba; and as he foresaw that this event would plunge Europe again into war, and knew that, even to the moment of his fall, Bonaparte had cherished the hope of recovering Egypt, he set out with all haste from Medina, sailed from Djidda for Cosseir, and arrived at Ghizeh on the 18th of June 1815, the day of the battle of Waterloo. The following morning he made his public entry into Cairo.

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[1] Mengin, *Histoire de l'Egypte sous Mahommed-Aly*, tom. i. pp. 363, 364, et seqq.; *Life and Adventures of Giovanni Finati*, vol. i. p. 101, et seqq.; *Abrégé de l'Histoire des Mamlouks; Bulletin*, tom. x. pp. 223, 224. The account of the massacre, contained in the "Adventures of Finati," differs in some particulars from the less picturesque but probably more accurate account of Mengin, who was on the spot at the time, and an eye-witness of part of the tragedy. In the text we have chiefly followed the *Abrégé*, which appears to have been compiled, with singular care and accuracy, from the best authorities.

Many anecdotes have been told of the conduct of the Mamlukes on this dreadful occasion; but the most remarkable is that which relates to Amim Bey, brother to the celebrated Elfi, and the only one of the Beys who escaped the massacre. Being detained by business, he was too late to occupy his proper place in the procession, and he only arrived in the citadel when the troops were defiling through the gate on their return to the city. Having reined up his charger, he waited until the column had entered the hollow road, intending to join his own body; but seeing the gate suddenly closed, and all retreat intercepted, whilst discharges of musketry immediately followed, the gallant chief, preferring to be dashed in pieces rather than to be slaughtered by concealed enemies whom it was impossible to reach, urged the charger which he rode until the horse clambered upon the rampart, when, spurring the noble animal to desperation, he leaped headlong down the precipice, a height of more than forty feet. The horse was killed on the spot, but the rider remained unhurt, and, having made his way into the city, at length succeeded in effecting his escape to Syria. The desperate leap which Amim took from the parapet of the citadel has been compared to leaping out of a four-pair-of-stairs window. According to another account, the Bey was received and sheltered by some Arabs, who, notwithstanding the offer of a large reward, refused to deliver him up. (Finati, p. 64.)

[2] In the year of the Hegira 1110, or of our era 1691, a sheikh of the village of El-Ayeyneh had a son, named Mohammed-Abd-el-Wahâb, whom he destined to succeed him. The youth was initiated by his father in the elements of Islamism, and afterwards sent to college at Bassorah, there to complete his studies. Having finished his education, and performed the pilgrimage to Mecca and Medina, he returned to his native country, but afterwards withdrew to Horymlâ, where he took unto himself a wife. In this new retreat he undertook to reform the manners of the inhabitants, who, however, far from relishing his maxims, forced him to take refuge amongst his countrymen. But he did not remain long among the latter, having been banished by orders of the governor of the province of El-Hassan, who was incensed at an act of barbarity which he had caused to be committed. In this conjuncture, Abd-el-Wahâb accepted an asylum which had been offered him at Derayeh or Deraeyeh, the capital of the Nedjd, by Mohammed-ebn-Souhoud; and it was in this city that he commenced the exposition of those principles of reform which were soon to exert so powerful an influence over Arabia. The emir Souhoud had calculated that, favoured by a change of religion, he might be enabled to extend his possessions; nor was he disappointed in his expectations. From all parts ardent sectaries came to offer their arms and their services to the inspired sheikh; and in a short time the villages of El-Ayeyneh, Horeymlâ, El-Ammaryeh, and Manfouah had received his doctrine. On his part, Souhoud directed his views towards the Nedjd, and made incursions into the neighbouring provinces, most of which were attended with success. The emir died in 1765, leaving the power to his son Abd-el-Aziz, who had already signalized himself in several military expeditions, the command of which had been entrusted to him by Ebn-Souhoud. This young prince, aided by his son, enlarged the dominions which had been left to him by his father, and greatly increased the Wahabite power. He imposed tribute on his neighbours, took possession of El-Ryad and El-Delem, seized on the province of El-Kharg, and ruled over all the surrounding tribes. Being a witness of these triumphs, which ensured the success of his reform, and grateful for the services which Souhoud the son of Abd-el-Aziz rendered to his cause, Mohammed-Abd-el-Wahâb collected the principal inhabitants of Derayeh, in order by their means

Mehemmed Ali, well aware that tactics often supply the place of numbers, and that bravery without discipline is alike unmanageable and unavailing against regular troops, had long had the intention of clothing and instructing his troops in the European manner; and indeed, from the period of his first accession to power, he had encouraged the formation and training of Turkish and Albanian troops according to the Frank discipline. But it was only after his return from Arabia that his determination was manifested in a formal manner. Having secured the services of several French officers who had been trained in the school of Napoleon, he repaired to Boulak on the 2d of August, and, after some preparatory exhortations, he began to exercise the troops of his son Ismaël. These he put through some evolutions, at the same time declaring that he wished to establish among them the nizam-jedid, and that whosoever should disobey his orders would be severely punished and then expelled from the army. The troops murmured, but Mehemmed remained firm. A regular course of drilling was immediately commenced, and enforced with all the rigour of oriental despotism, whilst the success of his arms encouraged him to persevere. But excessive pressure at length wrenched off the head of the screw, and the spring recoiled with tremendous force. The soldiers mutinied, murdered their officers, plundered Cairo, and marched in a body towards the citadel for the avowed purpose of putting Ali to death. Fortunately the pillage of the bazars attracted their attention in the first instance; the chiefs of the government, who were quite unprepared for an attack, had time to recover from their

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to ensure to this prince the succession of Abd-el-Aziz; and he died several years afterwards (14th June 1787), at the advanced age of ninety-five. But this event did not diminish the zeal of the followers of his doctrine; and such was the terror which the Wahabis inspired on all sides, that the towns in the neighbourhood of Bassorah were obliged to implore the protection of the Pasha of Bagdad, who, in 1796, caused a considerable army to march against the heretics. The troops of the pasha were however repulsed by Souhoud, who, encouraged by this success, ventured the following year to make an incursion into the province of El-Irak, situated between Bassorah and Bagdad, where he committed dreadful ravages with impunity. The Scherif Ghaleb, who had long struggled in vain against the growing power of these formidable enemies, was constrained to make peace with their chiefs; and Salem-ebn-Schekban of Byeheh felt himself equally obliged to submit to the prince of Derayeh. Intoxicated with these successes, Aziz now wished to attack the Persians as well as the Turks; and accordingly he sent his son at the head of 20,000 men, who directed their march upon Kerbeleh. On the 20th of April 1810, the Wahabis took possession of this city, which the Persians account sacred, as containing the tomb of Ali, and put all the male inhabitants to the sword. Souhoud, thinking that he had not yet done enough, next directed his march towards Mecca, forced the Scherif Ghaleb to fly, and interrupted the most sacred ceremonies of Islamism. Meanwhile the sacrilege which Abd-el-Aziz had committed in the eyes of the Persians did not pass unpunished; for a fanatic having undertaken to avenge the violation of the tomb of Ali, proceeded to Derayeh, and poignarded the prince whilst he was reciting his prayers in the mosque. But Souhoud in his turn swore to avenge the death of his father. Accordingly, having assumed the chief command of the Wahabis, he marched the following year against Bassorah, without being intimidated by the menaces of the Shah of Persia. The Scherif Ghaleb thought the moment favourable for striking a blow in retaliation of the injury he had sustained; but the check which his arms experienced constrained him to sue for peace; and soon afterwards he was under the necessity of submitting entirely to Souhoud. The latter, at the head of 40,000 men, now made a pilgrimage to Medina, in order at the same time to prevent the arrival of the caravans; and left in that city one of his generals whom he appointed governor. From Medina he proceeded to Mecca, and after having there piously fulfilled all the duties of the pilgrimage, he caused the tomb of the Prophet to be broken open, and unscrupulously took possession of the riches it contained. Such acts of sacrilege, boldly committed, and frequently repeated, roused the indignation of the whole Moslemin world; and the viceroy of Egypt was in consequence enjoined by the Porte, as above mentioned, to march against the audacious heretics. The Wahabis are a sect of Mohammedan Socinians, who regard all pilgrimages, relics, ablutions, and other outward ceremonies or symbols, as rank idolatry, and who, professing the principles of pure deism, reduce the whole duty of man as a religious being, to prayer and good works. (Mengin, *Hist. de l'Egypte sous le Gouvernement de Mohammed Aly*, tom. i. p. 378, et seqq. For an admirable account of the Wahabis, see also *Anastasius.*)

surprise; and the pasha, apprised of the revolt while at his palace of Ezbekyeh, caused arms and ammunition to be distributed amongst the inhabitants of the Frank division of the capital. His palace was indeed attacked; but the guard, having thrown up entrenchments, repulsed the assailants; and the viceroy had previously quitted it for the citadel, which he entered by the mountain gate, accompanied by a numerous escort. Here he was in comparative safety; but he had nevertheless to endure many bitter hours of anxiety and suspense; and, as he could not know how far the mutinous spirit had extended, nor confide even in those around him, he must have felt that he was liable every moment to be dragged forth and torn in pieces. When the fury of the revolt had somewhat exhausted itself, and the sated indignation of the mutineers had momentarily subsided, Mehemmed re-appeared; and the full force of his character may be understood from the union of wisdom and firmness which he displayed on this critical occasion. He showed neither fear nor anger, distrust nor indignation; but immediately issued a proclamation, pledging himself, if the troops would return to their duty, to discontinue the obnoxious system, to grant a general amnesty, and to indemnify the merchants and inhabitants who had been pillaged, for the losses they had sustained. This declaration produced the desired effect; the troops gladly availed themselves of the proffered pardon, coupled as it was with the promised abandonment of the European discipline; Cairo was restored to tranquillity; and as the number implicated in the guilt of disaffection was too great for punishment, even by way of example, the viceroy wisely judged it prudent to adhere strictly to the conditions of the amnesty he had proclaimed. No pains were spared by the government, however, to discover the prime movers and ringleaders of the revolt; and notwithstanding the assertion of Finati, that no clew was ever obtained that could lead to the detection of the principal instigators of the mutiny, there is some reason to believe that they were not unknown to the pasha; for it was observed that, shortly afterwards, several persons died sudden deaths, and many of the chiefs and Beys disappeared, no one knew how or by what means.

The treaty which had been hastily concluded with the Wahabis proved of short duration; indeed scarcely had the Egyptian army retired, when the fierce and warlike heretics of Derayeh again flew to arms. At the head of forty thousand of these sectaries, Souhoud marched to Medina, which he obliged to open its gates; and following up his success, he proceeded to Mecca, which he took with as little difficulty. At the latter city he broke open the tomb of the prophet; abstracted numerous jewels, such as diamonds, rubies, and emeralds, which had long been venerated by all true believers; melted the golden vessels, chandeliers, and vases; and having exposed the whole to public sale, distributed the money amongst his soldiers. Nor was the former city treated with more respect by these Mahommedan schismatics, who despised all outward show and parade in matters of religion, placing their whole reliance on the joint efficacy of prayer and of good works. As might have been expected, such bold acts of sacrilege excited against Souhoud the indignation of every true Moslemin; and the government at Constantinople, fully as much alarmed at the progress of his arms, as shocked at his impieties, immediately sent orders to the viceroy of Egypt to chastise the daring heretic, and to deliver the holy cities out of his hands. An army was accordingly assembled and marched into Arabia under the command of Ibrahim Pasha, Toussoun having fallen the victim of either disease or poison. Notwithstanding the motley composition of his force, Ibrahim, who now entered upon that career of victory which has since rendered him so celebrated as a commander, succeeded in accomplishing all the objects contemplated by the expedition. Having concentrated his troops at Henakeyeh, he marched on El Mayoueh, which he occupied in force, at the same time baffling an attempt made against it by the Wahabite chief; and soon afterwards laid siege to El-Rass, which he thrice assaulted, but without success. The situation of the Turkish army now became critical; but although Ibrahim felt himself under the necessity of raising the siege, he nevertheless rejected proposals of peace which were made by Abdallah-ebn-Souhoud. But though baffled before El-Rass, the Egyptian commander took in succession Khabra, Aneyzeh, Boureydeh, and laid siege to Chakra, which capitulated in a few days. He then marched against Dorama, which he carried by assault, and sacked, putting the inhabitants mercilessly to the sword. From Dorama he proceeded to Derayeh, the capital of the Wahabis, which he besieged. This was the grand operation of the campaign, and here accordingly he met with the most determined resistance. For three months did the brave defenders successfully repulse every attempt to take the town; and all the efforts of Ibrahim would have been unavailing had not want at length compelled them to surrender. With the capture of this place the campaign against the Wahabis terminated; but not so the severities of Ibrahim, who is remembered as the scourge of Arabia and the destroyer of Derayeh. In a moment of passion the viceroy had threatened to exterminate the heretics, and not to leave one stone upon another of their city. The former part of this menace Ibrahim found it impossible to execute, but the latter was carried into effect to the fullest extent. The unfortunate Souhoud was sent as a prisoner to Constantinople, where he was beheaded like a common malefactor, notwithstanding the viceroy had interceded for his pardon; those of the inhabitants who had escaped the sword were driven into the desert, where many of them perished; and Ibrahim, having spread far and wide the terror of his name, returned in triumph to Egypt.

But excessive severity generally defeats its object. The cruelties of Ibrahim, so far from extinguishing the Wahabite reformation, appear only to have inflamed and exasperated the spirit of resistance by which it was animated. Hence in 1824 the war was renewed with as much ferocity as ever, and protracted during the three following years, in which it was carried on with various success. Latterly, however, owing to the struggle made by the Greeks to recover their liberty, and the consequent detention of the troops under Ibrahim in the Morea, the contest was allowed to slumber, and at length it terminated with the capture of Mecca, which was effected under the direction of a French officer. Achmet Pasha, who commanded in chief, was very inferior to Ibrahim both in genius and enterprise; and although he frequently defeated the enemy, he wanted the skill and address necessary to enable him to profit by victory. The only relation of these campaigns is that of Planat, which is exceedingly meagre, and, excepting an itinerary of the marches and countermarches of the pasha, contains few particulars deserving of attention.

The mutiny at Cairo, though it had had the effect of interrupting the execution of the viceroy's scheme for introducing the European discipline, did not lead to the abandonment of the design. Mehemmed was resolved to possess a regular army trained on the European model, and when he found the Turks and Albanians unmanageable, he applied himself to the natives of Egypt. He had the good sense to attribute his first failure to the imprudent rigour which he had employed; and, therefore, he resolved to change his system, and to make his military projects popular by rendering them desirable. His next object was to secure the services of an European officer properly qualified to lay the foundation of that revolution in tactics which he now meditated; and in Colonel Sèves he was fortunate in finding an officer exactly suited to his purpose. In 1818 or 1819 Sèves, the son of a miller at Lyons, formerly a lieutenant-colonel of cavalry in the French army, and aide-de-camp to Marshal Ney, an officer of approved courage and of an intrepid and enterprising character, having been persecuted in his own country, and forced to expatriate himself, went to seek an asylum in Egypt; and he was living in great misery at Alexandria, when the pasha arrived there some time after his landing. Having learned that a superior French officer had come to seek an asylum in his territory, Mehemmed, who was then meditating the project of reform which he afterwards adopted and carried through with so much success, sent for Sèves, received him graciously, and granted him an allowance of L.200, without any definite employment. The only duty which he had at first to perform was to answer the questions which the pasha frequently put to him respecting the Emperor Napoleon, his victories, his armies, and the French empire. Several months passed in this way, and Sèves was puzzling himself to account for so much munificence without any apparent motive, when Mehemmed, who had been long meditating an excursion into Upper Egypt and Sennaar, sent for him, and inquired if he would undertake to organize some regular battalions in the Egyptian army. Happy to be employed, and pleased to have an opportunity of testifying his gratitude towards his benefactor, Sèves at once agreed to make the attempt; and being provided with money and invested with unlimited power, he at once applied himself to the task which he had undertaken. He associated with himself several French and Italian non-commissioned officers, who were exercising various professions at Alexandria, and with their assistance commenced his work. His first battalions were raised out of a great number of vagabond Turks and Arabs, the only class indeed to which he could apply; and out of these the instructors selected the most intelligent, in order to form them into model platoons, and also prepare them to act as sub-instructors. Sèves and his assistants had to surmount the greatest difficulties, obliged as they were to take man after man without distinction, and thus to enact a sort of pantomime. The repugnance of the Turks to these innovations was inconceivable, and often manifested itself by the most violent acts. The lives of the instructors, indeed, were frequently in danger; and several musket-balls were fired point blank at Sèves, who escaped as if by a miracle. But he was not to be intimidated in the discharge of his duty; and, amidst dangers of every kind, he went straight to his object with unflinching intrepidity and perseverance.[1] At length, in about a year, several battalions appeared in line, armed with English, Austrian, and French muskets, and with sabres of all sorts and models.

Such was the nucleus of the disciplined army which Mehemmed Ali now possesses, and which has amply rewarded him, by its brilliant successes, for the liberality and wisdom which presided in its formation. Nor did the viceroy lose any time in making a trial of the new battalions, in the long-projected expedition to Upper Egypt. Ismaël Pasha, his second son, assumed the command of the army; Sèves, however, directed the campaign; the regular troops carried all before them; and Upper Egypt was conquered. The viceroy had promised a brilliant recompense to Sèves if the Egyptian army returned victorious from Sennaar; but, in point of fact, Mehemmed gave him none, and in this he obeyed the imperious law of necessity. The instructors could hold no command in the army unless they embraced Islamism; their authority was confined to the ground on which the troops were manœuvred, and, in actual service, to the council of war. The pasha durst not trample under foot the prejudices of his subjects, whose fanaticism he was far from sharing; whilst, appreciating the merit of Sèves, afterwards known by the name of Soliman, he felt the necessity of giving that officer a superior command in the army. To reconcile every thing therefore, he proposed to the Frenchman to abjure the Christian religion, at the same time promising him a brilliant fortune, the title of Bey, and other tempting advantages, in the event of compliance. Sèves, however, rejected the viceroy's proposition, and was immediately dismissed from all his employments. But, partly by poverty, and partly also by the influence of Drovetti, consul-general of France, his scruples were at length overcome, he became a Moslemin, was raised to the dignity of Bey, and received the command of a regiment of infantry. But although Soliman-Bey (Sèves) was endowed with the energy and capacity necessary to conduct the instruction of the Egyptian army, nevertheless, it was only after the arrival of General Boyer, in the year 1824, that it really began to assume consistence. In a short time this officer performed wonders. The army increased in numerical force, in *moral*, and in discipline; the instructors, respected and well treated, laboured with increased zeal and success; and when the troops were ordered to take the field, these men marched at their head against the enemies of the pasha. To Domergue, a French officer, born at Carcassonne, the viceroy owed the conquest of Mecca and of the country of the Wahabis; whilst, on the other hand, it was the Marquis of Livron, agent of the pasha in France, who supplied every thing necessary for the *matériel* of the army, and who provided the pasha with artillery instructors and with surgeons.[2]

The preparations for the war in the Morea determined the pasha to augment his regular troops; and a great number of Piedmontese and Neapolitan refugees having about this time arrived in Egypt, Ali soon acquired a formidable and well-appointed army. It was in part destroyed, however, during the campaign in the Morea; but he afterwards added nine regiments of cavalry, and at present it is finer and stronger than ever.

According to an authentic statement published in 1831, the Egyptian army is composed of a general staff; of infantry, including artillery; and of cavalry. Ibrahim Pasha is commander-in-chief of the army; and the sons or relations of the pasha are the only lieutenant-generals with the title of pasha. Each brigade of infantry or cavalry has its general. Two regiments compose a brigade, and the regiments of guards are each commanded by general officers. The total number of the latter, therefore, is fifteen, with rank equivalent to that of major-general. The artillery has two generals with the title of Bey, one of whom is the director, and has the inspection of founderies, laboratories, workshops, arms, and the like. The infantry is composed of a regiment of guards and fourteen regiments of the line, each consisting of four battalions of a thousand men; thus making a total of fifty-six thousand. The artillery, with the train, consists of one regiment of six thousand men, and the engineers of two battalions of six hundred each, besides a company of artificers two hundred strong, and a company of gendarmerie of the same force. The cavalry, which has only been formed since 1828, is by no means equal to the infantry. It is composed of a regiment of guards, of four squadrons, each consisting of four troops, into which Turks only are admitted, and eight regiments of the line, forming four brigades, making, with supernumeraries, four thousand five hundred men and horses. The total strength of the Egyptian army is therefore 67,600 infantry, and 4500 cavalry.[1]

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[1] On one occasion, when a volley was fired, a ball whizzed past the ear of Sèves, so close as almost to graze the skin. Without betraying the slightest emotion, or taking the least notice of the circumstance, he ordered the party to re-load their pieces, and merely saying, "You are very bad marksmen," gave the word to fire. They did so; and no ball was now heard to hiss through the air. The cool courage of the Frenchman disarmed their resentment; and, from being an object of the deepest hatred, he became the idol of their admiration. (Planat, *Histoire de la Régénération de l'Egypte*, p. 28.)

[2] *De l'Egypte et de son Organisation Militaire.* Paris, 1831.

This army is recruited by a stern system of impressment, the most arbitrary and iniquitous which can well be conceived; yet, excepting at the moment of its operation, it is scarcely felt as an evil. Once with the regiment, the young soldiers soon become reconciled to their new mode of life; they acquire a taste for the service, and speedily forget, in the enjoyment of the comforts provided for them, the violence which tore them from their miserable homes. They are excellently clothed, have abundance of wholesome food, and even exercise a sort of superiority over their countrymen. A soldier is a kind of authority; he in fact makes the law; and the people tremble before an uniform. Hence in this army, thus recruited by violence, there are scarcely any desertions. Besides, the Arabs, of whom it is principally composed, are intelligent, observing, inquisitive, brave; they love the service, both for its immediate advantages, and also because promotion from the lowest to the highest ranks is thrown open to all; they feel that they are men, and already begin to lay aside that fanaticism which at first opposed the most formidable obstacle to the success of the viceroy's plans. The only danger to which Mehemmed is exposed appears to consist in the tendency of such elements to too great a transition, and in the formation of opinions incompatible with the existence of even an enlightened despotism. But whilst the reins of discipline are held by a steady and vigorous hand, there will be little ground for alarm on this score; though any undue relaxation would, in all probability, be productive of the greatest misfortunes. The chief hazard to Mehemmed's system arises from this, that it is so closely connected with, and dependent upon his personal character. But he may leave a successor worthy of his talents.[2]

With a view to the consolidation of his military reforms, the viceroy has established a number of schools and colleges, the principal of which we shall now briefly advert to. The school of the staff is at Kaukeh. It contains an indeterminate number of pupils, and is provided with professors of mathematics, fortification, and design; branches which, however, are as yet but indifferently taught. A cavalry school has been organized at Ghizeh, in the palace of Murad Bey, and is under the orders of a French cavalry officer named Varrin. It contains a hundred pupils, who, during a course of two years, are instructed in military equitation, hippiatrics, and cavalry evolutions; but hitherto no great progress has been made in any of these branches. At Bouzah-a-Bel there is a school of surgery, the object of which is to supply the regiments with surgeons. The pupils show address and good will; but their teachers allege that, when left to themselves, they become good for nothing. This school is under the direction of Dr Clot of Marseilles, a man of great merit and undoubted knowledge. A school of pharmacy has also been opened at the same place, under the superintendence of an Italian named Alexandri. The school of veterinary surgery is likewise established at Bouzah-a-Bel, and is under the management of a Frenchman named Hamont, an élève of the school of Alfort, and a man of merit. Besides these, there was a school of military music at Kaukeh, for training regimental bands; but, in 1829, Ibrahim Pasha ordered it to be suppressed, probably from motives of economy; and the only establishment of the kind at present in existence is a school of trumpeters, in the camp of Soliman-Bey, where a hundred pupils are trained according to the French mode.

The pay, appointments, and clothing of the Egyptian army are not only equal, but in several respects superior, to those of any army in Europe. The monthly pay of a general, or, to speak more correctly, the pay from one moon to another, is L.120 besides rations; that of a colonel is L.90, that of a lieutenant-colonel L.30, that of a captain L.10, and that of a lieutenant L.3, exclusively of rations. A general receives fifteen rations a day, a common soldier one, and the intermediate grades in proportion to their relative positions in the scale of rank. The pay of the non-commissioned officers is likewise ample; and that of the common soldier is eighteen piasters a month, besides his daily rations and his clothing. The ration is composed of bread, rice, oil, butter, beans, salt, and meat, and is served out twice a week. The clothing of the army is excellent, and the dress of the officers superb. The uniform of the generals, as well as that of the Turkish officers, is scarlet embroidered with gold; all the difference consisting in the quantity and richness of the embroideries. The distinctive marks of military rank are crescents and stars. Those of a lieutenant-general are crescents enriched with diamonds, in the middle of which are placed three stars, also in diamonds; those of a brigadier-general are the same crescents with two stars only; those of a colonel are the same crescents with only one diamond star; those of a lieutenant-colonel are two crescents in gold with a star in diamonds; those of a major are two crescents with stars in gold; those of a captain two crescents and stars in silver; and those of lieutenants and sub-lieutenants a crescent in silver. These decorations are placed on both breasts, and have a very brilliant effect. On occasions of ceremony, the superior officers also wear scarlet pelisses, fastened with two large clasps of gold set with emeralds. The loins are begirt by a sash; and the Turkish papooshes have given way to a less voluminous and more convenient nether habiliment, which is made fast under the knees, and fitted close to the legs.

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[1] Military men will no doubt remark the great disproportion between the infantry and cavalry of the Egyptian army; but it ought to be kept in view that we only speak here of the regular army, and not of the whole forces which Mehemmed Ali has at his disposal; and that, moreover, the battalions of infantry had been ten years in line ere the model squadron of cavalry began to be organized. When the cavalry was formed, Captain Thurlet of the 13th regiment of French chasseurs, happening to be in Egypt, was charged with its organization; but as this was a task beyond his ability to execute, the Marquis de Livron was commissioned to engage three *chefs d'escadrons* to complete the instruction of the brigades, and accordingly sent out Deschales, Petit, and Touchebœuf-Clairemont, who are now the only superior officers attached to the cavalry. The subaltern officers were taken from the infantry, from the schools, and from the counting-houses of Alexandria, where a number of discharged military men, whom the Restoration of 1815 had forced to quit France, were employed as clerks. The horses of the cavalry are in general excellent, and they are classed in squadrons according to their shades of colour. (*De l'Egypte et de son Organisation Militaire.* Paris, 1831.)

[2] *De l'Egypte et de son Organisation Militaire. Bulletin des Sciences Milit.* tom. x. p. 270.

In point of arms and equipment the infantry, cavalry, artillery, and engineers resemble the corresponding branches of the French service, upon which, indeed, the whole has been modelled; and the same observation applies to the mode in which the troops are disposed, whether in cantonments or in camps. Nor are the men any longer liable to arbitrary punishments. Every soldier charged with a breach of military discipline must be tried before he can be bastinadoed, and some other penalty less degrading, as confinement, degradation, or hard labour, is generally inflicted. Officers, again, when accused of a dereliction of duty, are placed under arrest; and the question of their guilt or innocence is commonly left to the determination of a court-martial. By these wise provisions the moral character of the Egyptian army has been raised to a level with that of the best troops in Europe; and its devotion (as already stated) has been further secured by the impartiality with which promotion is bestowed, and by the highest grades of the service being thrown open to the ambition of the humblest soldier in the ranks.[1]

Nor in thus organizing a powerful army has the viceroy neglected to provide himself with a respectable navy. His ambition, indeed, has all along been to raise Egypt to the rank of a naval power; and it was no doubt principally with this view that he seems to have early resolved to possess himself of Syria; a country which, from its extensive line of coast, and its internal resources for ship-building, afforded every facility for the development and execution of his plans. As early as the year 1824, he had accordingly either acquired by purchase, or caused to be built for his service, a considerable number of ships of war; and, notwithstanding the disaster which befel his squadron at Navarino in October 1827, he prosecuted his original design with such systematic perseverance, that he not only repaired the loss he had sustained, but greatly augmented his marine both in number and in force. According to the most authentic information which we have been able to obtain, therefore, the Egyptian navy consists at present (1833) of twelve sail of the line, one of which is a first-rate carrying a hundred guns, about as many frigates, some of them double-banked, and a great number of corvettes, brigs, schooners, and sloops of war; a naval force equal, if not superior, to that of the Porte itself, and which, in fact, during the Syrian campaign of Ibrahim, defeated the Turkish fleet off Tripoli, thereby contributing in the most essential manner to the success which crowned the pasha's enterprise.

The superiority of troops disciplined according to the European method was strikingly evinced by the results of the expedition to Upper Egypt and Nubia, and still more by those of the concluding campaigns against the Wahabis, which fully realised the most sanguine expectations of the viceroy. But the prowess and efficiency of that army which had been alike victorious in the deserts of Arabia, and in those of Dongola and Kordofân, were destined to be further proved on a much more celebrated theatre of action. The sultan having required the pasha of Egypt to assist with his forces in putting down the insurrection in Greece, an expedition consisting of sixty ships of war of all sizes, and a hundred transports, having on board seventeen thousand infantry, eight hundred cavalry, and artillery both for service in the field and for sieges, together with ammunition and provisions for a long campaign, sailed from Alexandria in July 1824, the whole being under the command of Ibrahim Pasha; but having touched at Rhodes, in the hope of effecting a junction with the Capitan Pasha commanding the Turkish fleet, and the ships of war having suffered considerable damage in an encounter with the Greek squadron under Canaris, it did not reach Modon in the Morea until the end of February 1825. The events of the three campaigns which followed belong rather to the history of Greece than to that of Egypt. It will be sufficient to state here that Ibrahim was successful at nearly every point; that the strong places of the Morea had, almost without exception, yielded to his arms; and that his father was believed to cherish a design of establishing his own power in the Peloponnesus; when the treaty of London changed the aspect of affairs, and the naval battle of Navarino, fought on the 20th of October 1827, proved a most "untoward event" for the viceroy's designs, depriving him of the fruits which he expected to reap from Ibrahim's victories, and completely isolating the Egyptian army, which depended for its chief supplies on Alexandria. The final deliverance of the Morea was effected by the French expeditionary force of fifty thousand men under General Maison, which, having cleared the country of the Egyptians, delivered it up to the provisional government which had received or assumed the reins of authority in Greece.[2]

But if, yielding to the pressure of superior force, Mehemmed was compelled to quit his hold of the Morea, still he was not altogether a loser; for, during the campaigns in the Peloponnesus, his army acquired experience in all sorts of military operations, and may be said to have in some measure prepared itself for achieving those brilliant successes which lately shook the Ottoman empire to its foundations, and humbled the pride of Sultan Mahmoud. From the commencement of the contest with Turkey till the decisive conflict at Koniah, in which tacticos and irregular troops were equally overthrown, and the road to Constantinople completely uncovered, its career was one of uniform victory. The fate of Syria was decided by the battle of Damascus, which proved the great inferiority of the Turkish infantry; Aleppo opened its gates; the barrier of Mount Taurus, hitherto regarded as a rampart of Constantinople, was crossed; and, descending into the plains of Anatolia, Ibrahim swept onward like a torrent, until, arrested for a moment at Koniah by an enemy resolved to make a last effort to retrieve its reverses, he there completed the series of his winged victories, and beheld "Stamboul's diadem" almost within his grasp. The rest is too well known to make it necessary for us to enter into details. Denied the aid which he solicited from Great Britain, the sultan was reduced to the humiliating necessity of applying for help in his day of need to the power whose ambitious designs he had the most reason to dread; whilst Russia, eager to avail herself of the opportunity thus offered, of giving to her aggrandising policy in regard to Turkey a protective rather than an aggressive character, lost no time in responding to the sultan's demand; and, in a short space, the strange spectacle was exhibited of a Muscovite corps d'armée cantoned in the vicinity of Constantinople, and of a Muscovite fleet at anchor in the Bosphorus. The sultan was saved; peace was concluded; and the whole of Syria, with its dependent territories, rewarded the successful rebellion of Mehemmed Ali.

The individual by whom all this and more has been accomplished would, even under the most favourable circumstances, have been accounted an extraordinary man; and amongst Turks he is certainly to be regarded as little less than a prodigy. His own greatness, indeed, is the immediate result of a creative power vigorously but skilfully exerted, and almost invariably directed towards the accomplishment of some object calculated to promote improvement and advance civilization; nor has the general policy of his government been less distinguished for ability, address, and energy, than was the conduct of those great measures by means of which he regenerated Egypt, and laid the foundations of his own supremacy. His army alone is a wonderful achievement; his fleet scarcely less so: and if the brilliant victories of the one have rewarded that wisdom which knows how to amend a fault, and that liberality which, when judiciously exercised, is all-powerful in its influence on the human mind, the day is probably not distant when the triumphs of the other will cause the flag of Egypt to be alike respected in the Mediterranean and the Indian Ocean. But it is not by the splendour of his winged victories, nor the extent of his rapid conquests, that the name of Mehemmed Ali will be honoured and distinguished. His are much higher and more difficult achievements than mere feats of arms; his is a nobler and more enviable glory than that which is reaped amidst the strife and carnage of the battle-field. It was the proud boast of Napoleon that he found France in the kennel, and placed her in the van of Europe. But with more truth and less ostentation might Mehemmed Ali say the same thing concerning Egypt. Napoleon, indeed, found confusion, but, as observed by an able writer, still it was the confusion of brilliant materials. Not so the Albanian, who out of a mere chaos of ignorance, treachery, and ferocity, has formed a kingdom possessing a disciplined and victorious army of seventy-five thousand regular troops, with a respectable marine of twelve ships of the line and more than thrice that number of frigates and other vessels of war. Nor is this all. He has organized a vigilant police, by means of which Egypt, formerly a land of violence and bloodshed, has been rendered as safe as any part of England or France; he has established an active and vigilant administration of the laws, by which persons and property enjoy security; he has constructed roads, formed canals, and introduced manufactures; he has improved agriculture, extended commerce, and reared an industrious population; and, notwithstanding all the cost of his various establishments, and the heavy expenditure incident to a state of frequent warfare, he has forestalled none of his ordinary revenues. During his reign the exports and imports of Egypt have accordingly risen from a mere trifle to several millions annually. Eager to obtain useful information himself, he has diffused a thirst of knowledge amongst his subjects, by making the possession of it the indispensable condition of advancement either in civil or military employments; he has ministered to the mental wants of his people by the erection of schools and colleges in various parts of his dominions; and he has, from time to time, sent young men into Europe, not to ape its fashions or copy its manners but to study the laws, institutions, and practical working of modern civilization, and to carry back the results of their observation for the improvement of their own country. His government, it is true, is a naked despotism, and, with all its general wisdom and beneficence, exhibits some of the worst features of that species of government; whilst the unhappy Fellahs are still ruled, if not oppressed, by a rough coercive hand, and exposed to exactions indicating a short-sighted cupidity on the part of their rigorous taskmaster. But, on the other side, it must be admitted that the strong arm of absolute power, guided by a stern and resistless will, could alone have effected that renovation which has been produced in Egypt; and as to his exactions and monopolies, Mehemmed Ali may easily silence rebuke on this head by pointing to many scarcely less odious or objectionable than his own which are still selfishly upheld in some of the most enlightened communities of Europe. And let it also be remembered that, as establishments must be maintained, the chief cause of the severity of his imposts has been the extent of his improvements, by which in time their rigour will be mitigated; and that monopoly is the price which must in the first instance be paid for the introduction of new and more effective modes of industry. Nor have the actual results belied the calculations on which this enlightened and vigorous ruler has proceeded. A country long devoted to misrule now teems with labour, and produces cotton and flax which may compete with the best in our markets; it exports silk, sugar, tobacco, and various other commodities, besides grain; and as long as personal security is maintained by an impartial administration of the law, these will continue to multiply in a land where an annual renewal of the soil, irrigation, and sunshine are certainties. Such are the triumphs which have been effected by the Albanian peasant, who has established an independent empire in Egypt.[1] He is

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[1] *Bulletin des Sciences Militaire*, tom. x. p. 274.

[2] Planat, *Hist. de la Régénération de l'Egypte*, p. 258 et seqq.

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[1] Mehemmed Ali is now in the sixty-third year of his age; he is rather short in stature, thick set, and inclined to embonpoint; his countenance is large, his forehead high, his nose aquiline, and his general expression indicative both of firmness and penetration; he bears himself with easy dignity, without the smallest approach to hauteur or reserve, and, for a Turk, is remarkably social and communicative; and his dress is usually plain, the only expense which he indulges in matters connected with personal decoration being lavished upon his arms, which are richly studded with diamonds. In a word, his appearance and demeanour immediately impress strangers with a conviction that he is no ordinary man; whilst his eager and inquisitive curiosity, continually on the alert in quest of information, shows that he has not only appreciated the importance of knowledge generally, but learned that it is the only solid basis of power. The following anecdotes of this remarkable person have been collected by Dr Russell, from the works of recent Egyptian travellers.

"'On our arrival being announced,' says Dr Richardson, 'we were immediately ushered into his presence, and found him sitting on the corner of the divan, surrounded by his officers and men, who were standing at a respectful distance. He received us sitting, but in the most gracious manner, and placed the Earl of Belmore and Mr Salt upon his left hand, and his lordship's two sons and myself at the top of the room on his right. The interpreter stood, as well as the officers and soldiers, who remained in the room during the whole time of the visit. He began the conversation by welcoming us to Cairo, and prayed that God might preserve us, and grant us prosperity. He then inquired of the noble traveller how long he had been from England, and what was the object of his journey to Egypt; to all which he received satisfactory answers. His highness next adverted to the prospect before him—the Nile, the grain-covered fields, the pyramids of Djizeh, the bright sun, and the cloudless sky—and remarked, with a certain triumphant humour on his lip, that England offered no such prospect to the eye of the spectator.' He was told that the scenery of England was very fine. '"How can that be," he shortly rejoined, "seeing you are steeped in rain and fog three quarters of the year?" He next turned the conversation to Mr Leslie's elegant experiment of freezing water in the vacuum of an air-pump; which he had never seen, but admired prodigiously in description, and seemed to anticipate with great satisfaction a glass of lemonade and iced water for himself and friends, as the happiest result of the discovery. Talking of his lordship's intended voyage up the Nile, he politely offered to render every possible facility; cautioning him at the same time to keep a sharp look-out when among the Arabs, who, he believed, would not take any thing from him or his party by violence, but would certainly steal if they found an opportunity of doing it without the risk of detection. He then related a number of anecdotes touching the petty larcenies of that most thievish race; some of which were by no means without contrivance or dexterity. But the one which seemed to amuse both himself and his friends the most, was that of a traveller, who, when eating his dinner, laid down his spoon to reach for a piece of bread, and by the time he brought back his hand believed to cherish schemes of ambition still more gigantic than any which his past career has disclosed. The caliphate and an Arabian empire have, it is thought, long floated before his wishful eye; and there can be little doubt that, in the event of a new rupture with Turkey, Bagdad and the holy cities would be irrecoverably lost to the Porte, and restored to the successors of the Saracens. Wherever the Arabic language is understood, the power of Egypt seems destined to prevail.[1] But our business here is not with speculation, but facts.

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the spoon was away; the knife and fork soon shared the same fate; and the unfortunate stranger was at length reduced to the sad necessity of tearing his meat, and lifting it with his fingers and thumb, like the Arabs themselves. Many persons were near, but no one saw the theft committed; and all search for the recovery of the property was in vain. We now took leave of the viceroy, leaving him in the greatest good humour; he said we might go everywhere, and see every thing we wished, and that he hoped to have the pleasure of seeing us again.' In reference to the freezing experiment, we may mention, that Mehemmed Ali, very soon after the visit now described, obtained from England, through Mr Salt, the requisite apparatus. The machine on its arrival was conveyed to his palace, and some Nile water was procured for the purpose. He hung over the whole operation with intense curiosity; and when, after several disappointments, a piece of real ice was produced, he took it eagerly in his hand, and danced round the room for joy like a child, and then ran into the harem to show it to his wives.

"No one has attempted to conceal that there is in the temper of Mehemmed Ali, intermingled with many good qualities, a deep tincture of barbarism and fierceness. Impatient of opposition, and even of delay, he occasionally gives himself up to the most violent bursts of passion; and in such moments there is hardly any cruelty which he will not perpetrate or command. For instance, some time ago he had ordered that the dollar should pass for a fixed number of piasters, and it was mentioned in his presence that the rate was not strictly followed. His highness expressed some doubt of the fact, when the head interpreter carelessly observed that a Jew broker, whom he named, had a few days before exchanged dollars for him at the rate asserted. 'Let him be hanged immediately,' exclaimed the pasha! The interpreter, an old and favourite servant, threw himself at his sovereign's feet, deprecating his own folly, and imploring pardon for the wretched culprit. But all intercession was in vain; the viceroy said his orders must not be disregarded, and the unfortunate Jew was instantly led to his death. We find proofs of a similar sally at Djidda, where he appears to have used his own hands to inflict a punishment which he thought it inexpedient to remit. Hoseyn Aga, the agent for the East India Company, resident in that town, was, says a recent traveller, a remarkably fine-looking man, displaying an air of dignity mixed with hauteur; handsomely clad, too, though the heavy folds of his muslin turban were studiously drawn over his right eye to conceal the loss of it, for Mehemmed Ali one day in a fit of rage pulled it out. Yet these men are friends—great friends just at present, and will remain so as long as it may be convenient and agreeable to both parties to consider each other in that light. But the master of Egypt is not at all times so ferocious. For example, when Mrs Lushington was at Alexandria, intelligence was brought to him that a small fort at the entrance of the harbour had been taken possession of by certain Franks, and that the Turks belonging to it had been made prisoners. Some consternation prevailed among his people; but instead of being angry, he laughed heartily, and swearing by his own eyes—his favourite oath—that they must be English sailors, he directed his interpreter to write to their captain to order his men on board ship again. Upon inquiry it proved as the pasha had anticipated; the men had landed, got drunk, and crowned their liberty by seizing on the fort, and confining the unfortunate Turks, who, indolently smoking their pipes, never could have anticipated such an attack in time of profound peace. He evinced equal self-command, and still more magnanimity, when he first heard of the event which destroyed his infant navy and humbled his power. We allude to the battle of Navarino. He had not finished the perusal of the unwelcome dispatches, when he desired a European consul to assure his countrymen and all the other Franks that they should not be molested, and that they might pursue their wonted occupations in perfect security. Among the ships lying in the harbour was the wreck of one of the pasha's own vessels. The captain had committed some crime which was represented by his crew to the viceroy, who ordered him immediately on shore to answer his accusers. Conscious of guilt, he pretended sickness, till a second message from the same quarter left him no alternative; and unable longer to shun his fate, he sent all his crew ashore, and calling to an old and faithful servant, the only person on board, he bade him jump out of the port into the sea; at the same time, having loaded two pistols, he fired into the magazine, and blew up the ship and himself together. When the story was related to the pasha, he said, 'These are Frank customs; this is dying like an Englishman!'

"There is something characteristic in the following notice by Sir Frederick Henniker, who remarks, that the pasha appeared to him to have a vulgar low-born face, but a commanding intelligent eye. 'He received us in the court-yard, seated on a sofa, and wielding a pipe, dressed like a private individual, as Turks of real consequence generally are, excepting on gala days. The vice-consul and myself sat down on the sofa with him. Pipes are not offered except to equals; coffee served up,—no sugar, even though the pasha himself has a manufactory of that article,—the attendants ordered to withdraw; no pride, no affectation, even though the pasha is an upstart. Remained nearly an hour discoursing on English horses, military force, the emerald-mines at Cossier, his son's victory over the Wahabis, and his expected triumphal entry.'—It is generally stated, that since Mehemmed Ali has felt himself secure in the pashalik he has ceased to be cruel. Seldom now does he take away life, and never with torture; and if his subordinate officers were as well disposed as himself, the people, notwithstanding the oppressive taxes, would feel their property more secure. One instance of his prompt justice excited much astonishment; although a slower and more regular method would not, it is probable, in a nation so completely disorganized, have produced an equal effect. A kiachief who had not been long accustomed to the government of the viceroy punished one of his own servants with death. He was called before Mehemmed, who asked him by what authority he had committed this outrage. He thought it enough to urge in his defence that the man was his own servant. True, retorted the pasha, but he was my subject; and, in the same breath, passed sentence that the culprit should be immediately beheaded,—an effectual warning to the rest of the grandees present. This act of severity has saved the lives of many of the Arabs, who, in former times, were sacrificed by their Turkish masters on the most trifling pretences. In short, Mehemmed is well spoken of by most European travellers, though in general they estimate his character by too high a standard—the principles and habits of their own countries. There is only one author whose impression was rather unfavourable: 'I sat in the divan,' says he, 'with my eyes fixed on him; I wanted to examine the countenance of a man who had realized in our day one of those scenes in history which, when we have perused it, always compels us to lay down the book and recover ourselves. There he sat—a quick eye, features common, nose bad, a grizzled beard, looking much more than fifty, and having the worn complexion of that period of life. They tell you he is not sanguinary; men grow tired of shedding blood as well as of other pleasures; but if the cutting off a head would drop gold into his coffers, he would not be slow to give the signal. His laugh has nothing in it of nature; how can it have? I hear it now—a hard, sharp laugh, such as that with which strong heartless men would divide booty torn from the feeble. I leave him to his admirers.'—'In the usages of the table,' says Mr Carne, 'he is still an Osmanlee; knives, forks, and other useful appendages, never make their appearance at his meals. About five years ago some English travellers were graciously received by him, and pressingly invited to dine. But not even in compliance with the taste of his guests would he depart from his own habits; for, wishing to show a noble lady particular attention, he took a large piece of meat in his hand, and politely placed it before her. Perfectly dismayed at the compliment, and the sight of the savoury morsel which rested on her plate, she turned to her companion, who was more used to oriental manners, and earnestly asked what she was to do. "Eat it to be sure," was the reply. She looked at the pasha; his fine dark eye seemed to rest on her with a most kind and complacent expression; and there was no help for it but to follow the excellent advice given her by her more experienced friend.'" (*View of Ancient and Modern Egypt*, p. 358, et seqq.)

[1] *Edinburgh Review*, vol. lix. p. 124, et seqq. We have great pleasure in acknowledging that, for the leading features of the character of Mehemmed Ali, as above delineated, we have been indebted to a very able article in this journal on the state and relations of the Turkish empire. We have merely filled up, as it were, the masterly sketch drawn by the reviewer.

SECTION III.

PHYSICAL GEOGRAPHY OF EGYPT.

General description and physical conformation of the country.—Its divisions.—Is Egypt the gift of the Nile?—Opinions of Savary, Bruce, Shaw, Volney, and others on this subject.—Various depth of the alluvial soil.—Attempts to ascertain the mean rate of the deposition of mud or sediment by the river.—Speculations of the French philosophers.—Supposed difference of level, and conclusions thence deduced as to the comparative antiquity of existing monuments.—The Nile.—Its branches.—Supposed position of the source of the Bahr-el-Abiad, or true Nile.—Its alleged communication with the Niger.—Course of the river.—The Cataracts or Rapids.—Nature of these.—Physical aspect of the country.—The mouths, ancient and modern, of the river.—Its navigation.—The soil.—Lakes and canals.—The periodical inundation of the Nile.—Cause of this phenomenon.—Modes in which the waters of the inundation are distributed for the purposes of irrigation.—Air and climate of Egypt.—Etesian Winds.—Hot Winds.—The Khamsim of Egypt, the Samiel of Arabia, and the Simoom of the Desert.—Interesting particulars connected with these winds given by Volney and Bruce.—Diseases.—Plague.—Ophthalmia.—Hydrocele.—Cutaneous distempers.—Malignant Fevers.—Treatment.—Geological structure and characteristics of Egypt.

Egypt occupies the north-eastern portion of Africa, and is bounded on the north by the Mediterranean, on the east by the Red Sea, on the south by Nubia, and on the west by the deserts of Libya. Its physical configuration has been generally described at the commencement of this article. "Pour se peindre en deux mots l'Egypte," says Volney, "que l'on se représente, d'un côté une mer étroite et des rochers, de l'autre d'immenses plaines de sable, et au milieu un fleuve coulant dans un vallée longue de cent cinquantes lieues, large de trois à sept, lequel, parvenu à trente lieues de la mer, se divise en deux branches, donc les rameaux s'égarent sur un terrain libre d'obstacles, et presque sans pente."

Egypt is divided into Upper, Middle, and Lower. Upper Egypt extends from Nubia to the province of Cairo; Middle Egypt comprehends the province of Cairo, and the lateral provinces; and all the country included between the territory of Cairo, the Mediterranean, the isthmus of Suez, and Libya, forms Lower Egypt. Upper Egypt is only a long narrow valley, confined between two chains of mountains running from north to south, which commence at the last cataract of the Nile, and on reaching Cairo separate to the right and left as if to enable the Nile to extend its arms; the eastern chain taking the direction of Mount Colzum, and the western terminating in some sand hills near Alexandria. The former terminates on the borders of the valley by an escarpment, which in some places has the appearance of a very elevated wall or rampart, intersected at intervals by ravines; whilst the latter generally terminates in a gentle slope, excepting at the elbow formed by the Nile in the direction Kenneh, where it becomes more precipitous towards Siout.

The mountains which form the boundaries of this valley are the more deserving of attention, because from them, under the Pharaohs, the Ptolemies, and the Antonines, were obtained the materials not only for those stupendous monuments, which, even in their state of ruins, still make Egypt a land of wonders, but also for many of the public buildings of Italy, the remains of which attest alike the munificence of the Roman emperors, and the genius of the Roman artists. Beyond these mountains are deserts bounded by the Red Sea on the east, and by other parts of Africa on the west.

Four leagues from the Nile, and opposite Cairo, these mountains are only a ridge of rocks of about forty or fifty feet in height, dividing Egypt from the plains of Libya; and this ridge accompanies the course of the river, at a greater or less distance, like embankments intended to confine the general inundation.

Lower Egypt, comprehending all the country from Cairo to the sea, forms a triangle nearly equilateral, at least if it be reduced to the space included between the two arms of the Nile, which discharge themselves into the sea, the one at Rosetta and the other at Damietta. The base of this triangle is estimated at about seventy leagues. The name of Delta, which the Greeks gave to this part of Egypt, was applied on account of its resemblance in point of form to the fourth letter of their alphabet.

With respect to the formation of the Delta, it has been the opinion of many, even in very ancient times, that it was produced by the mud brought down by the inundations of the Nile; and this notion was adopted by Savary, who argues strenuously in support of it. In those early ages in which history has fixed no epoch, a certain people, according to him, descended from the mountains near the Cataracts, into the valley overflowed by the Nile, which was then an uninhabitable morass overgrown with reeds and canes. In what manner, or from what motive, these people were induced to descend from their ancient habitations to take up their residence amidst bogs, or how they found means to penetrate into a morass which is described as impenetrable, we are not informed, neither is it to our present purpose to inquire. At that time, however, the sea, it seems, washed the base of those mountains where the Pyramids were afterwards built, and advanced far into Libya. It covered also part of the isthmus of Suez, and the whole of what is now called the Delta formed a great gulf. But after many ages the Egyptians, by what means is not stated, formed canals to carry off the stagnant waters of the Nile; opposed strong embankments to check its periodical inundations; and, tired of dwelling in the caverns of rocks, built towns and cities upon spots elevated either by nature or art. Already the river was confined within its bounds, the habitations of men were placed out of the reach of its inundations, and experience had taught the people to foresee and announce them, when one of the kings of Egypt undertook to alter the course of the river. After running a hundred and fifty leagues between the barriers already described, the river, meeting with an insurmountable obstacle to the right, turned suddenly to the left, and, taking its course to the southward of Memphis, spread its waters throughout the sands of Libya. But the prince here spoken of caused a new bed to be dug for it to the eastward of Memphis, and, by means of a large dyke, obliged it to return between the mountains, and discharge itself into the gulf which bathes the rock on which the castle of Cairo is built. The ancient bed of the river was still to be seen in the time of Herodotus, and may even, it is alleged, be traced at this day across the deserts, passing to the westward of the natron lakes. To the herculean labours of this nameless monarch, Egypt, according to Savary, is indebted for the Delta. A regurgitation of the sea being occasioned by the enormous weight of the waters of the Nile, which precipitated themselves into the bottom of the gulf, the sands and mud carried along with them were collected into heaps; and thus the Delta, at first inconsiderable, arose out of the sea, from whose domain it was, so to speak, conquered. In short, it was a gift of the river, and it has since been defended from the attacks of the ocean by raising embankments along its base. Five hundred years before the Trojan war, the Delta was, according to Herodotus, in its infancy, eight cubits of water being then sufficient to overflow it. Strabo informs us that boats passed over it from one extremity to the other; and that its towns, built upon artificial eminences, resembled the islands of the Ægean Sea. At the time when Herodotus visited this country, fifteen cubits were necessary to cover all Lower Egypt; but the Nile then overflowed the country for the space of two days' journey to the right and left of the island, or Delta strictly so called. Under the Roman empire sixteen cubits produced the same effect; when the Arabs got possession of the country seventeen cubits were requisite; and at this day eighteen are necessary to produce a plentiful crop. Sometimes, however, the Nile rises to the height of twenty-two cubits; and the cause of this phenomenon is the accumulation of mud. Thus, in the space of rather more than three thousand two hundred years, the Delta, according to Savary, was elevated fourteen cubits.

It is natural to imagine, he adds, that the Delta has increased in length as well as in elevation. Under the reign of Psammeticus, the Milesians, with thirty vessels, landed at the mouth of the Bolbitinic branch of the Nile, now that of Rosetta, where they fortified themselves, and built a town called *Metelis*, which, in the Coptic vocabularies, has preserved the name of Messil. But this town, formerly a sea-port, is now nine leagues distant from the sea; and to this extent the Delta, according to him, has increased in length from the time of Psammeticus to the present day. Homer, in his Odyssey, makes Menelaus state, that in the stormy sea which washes Egypt there is an island called Pharos, the distance of which from the shore is such that a vessel with a fair wind may make the passage in a day. But from the manner in which he speaks of the Delta in other places, we may suppose that the island of Pharos, in his time, was not less than twenty leagues distant from the Egyptian coast, though it now forms part of the harbour of Alexandria. Great rivers occasion prodigious changes on the surface of the globe; sometimes elevating, at their mouths, islands which in time become portions of the continent. It is thus, according to Savary, that the Nile has formed almost all Lower Egypt, and created out of the waters the Delta, forming an equilateral triangle whose base is about seventy leagues; it is thus that the Meander, constantly repelling the waves of the Mediterranean, and gradually filling up the gulf into which it falls, has placed in the middle of the land the town of Miletus, formerly a celebrated harbour; it is thus that the Tigris and the Euphrates, descending from the Armenian hills, and sweeping with them in their course the sands of Mesopotamia, are imperceptibly filling up the Persian gulf.

Such are the reasons assigned by Savary for the opinion that the greater part of Lower Egypt had been produced by the operation of the Nile. But his theory has been strenuously contested by other travellers, particularly by Bruce, who has discussed the subject at considerable length. He begins by observing, that as the upper country of Egypt is merely a valley bounded by rugged mountains, it may hence seem natural to imagine that the Nile, overflowing the lower part, would be more ready to wash away the soil than add to it. It is stated by Dr Shaw, and confirmed by Bruce, that there is a gentle slope from the middle of the valley towards the foot of the mountains on either side, so that the middle, in which is the channel of the Nile, is really higher than any other portion of the valley. Large trenches are cut across the country from the channel of the river, and at right angles with its bed or channel, as far as the base of the mountains. As the river swells the canals become filled with water, which, descending to the base of the mountains, runs out at the farther extremity, and overflows the adjacent level country. When the water, having attained the lowest ground, begins to stagnate, it does not acquire any motion, by reason of the canals being at right angles with the channel of the Nile, unless in the case of excessive rains in Ethiopia, when the water by its regurgitation again joins the stream. In this case the motion of the current is communicated to the whole mass of waters, and every thing is swept away by them into the sea. It has been asserted that there was a necessity for measuring the height of the inundation, on account of the quantity of mud brought down annually by the waters, by which the landmarks were so covered that the proprietors could not distinguish their grounds after the river had subsided. But whatever might be the reason of this covering of the landmarks in ancient times, it is certain that the mud left by the Nile could not be the cause in the time of Herodotus, or during any period of time mentioned by that historian. He assigns only one foot of increase of soil throughout Egypt in a hundred years, from the mud left by the river; and the increase during one year, therefore, being only the hundredth part of a foot, could not possibly cover any landmark whatever. Besides, the Egyptian lands are at this day separated by huge blocks of granite, which frequently have gigantic heads; and these, at the rate mentioned by Herodotus, could not be covered in several thousand years. Besides, the Nile does not now bring down any great quantity of mud. Throughout Abyssinia, the channel of every torrent has been worn to the bare rock, and almost every rivulet runs in a hard stony bed, all the loose earth being long ago washed away; so that an annual and equable increase of the earth from the sediment or deposit of the waters is impossible. Bruce made a great number of trials of the water of the Nile during the time of its inundation, in different places. At Basboch, when just leaving the cultivated parts of Abyssinia, and about to enter Sennaar, the sediment was composed of fat earth and sand, and its quantity was exceedingly small. At the junction of the Nile and Astaboras the quantity of sediment was very little augmented; it consisted still of the same materials, though sand predominated in its composition. At Syene the quantity of sediment was almost nine times greater than before; but it was now composed almost entirely of sand, with a very small quantity of black earth. He also made a similar experiment at Rosetta, which however was not so often repeated as the others; but the result of the whole was, that in the strength of the inundation the sediment consisted mostly of sand, and, towards the end, it was in a great measure composed of earth. Had the Nile brought down the quantities of mud which it has been said to do, it ought to have been most charged with it at Syene, as there it contained the whole that was to be conveyed by it into Egypt. Instead of this, however, the principal part of the sediment at this place consisted of sand; which is accounted for from the vast quantities raised by the winds in the deserts between Gooz and Syene, and swept along the descending valley of the Nile towards Middle and Lower Egypt.

Bruce further adopts and argues in favour of the opinion that there has been a continual decrease of water since the creation of the world. In this case, therefore, if the land of Egypt had been continually increasing in height, whilst the water which was to cover it decreased, there must have been frequent famines on account of the want of a sufficient inundation. But so far is this from being the case, that, according to the testimony of several Arabian manuscripts, there had not, when Bruce was in Egypt, been one scarce season from the lowness of the inundation for thirty-four years, though during the same space famine had been three times experienced in consequence of too great an abundance of water. If there had been such an increase of land as Herodotus and others suppose, it must now have been very perceptible in some of the most ancient public monuments. This, however, is by no means the case. The base of every obelisk in Upper Egypt is to this day quite visible, excepting where covered by drift-sand. Near Thebes there are still extant two colossal statues, plainly designed as nilometers, and which ought by this time to have been almost covered with earth; but, notwithstanding the length of time these monuments have remained there, they are still bare to the very base.

The strongest argument which the advocates for the increase of land in Egypt make use of is, that the measures by which the quantity of inundation is determined are smaller now than they were in former times; and these small measures are said to have been first introduced by the Saracens. But, as Bruce observes, such an expedient could not have answered any good purpose, as no decrease of the measure could have augmented the quantity of corn produced by the ground. Savary admits that, to render his calculation concerning the increase of land in Egypt absolutely exact, it would be necessary to determine the precise length of the Greek, Roman, and Arabian cubit, and even to know the different alterations which that measure had undergone among the nations who employed them; but this nicety he considers as unnecessary, regarding the general fact to be fully established by what he had said before. Bruce, however, has treated the subject with much greater accuracy. From the situation of Canopus, the distance between Egypt and Cyprus, and the extension of the land to the northward, he concludes that no addition of any consequence can have been made to it for three thousand years past. The only argument left for the increase of land, therefore, must be derived from the nilometer. The use of this instrument was to determine the quantity of the inundation. The first step was to ascertain what space of ground was overflowed in a given number of years; and this being determined by mensuration, the next point was to determine the produce of the ground upon an average. Having thus become acquainted with the greatest and least crops produced, together with the exact extent of ground overflowed, they were furnished with all the necessary principles for constructing a nilometer; and nothing now remained but to erect a pillar in a proper place, and divide it exactly into cubits. This was accordingly done; the pillar was first divided into cubits, and these again were subdivided into digits. The first division of this kind was undoubtedly that mentioned in Scripture, and called the cubit of a man, being the length of the arm from the middle of the round bone in the elbow to the point of the middle finger; a measure still in use among all rude nations. But as no standard could be found by which this measure might be exactly determined, authors have differed very much concerning the true length of the cubit when reduced to our feet and inches. Dr Arbuthnot reckons two cubits mentioned in Scripture, the first containing one foot nine inches and $\frac{888}{1000}$ths of an inch, and the second one foot and $\frac{824}{1000}$ths of a foot; but Bruce is of opinion that both these estimates are too large. He found, by mensuration, that the Egyptian cubit was exactly one foot five inches and three fifths of an inch; and Herodotus mentions that in his time the cubit used for determining the increase of the Nile was the Samian cubit, containing about eighteen of our inches. The latter also informs us, that, in the time of Mœris, the minimum increase of the inundation was eight cubits, at which time all Egypt below the city of Memphis was overflowed; but that in his own time sixteen, or at least fifteen cubits, were necessary to produce the same effect. But to this account Bruce objects, that Herodotus could have no certain information concerning the nilometer, because the priests, who alone had access to it, refused to tell him anything of the matter. Herodotus also states, that in the time of Mœris a great lake was excavated in order to carry off the waters of the inundation; and this superfluous quantity Bruce supposes to have been conveyed into the desert for the use of the Arabs, whilst by such a vast drain the rise of the water on the nilometer would undoubtedly be diminished. But even granting that there was such a difference between the rise of the water in the time of Mœris and in that of Herodotus, it does not appear that any thing like it has ever since occurred. Strabo, who travelled into Egypt four hundred years after the time of Herodotus, found that eight cubits were then the minimum, as well as in the time of Mœris. From some passages in Strabo, however, it appears that it required a particular exertion of industry to cause this quantity of water to produce a plentiful crop; but there is not the least reason to suppose that the very same industry was not necessary in the time of Mœris; and hence it cannot be maintained that any increase of land is indicated by the nilometer. About a hundred years afterwards, when the Emperor Hadrian visited Egypt, we learn from unquestionable authority that sixteen cubits were the minimum when the people were able to pay their tribute; and that in the fourth century, under the Emperor Julian, fifteen cubits were the standard of contributions. Both of these accounts correspond with that of Herodotus. But Procopius, who lived in the time of Justinian, informs us that eighteen cubits were then requisite as a minimum.

From these accounts, so various and so discordant, it is obvious that no certain conclusion can be drawn. It is not easy indeed to determine the reason of this difference in point of fact. The only conjecture which can be offered is, that as it appears a smaller quantity of water will, by proper management, answer the purpose of producing a plentiful crop, so it is not unreasonable to suppose that at different periods the industry of the people has varied so much as to occasion the difference in question. This would undoubtedly depend very much upon the governor for the time; and indeed Strabo informs us that it was by the great care of the governor Petronius that such a small quantity of water was made to answer the purpose. From the whole of the above statements, however, it is probable that no increase of land was indicated by the nilometer from the time of Mœris to that of the Emperor Justinian. On the conquest of Egypt by the Saracens, their barbarous and stupid caliph destroyed the nilometer, causing another to be built in its stead; and afterwards fixed the standard of paying tribute considerably below what it had usually been. The Egyptians were thus kept in continual terror, and constantly watched the new nilometer, to observe the gradual increase or decrease of the inundation. On this he ordered the new nilometer to be destroyed, and another to be constructed, and all access to it to be denied to the people; a prohibition which was continued to Christians until the time of the present viceroy. From his own observations, however, Mr Bruce concludes that fifteen cubits are now the minimum of the inundation; and as this coincides with the accounts given in the times of Herodotus and Hadrian, he infers that, from the earliest ages to the present time, the same quantity of water has been necessary to overflow this country.

With respect to what has been urged by Savary concerning the former distance of the island of Pharos from the mainland to which it is now joined, and also regarding the city of Metelis having been once a sea-port, Volney proves that he has quoted Strabo unfairly, and consequently that no stress whatever should be laid upon a garbled authority. The principal, indeed the only evidence, which remains, therefore, is the passage already quoted from Homer, in which it is stated that the island of Pharos was as far distant from one of the mouths of the Nile as a vessel could sail in one day before the wind. But it is to be observed that, when Homer speaks of the distance of this island, he does not mean its distance from the shore opposite, as Savary has translated him, but from the river Nile; and, further, that by a day's sail we must not understand the indefinite distance which the vessels, or rather boats, of the ancient Greeks, could navigate in a day, but an accurate and determinate measure of five hundred and forty stadia. This measure has been ascertained by Herodotus, and is the precise distance between Pharos and the Nile, allowing, with M. d'Anville, twenty-seven thousand toises to five hundred and forty stadia. It is therefore far from being proved that the increase of the Delta or of the continent was so rapid or extensive as has been represented; and, if such an opinion were maintained, it would still be impossible to explain how the land at this point, which has not gained half a league since the days of Alexander, should have gained eleven in the much shorter period which elapsed from the time of Menelaus to that of the Macedonian conqueror. The utmost extent of the encroachment of the land upon the sea, however, may be learned from the words of Herodotus; who informs us, that the breadth of Egypt, along the sea-coast, from the Gulf of Plinthine to the Lake Serbonis near Mount Casius, is three thousand six hundred stadia, and its length from the sea to Heliopolis fifteen hundred stadia. For, allowing the stadium of Herodotus to have been equal to between fifty and fifty-one French toises, it follows that the fifteen hundred stadia just mentioned are equal to seventy-six thousand toises; which, at the rate of fifty-seven thousand to a degree, gives one degree and nearly twenty minutes and a half. But, from the astronomical observations of Niebuhr, the difference of latitude between Heliopolis and the sea is one degree twenty-nine minutes at Damietta, and one degree twenty-four minutes at Rosetta; and hence, supposing the measures of the historian and the observations of the traveller to be both accurate, there is a difference of three minutes and a half, or a league and a half of encroachment on the one side, and eight minutes and a half, or three leagues and a half, on the other.

The doctrine, therefore, that Egypt is absolutely the gift of the Nile, a doctrine which was originally proposed by Herodotus, appears to be wholly untenable. From the facts above stated, indeed, we may conclude, first, that the apparent augmentation of the land, arising from the encroachment of the river on the sea, has, in a long tract of ages, been exceedingly trifling; and, secondly, that even this superficial increase may be in a great measure, if not altogether, attributed to errors arising from the comparison of the ancient with the modern standards of measurement. But although the surface of Egypt may have undergone little change in point of extent, from the supposed encroachments of the river, there can be little doubt whatever that the alluvial deposits made by the Nile during its periodical inundations must, in the course of ages, have become considerable. Accordingly, the men of science who accompanied the French expedition to Egypt undertook to measure the depth of alluvial matter actually deposited; and, proceeding on the data thus obtained, they attempted to deduce the mean rate of accumulation, and thence to form conjectures respecting the comparative antiquity of a number of the monuments situated on the banks of the river. By sinking pits at different distances, and in a variety of places, both on the margin of the stream and on the outer edge of the stratum of alluvial matter, they ascertained that the surface of the soil slopes downward from the banks of the river to the base of the hills on either side; that the thickness or depth of the deposit is generally about ten feet near the current, but decreases gradually in proportion as it recedes from the stream; and that beneath the mud there is a bed of sand, analogous to that of the adjoining deserts, on which the alluvial deposit is, as it were, superimposed. Thus the surface of the valley has acquired a convex form, similar to that observed in the plains which border on the Mississippi, the Ganges, and other great rivers, where the alluvial deposits are generally most considerable on the margin of the currents. This being the case, then, the next step was to ascertain the mean rate of accumulation or deposition of alluvial matter in a given period of time, in order thence to form a sort of chronometrical scale, by which the age in which any monument or work of art in the immediate neighbourhood of the river had been erected might be determined by approximation. Assuming that in the original erection of monuments, whether temples, palaces, or statues, the men by whom they were constructed would not place their foundations or bases below the level of the river at ordinary or average inundation, and adopting as the standard of comparison the received chronology of the world, it is obvious that, from the total depth of the alluvial deposit, the mean secular accumulation would be at once obtained, and that this, again, would give the number of ages which had elapsed since any monument situated as we have already described had been founded.

But there is another mode of arriving at the same or similar results. We learn from Herodotus, that unless the river rose fifteen or sixteen cubits, it did not overflow its banks, and no contributions were levied; and under the Arabs sixteen cubits was the lowest elevation which would allow of an assessment. But the accumulation of soil has raised the standard; and unless the water rise considerably higher, there is now no chance of an abundant harvest. In 1779, which was a bad year, the water rose at the mikyas or nilometer, sixteen cubits and two inches; but in 1800 it reached eighteen cubits three inches. Now, supposing this height to be exactly equivalent to the standard of sixteen cubits at the time the mikyas was erected (A. D. 847), the difference between the two numbers (two cubits and three inches) will give the increase of elevation in the bed of the river since the year 847; so that we have 1·49 metres, or 3·77 feet, as the numerical expression for the accumulation of soil in about nine centuries and a half, or nearly four inches in a century. Again, at Elephantine near the southern extremity of Egypt, the ancient nilometer mentioned by Strabo is still standing, and the highest measure marked upon its scale is twenty-four cubits; but the water, when at its greatest elevation, now rises 2·413 metres, or nearly eight feet, above that mark, whilst, as appears from an inscription on the wall, it rose only 0·31 of a metre, or 1·01 foot, above the same point at the commencement of the third century of our era. The difference, then, between these numbers (2·11 metres, or 6·9 feet), gives the accumulation of soil in the bed of the river, at that place, during sixteen hundred years, that is, supposing no increase to have taken place in the absolute quantity of water in the river; and from this it follows that the secular or centenary accumulation amounts to 0·132 of a metre, 0·434 of a foot, or rather more than five inches. The approximation of the results thus obtained from independent data affords a very strong presumption in favour of their accuracy; and we shall probably come very near the truth in assuming the mean of both, or four inches and a half, as the average secular accumulation. Among the dates thus ascertained, we shall now proceed to mention some of the most remarkable.

And, first, the depth of the soil around the colossal statue of Memnon at Thebes gives only 0·106 of a metre, or rather less than four inches, as the rate of secular accumulation, whilst the mean of several observations made in the valley of Lower Egypt gives 0·126 of a metre, or rather more than four inches. But the basis of the statue of Memnon, having been placed on an artificial mound, must have been originally raised above the level of the inundation; and, from excavations made near it, the French ascertained that the original height of the terrace was six metres, or 19·686 feet, above the level of the soil. A similar result was obtained from examining the foundations of the palace at Luxor;[1] and, in both cases, no doubt remained that the foundations of these edifices were above the level of the river at ordinary or average inundations. Taking 0·126 of a metre, therefore, as the mean secular accumulation of alluvion, the depth of the soil round the statue of Memnon, divided by this quantity, gave 4760 as the number of years which had elapsed since the monument in question had been erected, or 2960 years before Christ. But, according to the system of chronology founded on the Samaritan text and the Septuagint version of the Scriptures, the deluge occurred in the year 3716 before Christ; and, therefore, according to the above calculation, and proceeding on the data we have mentioned, the erection of this colossal statue took place 756 years after the flood, which is also the approximate date of the foundation of Thebes.[2] Again, the alluvial deposit collected around the base of the obelisk of Luxor indicates, in the same way, that it was erected about fourteen centuries before the Christian era. Thirdly, the causeway which traverses the plain of Siout, or Lycopolis, furnishes similar data for concluding that it was founded nearly twelve hundred years anterior to the same epoch. Lastly, the pillar or obelisk at Heliopolis, six miles from Cairo, appears, from the same sort of evidence, to have been raised about the period last mentioned; but as the waters of the inundation recede more slowly on the plain of the Delta than in the valley of Upper Egypt, the accumulation of alluvial soil will consequently be more rapid there than higher up the stream, and hence the foundations of edifices and monuments will be at a proportionally greater depth than those of the same antiquity in the middle and upper provinces.[3]

It is obvious, however, that no great reliance can be placed on such calculations as those of which we have here endeavoured to give some account, and that several elements of error enter into the premises from which they have been deduced. In the first place, the experiments made by the French to ascertain the depth of the alluvial soil were too few in number, and too hastily performed, to render it safe to adopt the results obtained as the basis of reasoning. Secondly, the deposition of mud or soil in the valley of Egypt must have proceeded more rapidly in ancient times than it does in the present day, when all the rocks over which the Nile and its tributaries now flow have long been washed bare, or even than it has done ever since its effects first became an object of inquiry and examination. Thirdly, it is impossible to ascertain whether the measures referred to by the ancient historians were always of the same standard, or whether, in fact, there was any fixed standard at all. And, lastly, the variations in the different systems of chronology are, independently of all other considerations, a double source of uncertainty in such calculations as those which we have been considering. In fact, the very thing to be proved is in some measure taken for granted, and the assumption contained in the premises is merely reproduced in the conclusion. At the same time, in as far as any value may be attached to the dates thus ascertained, they unquestionably serve to negative the extravagant chronology of the ancient Egyptians, and to reduce it within those limits which history, both sacred and profane, has assigned to the early civilization which took root on the banks of the Nile. Further, it is manifest that, though the level of the land has been raised, its superficial extent towards the sea has not been materially increased, and that there appears to be but little ground for the apprehension expressed by Dr Shaw, that in process of time the whole country will be raised to such a height as to prevent the river from overflowing its banks, and that Egypt, deprived of the annual inundation, will, from being the most fertile, become one of the most barren parts of the universe.[4] "As the formation of land in the Delta," says Dr Russell, "proceeds at a quicker rate than in the higher parts of the basin, the issue of water into the sea becomes year after year less rapid, and consequently less copious; the current is retarded by the accumulation of mud; the mouths are successively choked by the increasing masses of sand and soil; and hence, in the course of ages, the stream, creating a barrier against its own escape, will be thrown back upon the more elevated portion of the valley, and become the willing servant of the agriculturists from Rosetta to the Cataracts."[5]

The soil of Lower Egypt is so horizontal and so equal, that at the moment when, on approaching it from the sea, the date trees are discovered in the horizon, the mariner is still about twenty miles distant from the coast; and if he penetrates the country by one of the branches of the Nile, he ascends by so gentle an inclination that he cannot advance more than a league in the hour. The aspects of the plain vary but little. These are, palm trees, isolated or in clusters, which become fewer as you advance; villages built of earth, and having an air of ruins; a surface without apparent limits, which, according to the season of the year, is a sea of fresh water, a marshy plain, an expanse of verdure, or an immense field covered with sand, over which the eye wanders fatigued by the monotony of the prospect. In advancing towards the apex of the Delta, or the point where the bifurcation of the Nile takes place, there are discovered towards the west three isolated masses, which from their forms are immediately recognized as the Pyramids. A little further on commences the valley of the Nile, which is prolonged towards the south, between two chains of heights nearly parallel, for about a hundred and fifty leagues. By its extent, its arid aspect, and its sterility, the eastern bank of the river justifies the denomination of desert which it has received; whilst the western bank, which is only the crest of a rock covered with sand, presents the appearance of a mound or causeway. In short, let the reader imagine on one side a narrow sea and rocks, on the other immense plains of sand, and in the middle a river, flowing through a valley of a hundred and fifty leagues in length, and from three to seven in width, which at the distance of thirty leagues from the sea separates into two arms, the branches of which wander over a soil almost free from obstacles and void of declivity, and he will be enabled to form a tolerable idea of this singular country. At the same time, the change of the seasons communicates variety even to the narrow valley of the Nile. Towards the winter solstice vegetation appears; the verdure of the meadows delights the eye; a multitude of odoriferous shrubs perfume the air; and Egypt forms then a delicious garden. At the vernal equinox the soil, subjected to all the influence of a sky without clouds, and of continual winds, which often blow with great violence, becomes dry and dusty; whilst, at a still later period, namely, after the periodical inundation, by which it is almost entirely renovated, it is only a vast marsh.[1]

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[1] This word is an European corruption of *El-Oksor* or *El-Ocsor*.

[2] According to the reckoning in the Hebrew text, the deluge occurred 2348 years before Christ; and hence, comparing the above calculation with this chronological estimate, the celebrated metropolis of the Thebaid was founded 612 (2960—2348) years before the flood. Klaproth, however, has shown that, in this matter, a preference ought to be given to the Samaritan text, or even to the Septuagint version, inasmuch as a singular approximation to the former is obtained by taking a mean between it and the Hindu and Chinese epochs. (*Asia Polyglotta*, 25, 29.)

[3] *Encyclopedia Metropolitana*, art. *Egypt*. "To form these calculations," says the able and learned writer whom we have here followed, "with such accuracy as would render them less liable to controversy, more time and observation would be requisite than could be given by the French during the short period they continued in undisturbed possession of Egypt; one general and important consequence, however, arising from their inquiries can hardly be overlooked or denied, viz. that the dates thus obtained are as remote from the extravagant chronology of the ancient Egyptians as they are consistent with the testimony of both sacred and profane history with regard to the early civilization of that country."

[4] Shaw's *Travels*, vol. ii. p. 235.

[5] Russell's *View of Ancient and Modern Egypt*, p. 42.

The Nile, which is the largest river of the old world, and may be described as the great artery of Egypt, has its true sources in a region to which the restless foot of adventure has not yet penetrated; and little more is known of them now than in those days when they excited the curiosity of Cæsar, and occupied the researches of Eratosthenes. The learned librarian of Alexandria, indeed, distinguished three principal branches of the Nile. The first or most easterly, being identical with the Tacazé of the moderns, flows down the northern side of the table-land of Abyssinia; the second known branch, or the Bahr-el-Azrek, after making a circuit or detour on the table-land of Abyssinia, descends through the plains of Sennaar; and both are tributaries of the Bahr-el-Abiad or White River, which is the true Nile, and probably has its sources in the elevated chain to the south of Darfûr, called Djibel-el-Kumri or Mountains of the Moon. The hypothesis of a connection between the Niger and the Nile has been destroyed by recent discoveries, which leave no longer any doubt that the former discharges itself into the sea by several mouths between the Bights of Benin and Biafra. Browne, indeed, has positively asserted that the rivers Misselad and Bar-koolla run from south to north; but even this fact, which is generally admitted, does not allow us to suppose any other communication between the Nile and the Niger than may be formed by canals, like those of the Cassiquiari in Guiana, winding along a table-land, where the sources of the Misselad and Bar-koolla are at a short distance from each other and from those of the Nile; or, perhaps, as it has been affirmed that travellers have passed by water from Timbuctoo to Cairo, it may be supposed that the sources of all these rivers are sufficiently near to admit of intercommunication by means of temporary lakes formed during the rainy season. But the Bahr-el-Abiad, or true Nile, whatever be its source, receives two large rivers from Abyssinia, and then turning to the southward, makes an extensive sweep through the country of Dongola. But at three different points of its course it is intersected by mountains, and at each it has forced a passage for itself through the rocky barrier. The second cataract in Nubia is the most violent and the most difficultly navigable. The third is at Syene or Assouan, the point where the Nile enters Egypt. The height of this cataract, which has been greatly exaggerated by some travellers, varies according to the season, and is generally about four or five feet. The Cataracts are in fact rapids rather than falls; and at the second, of which an admirable description has been given by Belzoni, the water rushes onward with great velocity. The ridges of rock which formerly crossed the line of the river, and gave rise to the celebrated falls the sound of which was heard at the distance of many a league, and stunned the neighbouring inhabitants, have been insensibly worn down by attrition, until the falls have disappeared, and rapids only remain.[2] From Syene to Cairo the river flows along the valley, between two mountain ridges, one of which extends to the Red Sea, and the other terminates in the deserts of Libya. The river occupies the middle of the valley as far as the strait called Djibbel-Silsili, about forty miles in length, at the mouth of which it runs along the right side of the valley, which is bounded by a steep line of rocks cut into peaks, whilst the ridge on the left is accessible by a slope of varying acclivity. The mountains which confine the basin of the Nile in Upper Egypt are intersected by defiles, which on one side lead to the shores of the Red Sea, and on the other to the Oases. Near Benisouef, the valley, already much widened on the west, presents on that side an opening, through which is obtained a view of the fertile plains of Fayoum, forming a sort of table-land, separated from the mountains on the south and west by a wide valley, a portion of which, being always laid under water, is hence called Birket-el-Karoun. Near Cairo, the chains which limit the valley diverge on both sides, whilst in front opens the vast plain of the Delta; and at Battu-el-Bahara the river separates into two branches, one flowing to Rosetta, the other to Damietta, and forming together two sides of the equilateral triangle called the Delta; which, however, was larger in former times, being bounded on the east by the Pelusiac branch, which is now choked up with sand, and on the west by the Canopic branch, which is partly confounded with the canal of Alexandria, and partly lost in Lake Etko.[3]

In ancient times the Nile discharged itself into the sea by seven different mouths or embouchures. The first of these was the *Canopic* mouth, which flowed into the sea near Canopus, a town situated 120 stadia or fifteen miles to the east of Alexandria, and corresponds with the present outlet of Lake Etko, or, according to others, with that of the Lake of Aboukir or Maadieh, through which the Nile then flowed;[4] the second was the *Bolbitic* or *Bolbitine*, from Bolbitiné, a town on its banks, near the place where Rosetta now stands; the third, the *Saïtic*, from Saïs, confounded by Strabo with Tanis, probably the opening into the present Lake Burlos; the fourth, the *Sebennytic*, from Sebennytus, the course of which is supposed to be marked by the canal of Shibin-el-koum; the fifth, the *Phatnitic*, *Pathmetic*, or *Bucolic*, which passes by Damietta, and now forms the eastern branch of the Nile; the sixth, the *Men-*

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[1] Rifaud, *Tableau de l'Egypte et de la Nubie*, p. 3, 4.

[2] "A similar effect, which time will produce on the cliffs of Niagara," says Dr Russell, "will be attended with a similar result on the chain of lakes that terminate in Erie, the contents of which will at length find their way to the ocean along the bed of the St Lawrence. In the remote ages of the future, the immense valleys now occupied by the Superior, Michigan, and those other inland seas which form so striking a feature in North America, will be covered with flocks, herds, and an agricultural population, and only watered by a fine river passing through their centre. In this way the interior of every continent is drained, while new tracts of alluvial land are added to its extremities." (*View of Ancient and Modern Egypt*, p. 43.)

[3] Malte-Brun, *Geography*, vol. iv. p. 20, Eng. transl. Girard, *Memoires sur l'Egypte*, tom. iii. p. 13.

[4] This was also called the *Heracleotic* and *Naucratic* mouth; the one from a *Heracleion* or temple of Hercules, and the other from Naucratis, a town on its banks. (See Coote's *Plan du Nouveau Canal d'Alexandrie dit Mahmoudyeh*, annexed to Mengin's *Hist. de l'Egypte.*)

desian, so named from Mendes, a town sacred to the Egyptian Pan, which is lost in Lake Menzaleh, the mouth of which is represented by that of Dibeh; and the seventh, the *Pelusiac*, which seems to be represented by what is now the most easterly mouth of Lake Menzaleh, near the spot where are still to be seen the ruins of Pelusium.[1] But the *septem ostia Nili*, or seven mouths of the Nile, are at present reduced to two, namely, the Bolbitinic and Phatnitic, or those of Rosetta and Damietta; and of the other five scarcely any distinct vestiges are now traceable, except a canal or two, which are only navigable during part of the year.

The depth and rapidity of the Nile vary according to the particular place and the season of the year. In its ordinary state, the river, from its mouth to the Cataracts, carries no vessel exceeding sixty tons burden. At Damietta it is seven or eight feet deep when the waters are low; but at Rosetta the depth does not exceed four or five feet in the same state of the river. When the waters are high, the depth at both embouchures is increased about forty-one feet, and corvettes carrying twenty-four guns can then sail up as far as Cairo. During the inundation the navigation is facilitated by means of agents which act in a contrary direction; for whilst the strength of the current carries vessels rapidly from the Cataracts to the bogaz or embouchure, the strong northerly winds, which prevail during nine months of the year, enable them with their sails set to ascend the river with almost equal rapidity. When the river is low, and the stream consequently less powerful, these winds, which are constant during the time they prevail, often render it impossible for vessels to make their way downwards even with their sails furled; and hence the practice at such times is to row down the stream during the night, when the wind has subsided, and to halt somewhere during the day; whilst, on the other hand, the vessels which are upward bound sail during the day, and come to an anchor during the night. The passage from Cairo to the Mediterranean occupies from eight to ten days; but, by means of steam navigation, it might easily be performed in less than half that time. When both voyages are practicable, it is an interesting sight to see the numerous boats impelled by opposite agents, passing one another with almost equal rapidity. The mouths of the Nile are of difficult navigation even during the high state of the river, the shifting sand-banks constantly creating unforeseen dangers. With the aid of a little address, combined with courage, the Cataracts are sometimes passed; the lowest in particular being, as above stated, a rapid rather than a fall, and the others, though more perilous, partaking of the same character.

It has already been observed, that the soil of Lower Egypt chiefly owes its existence to the deposition of mud or earth by the Nile, which has also formed the banks at the different mouths of that river. The mud of the Nile first covered the low ground nearest to its bed or channel, whilst the increase of soil from the deposition of mud was more gradual in its progress in distant parts; and hence arose the formation of lakes. But these in their turn were gradually filled up by the land formed out of the deposited mud of the river, which consequently increased the boundaries of Lower Egypt, by taking from the sea; yet as the tendency of the sea is to resist such encroachments, it is probable that the ground formed by the deposited mud of the Nile will no longer continue to increase in one direction without diminishing in another. The experience of centuries has fully evinced, that the sea has actually taken more from the extent of Egypt than has been compensated by the mud of the Nile. By the simple operation of physical causes, it may be concluded, that if nature and art do not co-operate, if the water be permitted to increase, and the channels of the different branches be augmented, the sea will continue to snatch new lands from the inhabitants; and this appears to be the inevitable doom of Egypt, unless counteracted by the labour and ingenuity of man. A large proportion of the land formerly watered by the branches of the Nile already described, is now the bed of Lake Menzaleh. Lake Bourlos, as we have seen, is not far from the mouth of what was formerly called the Sebennytic branch, and Lake Maadieh is near the mouth of the ancient Canopic arm. But Lake Mareotis was at too great a distance from the Nile to be filled up with the mud which it deposits, and its waters were diverted from the lake by a canal which had been cut for the conveyance of water to the city of Alexandria; and hence, having no communication with the sea, its waters were gradually evaporated, and it continued nearly, if not altogether dry until those of the sea were let into it by the British during the siege of Alexandria, in the manner already described. There are also a few lakes which owe their origin to the redundant waters of the Nile diffusing themselves over hollow places in which they are confined, and which only disappear by the gradual process of evaporation. In addition to the branches and chief canals already mentioned, there are numerous lesser canals in Lower Egypt which convey the waters of the inundation, whilst dykes in different districts serve to retain them. By these waters the more elevated grounds are fertilized, and then other cantons in succession, after which they are poured into the lakes, or are lost in the sea.

The cause of the fertility of Egypt is the Nile, without which, as it almost never rains in that part of the world, the whole country would soon become an uninhabitable desert. Swelled by the rains which fall in Abyssinia, the river begins to rise about the month of May; but the increase is inconsiderable till towards the end of June, when it is proclaimed by a public crier through the streets of Cairo. About this time it usually rises to the height of five or six cubits; and when it has attained sixteen, great rejoicings are made, and the people cry out that God has given them abundance. This commonly takes place about the latter end of July, or at farthest before the 20th of August; and the sooner it occurs, so much the greater are the hopes of a good crop. Sometimes, though rarely, the necessary increase does not take place till a later period of the season. In the year 1705 the river did not swell to sixteen cubits till the 19th of September; and the consequence was that the country was depopulated by famine and pestilence. In ordinary circumstances, however, the rise of the Nile commences at the summer solstice, or towards the end of June; it attains its greatest height at the autumnal equinox, or towards the end of September; it then remains stationary for several days, and at length diminishes, but at a less rapid rate than that at which it rose. But as the Nile of itself cannot overflow the whole country so as to fertilize it, there are cut from it across the country innumerable canals, by which the water is conveyed to distant places; and almost every town or village has one of these canals. In those parts of the country which the inundation does not reach, and where more water is required than it can furnish, as for irrigating of gardens, recourse is had to artificial means for raising it from the river. In former times Archimedes' screw was employed for this purpose; but it is now disused, and instead of it the Persian wheel, and other engines of more modern and approved construction, have been introduced. The rise of the inundation is measured, as has already been observed, by an instrument adapted for the purpose, and called a nilometer. This is placed between Gizeh and Cairo, on the point of an island in the middle of the river, but somewhat nearer to Gizeh. It consists of a round tower with an apartment, in the middle of which is a cistern neatly lined with marble. The bottom of this cistern reaches to that of the river, and there is a large opening by which the water has free access to the inside. The rise of the water is indicated by an octagonal column of blue and white marble, on which are marked twenty cubits of twenty-two inches each. The two lowermost of these have no subdivisions; but each of the rest is divided into twenty-four parts called digits; and the whole height of the pillar is thirty-six feet eight inches. When the river has attained its proper height, all the canals are opened, and the whole country is laid under water. During the time of the inundation a certain vertical motion of the waters takes place; but notwithstanding this, the Nile is so easily managed, that many fields lower than the surface of its waters are preserved from injury merely by a dam of moistened earth seldom more than eight or ten inches in thickness. This method is used particularly in the Delta when it is threatened with a flood.

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[1] In the time of Herodotus, the river, it appears, divided, near the point of the Delta, into three principal arms: the Canopic (1) on the west, the Pelusiac (7) on the east, and the Sebennytic (4) in the middle; whilst from the latter there issued two smaller arms, the Saïtic (3) on the west, and the Mendesian (6) on the east. These were considered as natural channels; but the two remaining arms, namely, the Bolbitinic, between the Canopic and Saïtic, and the Bucolic, to the west of the Mendesian, were artificial.

As the Nile does not always rise to a height sufficient for the purposes of agriculture, the former sovereigns of Egypt expended great labour in cutting proper canals, and in forming lakes or reservoirs, in order to supply the deficiency. Some of these are still preserved, but until the reign of the present viceroy great numbers had been rendered useless through the indolence or barbarity of his predecessors. Those which convey the water into Cairo, the province of Fayoum, and Alexandria, were formerly most attended to by the government; but now all are equally under its superintendence, and kept in a state of good repair. A number of other canals, under the care of those who derive advantage from them, proceed from that arm of the Nile which flows past Damietta, and fertilize the province of Sharkieh, which, forming part of the isthmus of Suez, is the most considerable of Egypt, and the most capable of a great increase of cultivation. The plains of Gaza, situated beyond this province, and possessed by the Arabs, would be equally fertile were it not for the propensity of these people to destroy every thing within their reach. A number of other canals run through the Delta; and the remains of those which watered the provinces to the eastward and westward show that in former times these were the best cultivated parts of Egypt. We may also presume, from the extent of the ruins of Alexandria, the construction of the canal, and the natural level of the lands which encompass the Lake Mareotis, and extend westward to the kingdom of Barca, that this country, now almost a desert, was once sufficiently rich in productions of every kind to furnish the city of Alexandria with its whole subsistence.

The air and climate of Egypt are extremely hot, not only from the height of the sun, which in summer approaches to the zenith, but from the want of rain, and the vicinity of those burning and sandy deserts which lie to the southward. In the months of July and of August, Reaumur's thermometer stands, in the shade, at the height of twenty-four or twenty-five degrees above the freezing point; and in the southern parts it is said to rise still higher. Hence the two principal seasons to be distinguished in Egypt are the cool and the hot, or spring and summer, with a very short winter in the north. "La température de l'Egypte," says Rifaud, "varie selon la latitude et l'époque de l'année où l'on fait des observations. Dans le nord, le thermomètre descend en hiver jusqu'à deux ou trois degrés au-dessus de zéro; dans les chaleurs, il descend rarement au-dessous de 22 degrés. Dans le sud, vers Ecouan (Assouan) on a constaté des chaleurs de 34 degrés à l'ombre, et le thermomètre, placé dans le sable, marquait jusqu'à 54 degrés au soleil.[1] The summer continues during the greater part of the year, namely, from March to November, or even longer; and by the end of February the sun is intolerable to a European even at nine o'clock in the morning. During the whole of this season the air seems to be inflamed, the sky sparkles, and profuse perspiration takes place, even without the least exercise, and although covered with the lightest dress. But this heat is tempered by the inundation of the Nile, the fall of the night dews, and the subsequent evaporation; so that some of the European merchants, as well as the natives, complain of the cold in winter. The dew which we speak of is not formed regularly throughout the summer, as with us, the parched state of the country not affording a sufficient quantity of vapour for this purpose. It is first observed about the end of June, when the river has begun to rise, and consequently a greater quantity of water is converted into vapour by the heat of the sun, which being soon condensed by the cold of the night air, descends in copious dews.

It might naturally be imagined, that as, during three months in the year, Egypt is a wet and marshy plain, the excessive evaporation and the putrefaction of the stagnant waters would render it exceedingly unhealthy. But this is by no means the case. The great dryness of the air causes it to absorb vapours of all kinds with the utmost avidity; and these rising to a great height, are carried off by the winds either to the southward or northward, without having time to communicate any of their deleterious effects. This dryness is so remarkable in the internal parts of the country, that meat exposed to the open air does not putrefy even in summer, but soon becomes hard and dry like wood. In the deserts dead carcasses dried in this manner, and which have become so light that one may easily raise that of a camel, are frequently met with. In the maritime parts, however, such dryness of the air is not to be expected, and the same degree of moisture which is usually met with in such situations prevails. At Rosetta and Alexandria, iron cannot be exposed to the air for twenty-four hours without rusting. The air of Egypt is also strongly impregnated with saline particles. The stones, says Volney, are corroded by natron or mineral alkali; and in moist places crystallizations are to be found which might be taken for saltpetre. The wall of the Jesuits' garden at Cairo, built with earth and bricks, is everywhere covered with a crust of natron, as thick as a crown piece; and when this garden has been overflowed by the waters of the kalidj or canal, the ground, after they have been drained off, sparkles on every side with crystals, certainly not brought thither by the water, which shows no indication of salt either to the taste or by distillation. But whatever may be the quantity of salt contained in the earth, Volney's opinion of its being produced by the air can

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[1] *Tableau de l'Egypte et de la Nubie*, p. 9, 10.

scarcely be maintained. The salt in question is excessively fixed, and cannot be dissipated into the air without the violent heat of a glass-house furnace; and even after this has been done, it cannot remain diffused throughout the atmosphere, but must quickly descend. No experiments have ever shown that any salt was or could be diffused in the air, except volatile alkali, which is now known to be formed by the union of two permanently elastic fluids; and it is certain that a saline air would quickly prove fatal to the animals who inhaled it. The abundance of this kind of salt in Egypt only shows, therefore, that by some unknown operation the heat of the sun forms it out of the two ingredients of earth and water, though we do not yet understand the manner in which it is effected, nor are we able to imitate this natural operation. To this saline property of the earth is ascribed the excessive quickness of vegetation in Egypt, which is so great that a species of gourd called *kara* will, in twenty-four hours, send forth shoots of four inches in length; but, probably from the same cause, no exotic plant is found to thrive in Egypt. The merchants are obliged annually to send to Malta for their garden seeds; and though the plants thrive very well at first, yet if the seed of them be preserved, and sown a second year, they become too tall and slender.

By reason of the extreme dryness of the air, Egypt is in a great measure exempted from the phenomena of rain, hail, snow, thunder, and lightning. Earthquakes are also seldom heard of in that country; though they have sometimes proved very fatal and destructive, particularly one which happened in the year 1112. In the Delta it never rains in summer, and very seldom at any other season. In 1761, however, such a quantity of rain unexpectedly fell, that a great number of houses built of mud walls tumbled down, in consequence of being soaked with the water. In Upper Egypt the rain is still less frequent; but the people, sensible of the advantages which result from it, always rejoice when any falls, however insufficient it may be to supply their wants. But this want of rain is supplied by the water of the inundation, and by the heavy dews already mentioned. The latter originate partly from the waters of the inundation, and partly also from the sea. These dews are more or less copious according to the direction of the wind. They are produced in the greatest quantity by the westerly or northerly winds, which blow from the sea; but the south and south-east winds, blowing over the arid deserts of Africa and Arabia, produce none whatever.

The periodical return of winds from a certain quarter is a very remarkable phenomenon in this country. When the sun approaches the tropic of Cancer, they shift from the east to the north; and during the month of June they always blow from the north or north-west. They continue northerly all the month of July, only varying sometimes towards the east, and sometimes in a contrary direction. About the end of the latter month, and during the whole of August and September, they blow directly from the north, and are of but moderate strength, though generally weaker in the night than during the day. Towards the end of September they return to the east, though they do not absolutely fix in that point, but blow more regularly from it than from any other except the north and north-west. As the sun approaches the southern tropic they become more variable and tempestuous, blowing most commonly from the north, north-east, and west, which they continue to do throughout the months of December, January, and February; and, during that season, the vapours raised from the Mediterranean condense into a mist, and even sometimes into rain. Towards the end of February, and during the succeeding month, the winds blow more frequently from the south than from any other quarter. During the whole of the months of March and April they blow from the south, south-east, and south-west; sometimes from the north and east, the latter winds being most prevalent about the end of that month, and continuing during the whole of May. "Les vents d'ouest et de nord-ouest," says Rifaud, "poussent vers l'Egypte les sables des déserts de l'Afrique. Ces sables, après avoir franchi la chaîne Libyque, descendent dans la vallée, et rétrécissent de plus en plus la bande de terrain cultivable. Ces sables, uniquement composés de grains quartzeux, s'accumulent en dunes en quelques endroits."[1]

It is to the long continuance of the north winds, formerly denominated the Etesian winds, that Egypt probably owes its extreme dryness, as well as part of the inundation by which it is fertilized. From the month of April till July there appear to be two immense currents in the atmosphere; the under one blowing from the north, and the upper one from the south. By the former the vapours are raised from the Mediterranean and the southern parts of Europe, whence they are carried over Abyssinia, and dissolve on the lofty chains of the interior in immense deluges of rain; whilst by the latter the superfluous vapours, or those raised from the country of Abyssinia itself, are carried northward toward the sources of the Euphrates, where the clouds coming from the south, and descending into the lower part of the atmosphere, dissolve in like manner into rain, and produce an inundation of the Euphrates similar to that of the Nile, and immediately succeeding it. Bruce had an opportunity of ascertaining this fact in the month of June 1768; for whilst on a voyage from Sidon to Alexandria, he observed great numbers of thin white clouds moving rapidly from the south, and in direct opposition to the Etesian winds.

Besides the ordinary winds here spoken of, Egypt is visited with the destructive blasts common to all tropical countries which have extensive deserts in their neighbourhood. The most destructive of these has been distinguished by various names, such as poisonous wind, hot wind, Samiel, the wind of Damascus, Khamsin, and Simoom. These are different names for the same wind, which is denominated Khamsin in Egypt, Samiel in Arabia, and Simoom or Seimoum in the desert. "Dès que ce vent de sud commence à souffler, l'atmosphère se trouble; une teinte pourpre plus ou moins vive la colore; le ressort de l'air et son élasticité cessent; une chaleur seche et brûlante les remplace, en même temps que des tourbillons, semblables aux émanations d'une fournaise ardente, se succèdent par intervalles. Lorsque cet état de l'atmosphère n'est que faible, il cause un mal-aise général, dont tous les êtres organisés se ressentent; à un degré plus intense, il rend malade, et peut même causer la mort."[2] Blasts of this description are in Egypt denominated "winds of fifty days," because they most commonly prevail during the fifty days preceding and following the equinox; though, were they to blow constantly during one half of that time, an universal destruction would be the consequence. Of the effects of these winds travellers have given various descriptions. Volney states that the violence of their heat may be compared to a large oven at the moment of drawing out the bread. They always blow from the south, and are undoubtedly produced by the motion of the atmosphere over extensive tracts of hot sand, by which it is deprived of its moisture, and heated as if it had passed through a furnace. When they begin to blow, the sky (as stated by Rifaud in the passage already quoted) loses its usual serenity, and assumes a dark, heavy, and alarming aspect; even the sun himself lays aside his usual splendour, and becomes of a violet colour. This terrific appearance seems not to be occasioned by any real haze or cloud in the atmosphere at that time, but solely by the vast quantity of fine sand carried along by these winds, and which is so excessively subtile that it penetrates everywhere. The motion of this wind is always rapid, but its heat is not intolerable till after it has continued for some time. Its pernicious qualities are evidently occasioned by its excessive avidity for moisture. It dries and shrivels up the skin; and the lungs being also powerfully affected by it, suffocation and death sometimes ensue. The danger is greatest to those of a plethoric habit of body, or who have been exhausted by fatigue; and putrefaction soon takes place in the bodies of such as have fallen victims of "the hot breath of the desert." Its extreme dryness is such that water sprinkled on the floor evaporates in a few minutes; all the plants are withered and stripped of their leaves; and, in the case of human beings, fever is instantly produced by the suppression of perspiration. It usually lasts three days, but is altogether insupportable if it continue beyond that time. The danger is greatest when the wind blows in squalls, and when travellers happen to be exposed to its fury without any shelter. The best method in this case is to stop the nose and mouth with a handkerchief. Camels, by a natural instinct, bury their noses in the sand, and remain in this position until the gust has passed by. The inhabitants who have an opportunity of retiring to their houses, instantly shut themselves up, or descend into pits made in the earth, till the destructive breath of the desert be overpast.

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[1] *Tableau de l'Egypte et de la Nubie*, p. 10.

[2] *Tableau de l'Egypte et de la Nubie*, p. 8.

The description of a blast of this kind which overtook Bruce in the desert of Nubia is still more striking than that given by Volney. Pillars of moving sand, raised by the winds in the desert, were observed by the traveller on this occasion in all their terrific majesty. Sometimes they appeared to move slowly; at other times they rushed on with incredible swiftness, so that they could not have been avoided by the fleetest horse. Sometimes they approached so near that they threatened destruction to the whole company. Frequently the tops, having reached an immense height, so as to be lost in the clouds, suddenly separated from the columns, and dispersed themselves in the air; sometimes the whole column broke off near the middle, as if it had received a cannon shot; and the size of some of the columns was such that at the distance of three miles they appeared about ten feet in diameter. Next day, however, they seemed of a smaller size, but more numerous, and sometimes approached within two miles of the party. The sun was now much obscured, and the transmission of his rays gave the columns of sand an appearance resembling pillars of fire. This was pronounced by the guide to be a sign of the approaching Simoom or hot wind; and he directed, that when it arrived, the people should fall upon their faces and keep their mouths on the ground, in order to avoid inhaling this pernicious blast. On his calling out that the Simoom was coming, Bruce turned for a moment to the quarter whence it came, which was the south-east. It appeared like a haze or fog of a purple colour, but less bright than the purple part of the rainbow, and seemed about twenty yards in breadth, and twelve feet above the ground. It moved with such rapidity, that before he could turn round and fall prostrate, he felt the vehement heat of its current upon his face; and even after it had passed over, which was very quickly, the air that followed was of such a heat as to threaten suffocation. Bruce had unfortunately inhaled some portion of the pernicious blast; by which means he almost entirely lost his voice, and became subject to an asthmatic complaint, from which he did not recover for nearly two years. The same phenomenon occurred twice afterwards during the journey through this desert. The second time, the blast came from the south a little to the east, and seemed to have a shade of blue blended with the purple, its edges being less perfectly defined; and it resembled a thin smoke, having about a yard in the middle tinged with blue and purple hue. The third time, it was preceded by an appearance of sandy pillars more magnificent than any which had yet been observed; and the sun shone through them in such a manner as to give to those which were nearest the appearance of being spangled with stars of gold. The Simoom which followed had the same blue and purple hue as before, and was followed by a most suffocating wind, which lasted for about two hours, and reduced our travellers to the lowest degree of weakness and despondency. This wind always came from the south-east, whilst the sandy pillars, which prognosticated its approach, kept to the westward, and occupied the vast circular space inclosed by the Nile to the west of the route followed by the travellers, sweeping round by Chagre towards Dongola. The heaps of sand left by them when they fell, or raised by the whirlwinds which carried them up, were twelve or thirteen feet in height, and exactly conical in shape, tapering to a fine point, whilst their bases were well proportioned.

Though the climate of Egypt is far from being unhealthy, yet there are not a few diseases which seem to be peculiar to that country, and originate either in the constitution of the atmosphere, or in the manner of living among the inhabitants. Till lately the plague was supposed to be one of these native diseases; but it is now agreed that this distemper never originates in the interior parts of Egypt; it always begins at Alexandria, and passes thence successively to Rosetta, Cairo, Damietta, and the rest of the Delta. It is likewise observed that its appearance is almost invariably preceded by the arrival of some vessel from Smyrna or Constantinople; and if it has been very violent in either of these cities, the danger of Egypt is just so much the greater. In fact, it is found to be in reality a native of Constantinople, whence it is exported by the absurd negligence of the Turks, who refuse to take any precautions to prevent the spreading of the infection. As they sell even the clothes of the dead, and as ships laden with this pernicious commodity used to be sent to Alexandria, it is no wonder that it should have made its appearance in the latter place. As soon as it is found to have reached Cairo, the European merchants shut themselves up with their families in their khans or lodgings, and take care to have no further communication with the city. But there is a remarkable difference between the plague at Constantinople and that which occasionally appears in Egypt. In the former place, it is most violent in summer; but in the latter, winter is the season of danger, the disease always disappearing in the month of June. It is also observed, that the water-carriers of Egypt, whose backs are constantly moist, from the nature of their occupation, never take the plague. Every fourth or fifth year, Egypt was till latterly visited with this dreadful scourge.

A malady which seems to be peculiar to Egypt is blindness. This is so common at Cairo, that out of a hundred persons whom Volney accidentally met on the streets he reckoned twenty quite blind, ten without the sight of one eye, and twenty others with their eyes red, purulent, or blemished. Almost every one wears a fillet, which is a token of an approaching or convalescent ophthalmia. In considering the causes of this disorder, Volney reckons the sleeping upon terraces as a principal one. The south wind cannot, according to him, be the cause, otherwise the Bedouins would be equally subject to it with the Egyptians themselves; but the principal cause, he thinks, is the poor and little nutritive food on which the natives are obliged to subsist.[1] The cheese, sour-milk, honey, confections of grapes, green fruits, and raw vegetables, which are the ordinary food of the common people, produce in the stomach a disorder which physicians have observed to affect the sight; and the raw onions, especially, which they devour in prodigious quantities, have a peculiarly heating quality. Bodies thus nourished abound in corrupt humours, which constantly seek a discharge; and, diverted from the ordinary channels by habitual perspiration, these humours fly to the exterior parts, and fix themselves where they find the least resistance. They therefore naturally attack the head, because the Egyptians, by shaving it once a week, and covering it with a prodigiously hot head-gear, principally attract to it the perspiration; and if the head receive ever so slight an impression of cold on being uncovered, this perspiration is suppressed, and falls upon the teeth, or still more readily on the eyes as being the tenderest part. The ancient Egyptians, who went about bareheaded, are not mentioned by physicians as having been so much afflicted with ophthalmia as the modern; and the Arabs of the desert, who cover their heads slightly, especially when young, are but little subject to this disease. In Egypt, blindness is often the consequence of small-pox; a disorder which, until lately, when vaccination was partially introduced by Mehemmed Ali, used to be very frequent and fatal. Another cause of this distemper may perhaps be found in the fine impalpable sand which is carried about by the wind, and also in the intolerable brilliancy of the sunbeams reflected from a burning and sandy soil impregnated with nitrous salt.

Besides these, there are two diseases less commonly met with in Egypt; namely, a cutaneous eruption, which returns annually, and a swelling of the testicles, which often degenerates into an enormous hydrocele. The former comes on towards the end of June or beginning of July, making its appearance in red spots and pimples all over the body, which occasion a very troublesome itching, and is probably occasioned by the waters of the Nile, which towards the end of April become putrid. The hydrocele most commonly attacks the Greeks and Copts, and is attributed to the quantity of oil which they make use of, as well as to their frequent hot bathing. In the spring season malignant fevers occasionally prevail. In the treatment of these bleeding is found prejudicial, whilst vegetable diet, and bark in large quantities, have been found useful.

We have already described the geographical configuration of the valley of the Nile, with its natural boundaries consisting of two elevated ridges between which the river flows for about a hundred and fifty leagues. These mountain chains are on many accounts highly deserving of attention, but on none, perhaps, more than by reason of their geological structure and characters. After passing through a district of primitive formation, they enter that of the secondary and flœtz-trap kind, and terminate in deposits belonging to the most recent species of stratified rocks.

The granite or southern district extends from Philœ to Assouan, in 24° 8′ 6″ N. and 33° 4′ E., and consists for the most part of syenite or oriental granite, in which may still be observed the quarries whence the ancient Egyptians detached the stupendous monoliths required for their colossal statues and obelisks. The granite is occasionally diversified by alternations of gneiss, porphyry, clay-slate, quartz, and serpentine, erroneously described as a green-coloured marble, containing imbedded in them a variety of carnelians and jaspers; and there has also been observed in this district a granular foliated limestone or marble, exhibiting various hues, as white, grey, yellow, blue, red, and, when combined with serpentine, forming the rock known by the name of verde-antico. From the quarries of Philœ, Elephantine, and Syene, were obtained the beautiful oriental or rose-coloured granite, called *syenites* by Pliny, from the place near which it abounded, but differing from the syenite of modern mineralogists. In this rock two thirds of the mass consists of felspar, varying in colour from a pale pink to a brick red; and the remainder is composed of mica exhibiting a metallic lustre, and diaphanous quartz, with sometimes a small quantity of hornblende, in which case it becomes the syenite of Werner. Pliny denominates it Thebaic stone, not from there having been any quarries of this rock in the neighbourhood of Thebes, but from the frequency of its occurrence in the gigantic monuments of the ancient capital of Egypt. The rose-coloured variety seems chiefly confined to the vicinity of Elephantine, though it is also found unmixed for some distance on both sides of the river. As syenite is connected by numerous shades and gradations both with the common granite and also with the succeeding species of rock, so we have accordingly the granitello of lapidaries when it is fine grained, grey syenite when the felspar is of that colour, black and white granite when the felspar is white and the mica black, and Egyptian or oriental basalt when it has been extracted from veins in which the mica and hornblende prevail in black homogeneous masses, with scarcely any admixture of felspar. The hardness of this stone is such as to preserve its surface uninjured by exposure to the atmosphere. But the remarkably perfect state in which the monuments of Egypt are found ought perhaps to be ascribed to the uniform dryness of the air, and the almost total absence of rain; and this is rendered more probable by the circumstance, that in the Delta, especially near the sea, where showers occasionally fall, and the atmosphere is charged with a greater quantity of moisture, the process of decomposition has commenced, and in some places made considerable progress.[2]

Between Assouan and Esneh, in 25° 19′ 39″ N. is the argillaceous sandstone or middle district, which supplied slabs for most of the temples; and beyond it the northern or calcareous district stretches to the southern angle or vertex of the Delta. At Esneh, indeed, the rocks assume the calcareous character, and retain it until they merge into the plain below Cairo, at the southern limit of the lower division of Egypt. From this last chain were quarried, not only the solid part of the Pyramids, but also materials for many public buildings, which, as they proved excellent stores of lime and stone for the Arabs and other barbarians who for so many centuries desolated Egypt, have long since been destroyed. The steep perpendicular cliffs of this limestone formation impart to the portion of the country where it prevails a hard and monotonous aspect, contrasting unfavourably with the bold and picturesque forms of the mountains in the south, which offer new points of view in continual succession, and give an agreeable variety to the landscape, even when the inundation is at its greatest height. The limestone of this region exhibits a splintery or conchoidal fracture, is grey or variegated in colour, and contains numerous petrifactions of shells, corals, and fishes. A similar rock occurs in the ridges bounding the transverse valley which leads to Cosseir; and in the same mountain district there are hills of limestone conjoined with gypsum. Here also the sand is partly calcareous and partly quartzose, thus indicating the composition of the strata from the debris of which it has been formed. The site of the ancient capital of Egypt is at the lower limit of the middle or sandstone district, and from the quarries of Djibbel-el-Silsileh or the Mountain of the Chain, were obtained the materials used in the construction of its stupendous temples and palaces. Here the sandstone terminates and the freestone begins; the hills are no longer parallel, but diverge in various directions; and on the first level of any extent below the Cataracts are found the ruins of Thebes, covering a large portion of the valley. From this point the calcareous chain continues on each side of the valley to the summit or vertex of the Delta, where the hills open to the east and west, uniting with the Libyan chain on one side, and inclining towards the mountains of Arabia Petræa on the other. But though generally calcareous, this chain, especially near the desert, is occasionally intersected by isolated masses of sandstone.[1]

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[1] This is no doubt one cause of the distemper; but Rifaud has shown that there are others. "On a attribué la fréquence des ophthalmies en Egypte aux vents qui soufflent périodiquement; je croirois plutôt pouvoir trouver la cause de cette maladie dans l'habitude où sont les Egyptiens de coucher sur les terrasses pendant neuf mois de l'année. Il faut considérer que les campagnes de l'Egypte sont d'immenses plaines, où la lumière est très vive; leur terrain est sec, friable, et brûlant, particulièrement en été; il est argilleux et crayeux, contenant le nitrate de potasse, le natron, et le muriate de soude. D'ailleurs, les jours sont d'une chaleur excessive, tandis que les nuits sont fraîches, humides, et nébuleuses. Ces circonstances physiques réunies ne peuvent agir sur l'organe de la vue sans y causer des désordres. On a remarqué que les ophthalmies sont plus communes en été qu'en hiver, et que les animaux y sont sujets aussi-bien que les hommes. (Rifaud, *Tableau de l'Egypte*, p. 9.)

[2] *Encyclopædia Metropolitana*, art. *Egypt*.

But the most singular portion of Egypt, in a geological point of view, is that which is comprehended in the Bahr-bilama or waterless sea, and the basin of the natron lakes. These two valleys run parallel to each other. The mountain of natron skirts the whole length of the valley of that name, but it contains none of the rocks which are found scattered about in the valley, such as quartz, jasper, and petrosilex. In the direction of this valley is a series of six lakes, the banks and waters of which are covered with crystallizations consisting of muriate of soda or sea salt, and carbonate of soda or natron. When a volume of water contains both these salts, the muriate of soda is the first to crystallize, and the carbonate of soda is then deposited in a separate stratum; but the two crystallizations sometimes affect separate localities in insulated portions of the same lake. The ridge which separates the basin of the natron lakes from the valley of the Bahr-bilama consists chiefly of natron mixed with muriate of soda, which salt is also found in the valley of the wilderness in thin compact layers supported by strata of gypsum, and in other deserts, where it occurs in a state of crystallization, sometimes under the sand, but much more frequently upon the surface. The valley of the Bahr-bilama, separated, as already described, from that of natron, is about eight miles in breadth. In the sand with which its surface is everywhere covered, trunks of trees have been found in a state of complete petrifaction. It is thought by some that a branch of the Nile once passed in this direction.[2]

Of the more precious minerals found in Egypt we shall only give a brief enumeration. The topaz, which is said to have attracted the attention of some ancient kings, is still found in various places, particularly in an island called Zamorget, or the island of topazes, in the Red Sea. Emeralds were anciently obtained by means of excavation, in the mountainous ridge which skirts the western shores of the Arabian Gulf, and constituted an article of commerce among the Romans; and Bruce speaks of an island of emeralds in the same sea, but, upon examination, it was found to produce nothing more valuable than fluor spar. Chrysoberyl is also enumerated amongst the mineral productions of Upper Egypt. The rarest varieties of quartz to be met with in any part of Africa are the Egyptian avanturine, and the rock-crystal of the northern shores. Chalcedony and carnelian have been picked up on each bank of the Nile, both in the upper and lower provinces. Agate belongs to the rocks which diversify the monotony of the desert to the eastward of Cairo. Jasper occurs in veins of considerable thickness in the clay-slate which bounds the upper part of the valley of the Nile, between Esneh and Siout; but a finer kind, for which Egypt has long been celebrated, is found both in the sandy waste between Cairo and Suez, and also in that part of the country below Benisouef, where it occurs imbedded in a species of conglomerate. Actynolite, epidote, and hornblende, to which may be added heavy spar, or sulphate of barytes, are frequently to be met with in the transverse valleys which diverge from Upper Egypt towards the Red Sea, particularly in the valley of Cosseir.

The mountains of Egypt, and those of the countries immediately contiguous thereto, have been so imperfectly explored that we are still ignorant of the amount and diversity of their metallic treasures. But, from the early advancement of the useful arts in Egypt, and particularly from the gigantic labours of the Anakim of ancient days, in not only detaching but working into a great variety of forms enormous blocks of the hardest granite, it may safely be concluded that iron was not unknown to them, that it must have been found at no great distance from the great works in which it was employed, and that the subjects of the elder Pharaohs were also acquainted with the method of converting it into steel. Their quarries whence gigantic blocks were detached, their obelisks covered with hieroglyphics frequently cut in relief, and their statues chiselled out of the hardest rock, indicate, in a manner not to be misunderstood, that instruments of the best temper must have been placed in the hands of their workmen and artists, and that they wrought with tools of the finest steel, which, of course, they must have known how to prepare. With regard to the precious metals, although Africa affords a considerable quantity of gold, which is obtained in the form of dust, or collected by washing from the sand of rivers or the alluvial soil of valleys between ranges of mountains, yet the position of Egypt deprives it, in a great measure, of this source of wealth. But in the countries above the Cataracts, particularly in Kordofân, there are several tracts where this metal is found in considerable quantities; and hence, probably, arose the opinion, so prevalent amongst the ancients, that Ethiopia was a country which abounded in gold. In our time, however, the supply of this metal received at Cairo and Alexandria is derived from that elevated region which contains the sources of the Gambia, the Senegal, and the Niger, and from the district of Bambouk, situated to the north-west of the lofty range which forms as it were the back-bone of the African continent. Of silver, copper, lead, and antimony, no traces whatever are to be found below Abyssinia. To Egypt nature having given the Nile, seems to have considered that precious gift, annually renewed, as an adequate compensation for the want of products far less available to the wants and necessities of man.[3]

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[1] *Encyclopædia Metropolitana*, art. *Egypt*. Russell, *View of Ancient and Modern Egypt*, p. 466.

[2] *Mémoires sur l'Egypte*, tom iii. p. 255. Denon, tom. ii. pp. 49, 158, 195, 208. Andréossy, *Mémoire sur la Vallée des Lacs de Natron*, dans la *Description de l'Egypte*, tom. i. Malte-Brun, *Geography*, vol. iv. p. 29.

[3] Murray, *Historical Account of Travels and Discoveries in Africa*, vol. ii. pp. 424, 438. Lyall, *Principles of Geology*, vol. i. p. 238.

These geological notices are, we admit, exceedingly imperfect. But hitherto travellers have, from various causes, bestowed much less attention on the geology of Egypt than the subject unquestionably requires; and, even in Lyall's *Principles* of this science, all that we meet with respecting either the valley of the Nile or the Delta is at once so meagre and superficial that it deserves to be signalized only for its want of satisfactory information. As yet no extensive or connected series of observations has been made in regard to the direction and inclination of the strata, either in the mountainous ridges within which the Nile is confined, or in the transverse valleys which branch off towards the Red Sea on the one hand and the Oases on the other; and although we are reminded of the usual mineralogical distinctions, and meet with much learned phraseology about primitive, secondary, flœtz, and alluvial formations, yet we search in vain for any thing like systematic views based on accurate observation, and are thus compelled to rest satisfied with conjecture, where, if facts had been supplied, we might have been in a condition to reason on established philosophical principles. Egypt is therefore a field which is still in a great measure unexplored by the scientific geologist, but it is nevertheless one which will amply repay the judicious and persevering labourer; and we trust that the period is not distant when a regular mineralogical survey will be executed of a country which, all circumstances considered, is certainly one of the most remarkable and interesting upon the face of the earth.

SECTION IV.

POLITICAL GEOGRAPHY AND ACTUAL STATE OF EGYPT.

Ancient and modern divisions of Egypt.—Relative positions of the provinces of each division.—Population.—Turks, Copts, Arabs.—Distinction between the Arabs and Copts.—Descent of the latter.—The Coptic language.—Turks.—Greeks.—Jews.—Total population.—Civil government of Egypt.—Court and household of the Viceroy.—Local authorities.—Tenure of land.—Mode in which it is cultivated.—Condition of the Fellahs or Cultivators.—Canal of Mahmoudyeh, between the Nile and Alexandria.—Circumstances which led to and attended the construction of this great work.—Trade of Alexandria.—Progress of the cultivation of cotton, and the introduction of cotton manufactures.—Quantity of raw cotton exported.—Silk, flax, sugar, tobacco, and other commodities.—System of monopoly and pre-emption.—Its disadvantages and probable results.—Indian trade.—Imports and exports.—Caravans.—Statistics of Egypt.—Comparative condition of that country before and under the government of Mehemmed Ali.—Its future prospects.—General reflections.

In modern as well as in ancient times, Egypt is divided into three principal parts: namely, the *Bahhari*, corresponding to the Delta or Lower Egypt; the *Vostani*, corresponding to the Heptanomis, or Middle Egypt; and the *Saïd*, corresponding to the Thebaid, or Upper Egypt. This division is indicated by the course of the river and the configuration of the country. The Bahhari, or Lower Egypt, includes the provinces of Bahhireh, Rosetta or Raschid, Gharbieh, Menouf, Manssourah, and Sharkieh. The Vostani, or Middle Egypt, comprehends those of Cairo, Gizeh, Attafieh, Kelioubeh, Fayoum, and Benisouef. The Saïd, or Upper Egypt, consists of the provinces of Siout, Djirdjeh, and Kenneh or Thebes.

The province of Bahhireh occupies the north-western province of Egypt, but is not comprised in the Delta properly so called. Its limits are the Mediterranean towards the north, and on the east and south-east the branch of the Nile between Darasoueh and Rosetta; whilst a line, exterior to Lake Mareotis, commencing at the Arabs' Tower, and sweeping to the south-east, would complete the circumscription of the province. The principal places of Bahhireh are, Alexandria and Aboukir on the coast, and, ascending the Rosetta branch of the Nile, the towns of Deïrout, Rhamanieh, and Damanhour. To the west and south-west of this province is the valley of natron, or the valley of the waterless sea. The province of Rosetta is inconsiderable, and stretches along the right bank of that arm of the Nile which terminates at the bogaz. Its most important point is the town of Rosetta. Gharbieh extends from the sea on the north, where it borders with the province of Rosetta, to that of Menouf on the south. The capital of Gharbieh is Mehallet-el-Kebir; and this province also contains the towns of Fouah, Samanhout, Tintah, and Zephteh. Lake Bourlos is situated in this province. Menouf is at the vertex of the angle formed by the two branches of the Nile which proceed, the one to Rosetta, and the other to Damietta. The capital is Menoufyeh, to the south-west of which are the village of Melik and the fort of Taoueh. The province of Manssourah extends to the right of the Damietta branch of the river, and is bounded on the north by Lake Menzaleh. In proceeding from the north to the south, the traveller successively reaches the village of Esbeh, and the towns of Damietta, Farescout, and Manssourah. On the eastern bank of Lake Menzaleh is the town of the same name. Sharkieh is situated to the east of the canal of Moez. This canal, which is the ancient Tanitic branch of the river, commences at the place where the ruins of Abril are observed, close to Banha, and runs north-east into Lake Menzaleh, at no great distance from the site of the ancient Pelusium. The country between Abril and Pelusium is one of the most fertile in Egypt, and contains several rich towns and villages, such as Guenieh, Heïheh, Karf-Four-Nigheh, and others. The eastern part of the province of Sharkieh is traversed by the road which leads from Cairo to Syria. Belbeis is the most considerable town which the traveller meets with in this direction; then come the group of Horaïn, and the canton of Salahieh, on leaving which he crosses the isthmus of Suez, and reaches El-Arisch, and lastly Gaza, the first town of Syria on the side of Egypt. Such are the different provinces of Lower Egypt, with their relation to one another in point of position.

Passing on to Central Egypt we come to Cairo, the capital of the country. This city stands at the distance of half a league from the Nile, and extends in an easterly direction towards the mountains, about two leagues. It is three or four leagues in circumference, and contains many fine places or squares, nearly three hundred mosques, and from four hundred thousand to four hundred and fifty thousand inhabitants. Boulak, a town situated on the eastern bank of the Nile, is close to Cairo, of which it is the entrepôt or port. Here all the boats which come from Lower Egypt discharge their cargoes. Gizeh or Djizeh is situated on the western bank of the Nile, at a short distance from the Pyramids, which are hence called the Pyramids of Gizeh or Cairo. The town of Gizeh, though of moderate extent, is, in the estimation of Europeans, the most agreeable in all Egypt. The province of Fayoum is situated to the south-west of Gizeh, and is very populous and fertile. Its capital is Medina, a town of some importance. A portion of Fayoum is constantly submerged. At the distance of two leagues from the bridge of Illaoun is the junction of the two great canals which supply it with water. These are the Bahr-Yussuf and the Darout-Scherif. The Bahr-Yussuf extends fifty leagues from the point of the Saïd, where it commences, to that of Fayoum, where it terminates. The province of Benisouef is situated to the south-east of Fayoum. Its capital, Benisouef, distant thirty-eight leagues from Cairo, is one of the most important towns in Egypt. The other places of note are Be-

beh, Fechneh, Abou-Girgeh or Abou-Djirdjeh, and Cheroneh.

Having arrived at the confines of the Saïd, the traveller, if, without leaving the valley of the Nile, he traverse the three provinces of which it is composed, will successively reach Minyeh, in latitude 28° 29′, and Benesef; the islands of Sohorrah and Gerabieh; Saoudi, Abouzir, Tounah, Achmonein, and Salam. Siout, a kind of capital, is situated in latitude 28° 51′; and farther on is Djirdjeh, another large town. Then come the towns of Bardys, Belyneh, Hayou, and Dendera, in latitude 26° 10′, opposite to which is Queneh or Kenneh. Medinet-Abou, Karnak, and Luxor, are situated in latitude 25° 44′ 15″. Still ascending, we next reach Assfoun, then Esneh in latitude 25° 17′, and lastly Edfou, which is six leagues south of Esneh. Assouan, in latitude 24° 27′, is a town at a short distance from the ancient Syene, and the island of Philœ. Four leagues above Kenneh, and nearly opposite Dendera, the ancient Tentyra, is the entrance of the valley of Cosseir, which leads to the port of the same name on the Red Sea.

The population of Egypt is chiefly composed of Turks, Copts, and Arabs, intermixed with Greeks, Jews, and Syrians. The schismatic Copts are estimated at a hundred and sixty thousand, and the Catholic Copts at five thousand souls. But the Arab class is by far the most numerous. It comprehends, first, the posterity of those who came to establish themselves in this country at the epoch of the invasion of Amru in 640, and who appear to have divided amongst them the lands of Lower Egypt, to the prejudice of the conquered Greeks; secondly, the Arabs who at subsequent periods came to join the first invaders, and who settled in Upper Egypt; and, thirdly, the Bedouins, who, instead of applying themselves to agriculture and commerce, live a wandering life, in families or in tribes, dwelling in tents, which they pitch sometimes on the borders of the Nile and sometimes in the desert, and are equally ready to use the arms which they constantly carry about, either for the purpose of plunder or for that of self-defence. The Copts are descended from the people enslaved and dispossessed by the Arabs; that is, from a mixture of Egyptians, Persians, and particularly Greeks, who, under the Lagidæ and the Constantines, so long occupied Egypt. This people differ from the Arabs and from the Turks in their religion, which is a form of Christianity; they differ also in the features of their visage, which exhibits the negro type, and in the colour of their skin, which is of a dingy and as it were smoked yellow. In the Arab the head is of a fine oval form, the forehead large, the eye brilliant but deep set in the head, the nose developed, and the mouth well formed, whilst the bright sunburnt hue of the skin is wholly different from the tarnished colour of the Copts. But as the negro type, if we may judge from the monuments, was that of the ancient Egyptians, and as this type, which is quite distinct from that of the Arabic race, still predominates amongst the Copts, it may hence be inferred that the latter, though a people of mixed origin, have never in any sensible degree amalgamated with the former, and that in the main they are the descendents of the ancient inhabitants of the country. To the Arabs, indeed, the Copts bear nearly the same relation that the Gauls did to the Franks under the first race of French kings; but the permanence of the ancient type shows that the admixture with Persians and Greeks had only been partial, and that amongst this people alone can we hope to find any distinct traces of the forms and language which obtained in Egypt in the days of Rhamses, Mœris, and Amenophis. Even the name which they still bear seems to betray their origin.[1]

That the Coptic language has been formed from that of ancient Egypt, of which it may in one sense be considered as a precious remnant, is proved beyond dispute by the researches of Etienne-Quatremère and Klaproth.[2] But still the modern idiom represents the ancient form of speech in a very incomplete and imperfect manner; and, besides, all that we possess in the former is confined to fragments of the Bible and of the lives of the saints, together with some Copto-Arabic glossaries of a comparatively recent date. The language itself has, moreover, ceased to be spoken; and all that portion of its vocabulary which occurred in the treatises composed by the monks of the Thebaid, is now irrecoverably lost. In the Christian versions all the pagan expressions relative to the ancient religion of the country were also carefully avoided by the translators, who preferred introducing Greek terms; and, from the list of words comprehended in the lexicons, there must further be deducted a great number of Arabic terms, which only found a place there because the original names had been altogether lost. The Coptic, therefore, as it now exists, is only a mutilated and imperfect fragment of a language through which various traces and lineaments of an elder form of speech are more or less faintly reflected; and, like the people from whom it derives its name, it is of mixed origin and impure descent, though not so corrupted, however, as to obliterate the characteristic type of the more ancient language, out of the remains of which it was principally formed. Two dialects of this language have been distinctly recognised, namely, the Bashmuric and the Theban; but, to say nothing of its scanty vocabulary, its general character is that of a rude and almost monosyllabic idiom. It is totally devoid of inflexions; its grammatical modifications are few and limited; and the accidents of gender and case are expressed by prefixes, in which respect it exhibits some affinity to the Hebrew and other oriental languages, particularly the Ethiopic.[3]

The religion of the Copts is that form of Christianity which was derived from the sect of the Eutychians; and the head of their church is the patriarch of Alexandria, who is elected by the great body of the clergy, and is everywhere implicitly obeyed. The officiating ministers are supported by the voluntary contributions of their flocks; and no person can be ordained who is unmarried, nor is any one who has been ordained permitted to marry a second time. But the monks from whose number the bishops are uniformly chosen are bound by their vows to observe strict celibacy; they are supposed to be dead to the world, and are hence prohibited from forming any connexion at variance with this supposition. The Copts practise the rite of circumcision, as well as auricular confession and other ceremonies or observances common both to the eastern and western churches. The great body of them are therefore schismatics; but, as we have already stated, there are at Cairo about five thousand who have conformed to the Roman Catholic communion, and who receive instruction under the direction of certain members of the College of the Propaganda at Rome.

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[1] The monosyllable *Gopt* or *Kopt* is evidently the root of the word Αι-ΓΥΠ-τος, or Αι-ΓΟΠ-τος, *Ægyptus*. This, we think, has been made sufficiently apparent at the commencement of the present article. (See D'Herbelot, *Bibliothèque Orient.* v. *Kebt* and *Kibt.* Malte-Brun, *Geography*, iv. p. 106. Kircher, *Prodromus Koptus.* Herodotus, *Euterpe.*)

[2] Etienne-Quatremère, *Recherches sur la Langue et la Littérature Egyptienne.* Klaproth, *Examen Critique des Travaux de feu M. Champollion sur les Hiéroglyphes.* Adelung, *Mithridates*, continued by Vater.

[3] *Edinburgh Review*, vol. lviii. p. 471.

Of the Turks little need be said here. After the taking of Constantinople by Mahommed II. they extended their conquests to the south, and in their turn made themselves masters of Egypt. But a power formed in Egypt as early as the sixth, and destroyed by the Turks at the beginning of the seventeenth century, resumed its ascendency after this long minority, and, excepting some short intervals, during which the Ottoman government displayed extraordinary vigour, domineered over the country, until the period of the French invasion in 1798, when it received a blow from which it never afterwards recovered. It was however reserved for Mehemmed Ali to complete the work which the French had begun, and not merely to destroy the power, but almost to annihilate the very race, of the Mamlukes. The Turks in Egypt are like the Turks everywhere else; men of grave features, sleek forms, fine dark eyes, large noses, handsome mouths, thin lips, short necks, and indolent habits; haughty, obstinate, prejudiced, and reserved, but, when stimulated by fanaticism or revenge, as fearless as the Damascus blades, which they use with so much expertness and address. The Greeks domiciled in Egypt to the regular features unite all the ingenuity and versatility which distinguished their ancestors; and they are charged, we fear not altogether unjustly, with a certain degree of sharpness, if not chicanery, in their mercantile transactions. The Jews in Egypt have the same physiognomy as in Europe, and are there, as everywhere else, devoted to the pursuits of commerce, but despised, insulted, buffeted, and oppressed in a manner which would exhaust the patience of almost any other race of men in existence. In the large towns they enter into competition with the Copts for situations in the customs, and for the management of property belonging to the rich; and, in consideration of gain, they are content to endure every species of contumely which insolent brutality, inflamed by religious hatred, may choose to inflict upon them. There are three thousand of this people in Cairo, where they inhabit a district which bears the distinction of their name, and is remarkable as the spot where, by reason of its crowded and filthy state, the plague commonly makes its first appearance.

Upon the whole, the inhabitants of modern Egypt may be rated and classed as follows:

Copts	160,000
Arab Fellahs	2,250,000
Bedouin Arabs	150,000
Arabian Greeks	25,000
Jews	20,000
Syrians	20,000
Armenians	10,000
Turks and Albanians	20,000
Franks or Levantines	4,000
Mamlukes	500
Ethiopians and others	7,500
Total	2,667,000

Egypt, formerly a dependency of Turkey, is now in reality, if not altogether in name, independent of the Porte, and is governed with absolute and unlimited authority by a man who, still retaining the title of pasha or viceroy, is content, under that denomination, to exercise all the rights and powers of a sovereign prince. The ancient form of the administration has, however, been preserved; and the present ruler, aware of the influence exerted on the minds of men by custom and names long familiar, has been careful to innovate as little as possible on the modes by which the country has hitherto been governed, or on the denominations of the government. The first administrative functionary is the kiaya-bey, or prime minister; under whom are placed all the secondary authorities, invested with powers conferred on them by the viceroy, and to whose office or tribunal all representations and private complaints, as well as the greater part of litigious disputes, are carried. The aga of the janizaries is charged with maintaining good order, and watching over the conduct of the troops. The wali, or aga of the police, exercises similar functions: he is the head of the gendarmerie; and his principal duty is to observe public women, and to pursue and seize all thieves and robbers. The direction of the markets, and the examination of weights and measures, are entrusted to the mohteseb, or aga of subsistence. The bash-aga, or superintendent of the civil police, causes the orders of the government to be executed, the streets to be patrolled day and night, and the coffee-houses and other public places to be watched by spies in his employment. In each quarter or district of the capital there is also a headsman or overseer, who is empowered to settle differences by arbitration, and is responsible for the peace and good order of his neighbourhood. All sorts of exactions, whether in the shape of fees or presents, have been abolished, and adequate salaries allotted in their stead; nor is it permitted to any officer, except the wali, who retains his former rights over prostitutes and thieves, to levy contributions on any pretext whatsoever. By the vigilance of the police, civil and military, and the activity of the district magistrates in removing bad subjects and allaying disturbances of every kind, the streets of Cairo have been rendered as safe as those of London, excepting only in the case of military tumults, which are now of rare occurrence; and by the extension of the same system throughout the country, crimes have been repressed, security afforded to person and property, and order established, in a land which was formerly filled with anarchy and violence.[1]

The administration of justice has in like manner been improved, by being purified from some of the enormous abuses which formerly prevailed; but still, in Egypt as in other countries much farther advanced, the poor litigant contends at a great disadvantage with his rich adversary, and the law is even yet sometimes scandalously eluded in favour of the powerful. The cadi is the supreme judge, and holds his appointment only for a year; but he has under him sheikhs and other men of the law, who are not removeable. The procedure before this judge is, as might be expected, exceedingly simple. The nature or relevancy of the process is first inquired into; parties are then fully heard, and witnesses, if necessary, examined; after which the members of the court deliver their opinions, and according to these the cadi at last decides. When the cadi is an easy, pacific man, the sheikhs convert their own houses into courts or tribunals, and arrogate to themselves the right of dispensing justice; but they discontinue their usurpations whenever they observe the supreme judge evince dispositions adverse to their interested views. The cadi also exercises the functions of a notary, and passes all contracts for the sale of real property, denominated *heggeh*, exacting a fee or duty of two per cent. upon each. The average cost of a lawsuit is stated at four per cent. of the value in dispute; and of this proportional charge, which is paid down whenever judgment is pronounçed, the cadi allows one fifth to the lawyers employed in his tribunal, and judiciously keeps the remaining four fifths to himself. He has, besides, other emoluments, which, added to the fees thus exacted, render his situation worth from five to six hundred purses, or between L.2000 and L.3000 a year. With regard to his assessors, they are not considered as at all scrupulous about the means of improving their incomes; and in truth they are accused of resorting to practices incompatible with the slightest pretension on their part to judicial purity.

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[1] Mengin, *Histoire de l'Egypte sous Mohammed-Aly*, tom. ii. p. 255 et seqq.

Besides the public functionaries above mentioned, there are others attached to the household or court of the viceroy; which is composed of the kiaya-bey or head of the civil administration, the khaznadar or treasurer, the divan-effendi or inspector of provisions, the selikdar or master of the household, the anaktar-aghassi or keeper of the wardrobe, the commandant of the citadel, and the superintendent of customs and excise, who are all paid by fixed salaries, so considerable in amount that some of them have been enabled to realize fortunes. The viceroy has also a body-guard, consisting of several hundred Mamlukes, and about six hundred yeomen of the palace; so that the establishment of his household, including subordinate functionaries in the civil and military departments, cannot be much short of fifteen hundred individuals. Many of these, however, are persons whom, on account of their merit, he has sought to attach to his service by placing them on his establishment, and who either hold nominal offices, or are kept as mere retainers until an opportunity offer for employing them to advantage.

The Saïd is governed by a pasha of two tails, who resides at Siout; and other pashas and beys are also placed at the head of the different branches of the administration, as already stated. Each province is divided into cantons; and these cantons are placed under the authority of the kiachefs and kaimacans, with whom are conjoined in office the cherbalettes for the direction of rural economy, and the cadis for administering justice. Each canton has also its scheraf for the collection of the contributions, which he transmits quarterly to the treasury of the grand divan; but the collections of Upper Egypt are, we believe, centralized at Siout, whence they are remitted to Cairo.[1]

It is exceedingly difficult, not to say impossible, to ascertain by what precise tenure land was held under the princes of the native dynasties by whom Egypt was anciently governed; but, judging from some papyral writings which modern ingenuity has deciphered, as well as from certain hints both in sacred and profane history, it seems evident that, in the days of the Pharaohs, a distinct property in the soil, however modified or affected, was recognized by the Egyptian monarchs. This, in fact, is attested by the title-deeds which have been found in the mummy-chests or coffins; and it may also be inferred from the transaction mentioned in Scripture, where Joseph transferred to the crown a large portion of land, giving to the famished peasantry, in return for their fields, a certain quantity of corn. It may also be observed in support of the opinion here stated, that, in the great Turin papyrus deciphered by Count Pollon, there is a very intelligible intimation of something like a law of prescription for securing persons whose right has not been challenged within a given time (thirty-eight years), in the undisturbed possession of their property; a circumstance which seems perfectly conclusive as to the existence of a distinct property in the soil, however that right may have been modified or restricted by the fundamental laws of the monarchy. This rule, by which unchallenged possession for a given period of time was sustained against a claim founded upon title alone without possession, appears to have been first laid down in a royal edict or decree, which is denominated "the benevolent," and to which accordingly distinct reference is made in the very remarkable monument to which we have alluded. For a long period subsequent to the Macedonian conquest, however, the territorial domain of Egypt appears to have been occupied on conditions somewhat analogous to those implied or involved in the system of fiefs or feudal tenures, which was at one time universal throughout Europe: the actual property of the soil was vested in the vassal; but a certain portion of the annual produce, or an equivalent for such portion, was made payable to the individual on whom the monarch, theoretically the proprietor of all the lands in the kingdom, had conferred the usufructuary interest, if not the feudal superiority.

Before the accession of the present viceroy, the representative of the Ottoman Porte was satisfied with levying a miri or land-tax, proportioned to the estimated value of the soil in point of quality and other advantages, and he at the same time acknowledged a quasi-right of ownership in the occupants, subject only to the payment of the territorial impost. But at present nearly all the lands, as well as the commerce and manufactures, of Egypt, belong to Mehemmed Ali; who, having assumed possession of the territorial property of the country, granted, in name of compensation, to the former holders who were thus deprived, annuities or pensions for life, but left them nothing which they could transmit to their children or their heirs. The lands which were seized in this way belonged either to the Mamlukes, whom it was the policy of the viceroy, if not wholly to extirpate, at all events to disconnect and detach from every means of regaining power; or to certain establishments for feeding the poor, and supporting mosques, fountains, public schools, and other similar institutions; or, lastly, to the ancient class of proprietors in feu-hold, whose principles or management were not such as to secure the confidence of the viceroy. But even the owners of those lands which have as yet escaped seizure are not the masters of the crops which they raise; they cannot dispose of any part of the produce until the agents of the government shall have had the pre-emption of such portion as they may think fit to take at a price fixed by themselves; and, besides paying the established miri, or land-tax, they are bound to supply all the families attached to the court with agricultural produce at half its current price in the market, whilst the viceroy regulates the price of such surplus as can be spared for exportation.

With regard to those lands of which the absolute property is now vested in the viceregal government, they are let or farmed out in portions at fixed rents to the cultivators, who may sow as they please, or not sow at all, but who, whether the seasons be propitious or the reverse, must pay the stipulated rent, which is exacted with the utmost rigour; and as this is invariably fixed at the highest limit to which it can possibly be carried, the condition to which the Fellahs or cultivators have in consequence been reduced is one of extreme misery and wretchedness. This unhappy class, which seems destined to be equally oppressed whoever be master, and which feels the government of Mehemmed to be even more grinding in its exactions than either that of the Turks or the Mamlukes, whom he superseded, is almost the only one which has derived no benefit from the various reforms he has introduced; and its situation would in fact be altogether intolerable and hopeless, were it not that the large standing army, which is principally recruited from the native population, opens up a field for the development of talent and enterprise, and holds out a certain and not very distant prospect of amelioration in the condition of this degraded caste. The natural fruits of such a system, however, are general abundance and individual misery;—the traveller sees with astonishment the richness of the harvests contrasted with the wretched state of the mud villages inhabited by the peasantry; and whilst he is convinced that no country is more prolific than Egypt of all those products which minister to the wants of man, he is also satisfied that there is none perhaps where the great body of the people are upon the whole more miserable.[1]

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[1] Rifaud, *Tableau de l'Egypte et de la Nubie*, p. 23.

In Egypt there are about four millions of feddâns[2] of land in cultivation. A feddân produces three ardebs or six quintals of cotton at the least, the same quantity of flax, from twelve to thirteen okes, or from fifteen to sixteen kilogrammes, of refined indigo, seven or eight ardebs of sugar, and other articles in proportion. Cultivation may be divided and classed as follows:

Cotton	200,000 feddâns.
Flax	100,000
Hemp	100,000
Indigo	100,000
Rice	100,000
Sugar canes	100,000
Dates, olives, &c.	500,000
	1,200,000 feddâns.

The remainder of the land in cultivation, amounting to 2,800,000 feddâns, is either appropriated to the raising of grain or to the purposes of horticulture. The total quantity of corn annually produced in Egypt has been estimated at three millions of ardebs, or six millions of quintals. Besides this, the country furnishes nitre, salt, natron, and soda; and about two hundred thousand ox and buffalo hides are annually collected for exportation. If to these products, then, be added the amount of the duties levied on industry and commerce, the gross return for all Egypt may be estimated at 68,600,000 great piastres, or L.14,500,000 sterling. According to this calculation, the net revenue of the viceroy ought to be 25,000,000 great piastres, or L.5,248,000 sterling; but if due allowance be made for contingencies, and if we take into account that this revenue is raised by means of extortion on the one hand, and monopoly on the other, we shall not probably err in making an abatement of 5,000,000 piastres from the nominal amount, and estimating it at L.4,000,000 sterling. Egypt has also woollen, cotton, linen, and silk manufactures, some few of which were in a state of considerable activity even before Mehemmed Ali introduced his new system; but notwithstanding the powerful stimulus which the viceroy has given to the industry of his subjects, and the great improvements which have thence resulted, it is manifest that, in manufactures, it is vain for a people situated like the Egyptians to attempt to compete with the capital, machinery, and skill of Europe; more especially as the nature of their climate, and the extreme fecundity of their soil, will always enable them to make advantageous exchanges, and to purchase superior articles at much less cost than inferior ones can be manufactured in their own country. The true policy of Mehemmed Ali is therefore to abandon entirely the system of monopoly to which he has hitherto clung with such blind tenacity; to render commerce perfectly free; to abstain religiously from interfering with the circulating medium, the alterations in which have hitherto been productive of so much evil; and, above all, to encourage and promote agriculture, which must ever remain the grand source of wealth to a country which, possessing a fertile soil, enjoys constant sunshine and the means of perpetual irrigation.

With all his defects, however, Mehemmed Ali, if he has not outstripped his age, is at least prodigiously in advance of the people over whom he rules; and he is disliked by the more influential classes of his subjects for those very qualities which have raised him so high in the estimation of Europe. The indulgence which he has granted to religious sects of every denomination; the introduction of vaccination, and other improved surgical practices borrowed from Europe; and, above all, the establishment of a school of anatomy, where the waxen models procured from Italy have at length been superseded by actual dissections; these are innovations which have shocked the prejudices and alarmed the ignorance of the bigoted and fanatical Moslemins. But Mehemmed, who in fact appears only to be a Turk among Turks, is not a man to be deterred from the pursuit of objects the accomplishment of which he foresees will be productive of great and certain advantages; and by his admirable management, combined with the outward observance of the rules of Islamism in his own person, he has overcome difficulties and surmounted obstacles which would have altogether appalled any ordinary man. Accordingly, whilst he has embellished mosques, decorated fountains, constructed reservoirs, and erected colonnades in honour of saints, for the gratification of the faithful, he has at the same time executed works of great public utility, some of which are calculated to confer lasting benefits on the country he now governs, and to accelerate more and more the development of its industry.

One of the most remarkable of these is the canal of Mahmoudyeh, which connects the harbour of Alexandria with the river Nile, near Fouah, and establishes a water communication between the capital and the principal port of Egypt. This magnificent work, which was opened on the 7th of December 1819, is forty-eight miles in length, ninety feet in breadth, and about eighteen feet in depth, and affords a means of conveyance by which the whole produce of the country may, without danger or delay, be brought to the place of exportation. A circumstance which occurred in 1817 first suggested to the pasha the idea of this great undertaking. In the winter of that year, when a scarcity prevailed all over Europe, multitudes of vessels resorted for grain to Egypt, where the crops had been unusually abundant; but owing to the difficulty of the bar at the Rosetta mouth of the Nile, and the tempestuous weather which prevailed along the coast, little or none of it could be conveyed in time to Alexandria; and hence, of about three hundred vessels which had assembled at that port, some were obliged to return in ballast, whilst others sailed with only half cargoes. This circumstance, which occasioned a heavy loss, and produced numerous disputes amongst the agents and merchants, suggested to the pasha the advantage of having a navigable canal to connect the main branch of the Nile with the port of Alexandria; and with his usual energy and decision he resolved to proceed as soon as possible with the undertaking. For this purpose he caused all the labourers in Egypt to be put in requisition, and a month's pay to be advanced, in order to enable them to provide necessaries; and to each village he allotted the extent of work which, it was expected, they were to perform. The Arabs, under their respective chiefs or sheikhs, were accordingly marched down in vast numbers to the line of the intended canal, along which they were distributed; and it is said that as many as two hundred and fifty thousand men were at one time employed at the work. The greatest Pharaoh of the olden time, including even Mœris himself, could not have

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[1] Mengin, *ubi supra*. Rifaud, *Tableau de l'Egypte*, p. 24.

[2] A feddân is a land-measure equal to about one third of an acre.

acted with greater energy than was displayed by the viceroy on this occasion. The whole excavation was completed in less than two months, at the end of which time the great mass of the labourers were permitted to return to their homes; but, in the autumn, several thousands were employed in facing certain parts of the excavation with masonry, equalizing the cut throughout, and thus rendering the whole navigable for vessels of considerable tonnage. The work having been carefully finished, was opened at the time above specified; and the increase of trade at the port of Alexandria has already proved the wisdom of the undertaking, and liberally rewarded the viceroy for his exertions.[1]

The following view of the actual trade of Alexandria, extracted from the second edition of a most valuable and instructive work,[2] contains much important information, and at the same time affords conclusive evidence of the rapidly improving state of Egypt:

" The imports principally consist of cotton stuffs, timber, hardware, iron and tin, tobacco, machinery, ammunition, silk goods, woollen staves, &c. The exports consist of raw cotton, wheat and barley, rice, linen, flax, linseed, sugar, coffee (from the Red Sea), drugs, gums, sal-ammoniac, saffron, wax, &c.

" The principal articles of importation into this country from Egypt are cotton, flax and linseed, senna, and gum. Of these, cotton is by far the most important. We began to import it in 1823; and since then the imports have been as follows:

Years.	Bales.	Years.	Bales.	Years.	Bales.
1824	38,022	1827	22,450	1830	14,752
1825	111,023	1828	32,889	1831	38,124
1826	47,621	1829	24,739	1832	41,183

" In 1832, the French imported 25,807 bales of Egyptian cotton; the imports at Trieste during the same year were about 50,000 bales, and those at Deghorn and Genoa were together about the same as at Trieste. The bale of Egyptian cotton weighs about 220 lbs. This important trade owes its existence almost entirely to the exertions of the pasha, by whom the cotton plantations have been established. The cotton exported is all long-staple, but of two sorts; one called in Egypt makko, and in England common Egyptian; the other, the produce of sea-island seed, called in Egypt Sennaar, and in England sea-island Egyptian. Besides these two descriptions, Egypt produces from 15,000 to 20,000 bales of short-staple cotton, similar in quality to that of Smyrna, and chiefly consumed in the country. The cotton brought from Egypt is found to be amongst the most useful that is grown; that raised from sea-island seed ranks next to American sea-island. The exports from this country to Egypt principally consist of cotton goods and twist, earthenware, iron and steel, arms and ammunition, &c. Their *real* value amounted in 1831 to L.122,832; but besides what goes direct, a good deal of British produce finds its way to Egypt at second hand from Malta, Smyrna, &c. Constantinople and the islands of the Archipelago are the great markets for the wheat and other grain exported from Egypt, the quantity sent to them being sometimes very large. The supplies are, however, extremely uncertain. Every thing in Egypt depends on the Nile; and when it does not rise to the usual height, the crops are very much below an average. Beans are extensively cultivated, and have sometimes been brought to England, but rarely, if ever, with advantage to the importers. They are very inferior to English beans, and are peculiarly subject to the worm. No oats are raised in Egypt, the horses being entirely fed upon barley. Besides cotton, the pasha has turned his attention to the culture of sugar, indigo, &c. The first has long been raised in Egypt, but the exports are not very considerable. Silk is grown to some extent. The date-palm thrives in every part of Egypt, and the fruit is largely exported. It is singular, that notwithstanding the luxuriance of many of its vegetable productions, Egypt should be entirely destitute of timber.[3]

" In 1831, there entered the port of Alexandria 1215 ships, of the burden of 198,299 tons. Of these the Austrian were the most numerous; next the English and Ionian; and then the French, Sardinian, Spanish, &c.

" *Money.* Accounts are kept at Alexandria, as at Cairo, in *current piastres*, each piastre being equal to 40 paras or medini, and each medino to 30 aspers. The medino is also divided into 8 borbi, or 6 forli. A purse contains 25,000 medini. The piastres struck in 1826 contain a great deal of alloy; 15½ or 16 piastres = 1 Spanish dollar; hence 1 piastre = 3½d. sterling, very nearly. Payments in transactions of any importance are generally made in Spanish dollars.

" *Weights and Measures.* The yard, or *pik*, = 26·8 English inches; hence 100 piks = 74·438 English yards. The measures for corn are the *rhebebe*, and the *quillot* or *kisloz;* the former = 4·364 English bushels, the latter = 4·729 ditto. The *cantaro* or *quintal* = 100 *rottoli*, but the rottolo has different names and weights: 1 *rottolo forforo* = ·9347 lb. avoirdupois; 1 *rottolo zaidino* = 1·335 lb. ditto; 1 *rottolo zauro* or *zaro* = 2·07 lbs. ditto; 1 *rottolo mina* = 1·67 lb. ditto.[4]

" *Duties.* With the exception of the commercial monopolies of the pasha, and the arbitrary principles on which he fixes the prices of commodities, there is nothing objectionable in his policy as to commerce. The duties on imports are only three per cent. We believe, however, that a small increase of the customs duty would compensate the pasha for the abolition of most of his monopolies; and there can be little doubt that his subjects would be materially benefited by the change."

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[1] The arbitrary energy displayed by the pasha in the construction of this great work in so short a space of time could scarcely be unattended with much suffering, and even a considerable mortality; but the statement of some writers, that twenty thousand labourers fell a sacrifice to the unsparing urgency of the viceroy on this occasion, is a manifest exaggeration. The advance of a month's pay must have enabled the workmen to repair to the intended scene of operations without much inconvenience; and the liberal remuneration they received while employed in excavating the canal must have afforded them better subsistence than they can ordinarily command. If any extraordinary mortality occurred, therefore, it must have fallen, not upon the labourers, but upon the crowds of women and children, who, as in the patriarchal times, accompanied them to the neighbourhood of Alexandria. This practice, which it has been found impossible to check, has been attended with great inconvenience in other cases, particularly in that of the military conscription. In the year 1827, twelve thousand recruits being wanted for the army, were, as usual, taken by force from their villages; but when these conscripts appeared at the camp near Cairo, they were attended by upwards of fifty thousand followers of all ages and both sexes, who, of course, must have suffered great privations before they could return to their miserable, and, in many cases, distant homes. Something of the same kind may, no doubt, have occurred at Alexandria, on the occasion referred to. But whilst it is inconceivable that any such mortality as that above stated could have taken place amongst the labourers employed, it is highly probable that their followers may have suffered severely; and, as the Franks are accused of having suggested the undertaking, the current story is believed, partly because it affords a pretext for throwing upon a race otherwise hated for their superior intelligence, the odium which naturally enough attaches to the remembrance of an oppressive servitude.

[2] M'Culloch's *Dictionary of Commerce and Navigation*, art. *Alexandria.*

[3] *Lords' Report of* 1827 *on the Price of Foreign Corn, Min. of Evid.* p. 120, and *private information.*

[4] *Manuel Universel de Nelkenbrecher.*

The increase of trade which is here shown from recent and authentic documents has been the result of the zeal, energy, and perseverance displayed by the viceroy. But accident also contributed to promote his success. A Frenchman named Jumel having one day discovered in the garden of a Turk a plant of the cotton-tree, immediately turned his attention to the subject of its cultivation, and in a short time propagated it with so much success that the discovery of this plant may be considered as having changed the commerce and statistics of Egypt. So rapid was the progress made that, in a few years, the same individual who had discovered the solitary specimen just mentioned, and who had made the government acquainted with its manifold uses, both as an article of domestic manufacture and of foreign trade, erected at Boulak, near Cairo, a large establishment for spinning, weaving, dyeing, and printing cotton goods, and introduced the latest improvements in machinery which had been made either at Rouen or Manchester, including, we believe, power-looms. In this extensive manufactory, which is formed on the model of the best establishments of the kind in Europe, steam is the principal moving power employed, and the whole is lighted up with gas prepared for the purpose on the spot. At Siout there is also a cotton manufactory, which, not long ago, was in full operation, affording employment to eight hundred men and boys, who earned ten, fifteen, twenty, or thirty paras, and sometimes three piastres, a day; and similar establishments were about to be erected in other parts of Egypt.[1] The principal difficulties experienced arise from this, that during the prevalence of the desert winds, which are charged with an impalpable sand, the machinery is liable to be disordered by the dust which then fills the air, and penetrates into the wheel-work and finer parts of the mechanism, disturbing and sometimes altogether stopping the movements; whilst, owing to the excessive dryness of the atmosphere, the wood-work is apt to get warped or rent, and the threads, becoming brittle, snap asunder with the least tension. But these disadvantages are in some measure compensated by the cheapness of labour in a country where the people, often in a state of famine, are obliged to be content with a scanty and miserable existence, and where the supreme ruler is directly interested in keeping down wages to the lowest possible point. In fact, it is only by this grinding and oppressive system, which renders labour in the cotton factories of Egypt one of the worst kinds of slavery, and but little preferable to that imposed by the Spanish conquerors of South America on the unhappy natives, that the viceroy can ever hope to compete with the manufacturers of Europe, or to undersell the merchants of India. Whenever the wages of labour in Egypt shall, from whatever cause, experience a rise, and the master manufacturer is no longer backed by absolute power, the whole fabric, which has been reared at an enormous cost, will fall to pieces of its own accord, and the dilapidated state of the cotton factories on the banks of the Nile will present to the eye of the traveller another practical proof of the absurdity of all attempts to force manufactures in a country where population can only be profitably employed in the cultivation of the soil.

The cotton now produced in Egypt is of a very superior quality to that which was formerly grown in the country, and the wool is considered as little if at all inferior to the best American. In the year 1822 the crop yielded nearly six millions of pounds; and a portion of it, sent to Liverpool on trial, was sold at the rate of a shilling a pound. The produce of the crop of 1823 was still more abundant; so much so, indeed, that, after supplying the demand in the ports of the Mediterranean, about fifty thousand bags were exported to England. This auspicious commencement only served to stimulate the energy of the viceroy. Tracts of ground long neglected were brought into cultivation, by clearing out the old canals and digging others for the purpose of irrigation; new species of cotton plants were obtained; improved modes of culture were adopted; the quality of the article was ameliorated in proportion as the quantity raised was increased; and so greatly has this branch of industry been extended, that the amount of cotton imported into this country from Egypt will at no distant period equal, if it do not exceed, that imported from America. In the culture of the cotton plant, indeed, the former country has a decided advantage in its favour. For, on the banks of the Nile, the crop is not exposed to the premature frosts and heavy rains, by which it is frequently injured in the more variable climate of the United States. In Egypt, an annual renewal of the soil, irrigation, and sunshine, are certainties; and as the accidents to which it is exposed are fewer, the supply must be proportionally less precarious.

Nor has the raising of cotton engrossed the whole attention of the viceroy; on the contrary, he has bestowed almost equal care on the cultivation of silk, flax, and the sugar-cane, to which may be added indigo, safranon or safflower, and henneh, which are employed in the various processes of dyeing and calico-printing. In the valley of Tomlut, anciently the land of Goshen, a colony of five hundred Syrians has been established, for the purpose of improving the mulberry-tree and rearing silk-worms; and in the rich and beautiful province of Fayoum, the vine and the olive are again approaching that perfection which they had attained in ancient times. Tobacco is likewise cultivated to a considerable extent; but it is so indifferent in quality that none except Egyptians will use it. In a word, it is difficult to set limits to the productive powers of a country like Egypt, where heat is constant, and moisture in some measure at the command of the agriculturist; and where, besides these two great principles of vegetation, the soil is annually renewed by the deposits of the inundation. A more enlightened experience on the part of the ruler, and the enjoyment of greater freedom on that of the industrious classes, seem to be nearly all that is wanting in order to render this early abode of civilization, which is still bestrewed with the remains of its ancient greatness and splendour, one of the richest and happiest countries on the face of the earth. But, with all his thirst for knowledge and his desire to improve, Mehemmed Ali has still much to learn, or perhaps to unlearn. Having created every thing himself, he naturally regards the whole as his own property, and is therefore almost a monopolist from necessity. He is everywhere, and in everything, intermeddling, dictating, or regulating, according to principles which can have no safe application, except in such extraordinary circumstances as those in which he originally found himself; his economical views are accordingly narrow in the extreme, and, if pushed to their consequences, will prove eminently pernicious; whilst his excise and custom-house regulations are formed upon the very worst models which Europe could supply. But the time is fast approaching when he must yield obedience to the maxim *pas trop gouverner*, and when, ceasing to interfere with the private industry of his subjects, he must consent to entrust them with the guardianship of their own interests. In short, without a large share of freedom, there can be no permanent prosperity.

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[1] Webster's *Travels*, vol. ii. p. 131.

The pasha has another infirmity, which is also peculiar to his situation and character. He is ready to embark in almost any speculation connected with foreign trade, indeed frequently insists upon doing so; but then, though in general willing to allow his partners in such adventures time to make good their reimbursements, he is by no means equally disposed to bear his proportion of the loss; so that all they obtain from him is the loan of funds and his protection. Hence the trade with India, attempted under his patronage, ruined the smaller, and shook the more wealthy houses which engaged in it. But, notwithstanding the failure of this first attempt, he is still most anxious to open an intercourse with the East, and, if possible, to re-establish that valuable traffic which was lost to Egypt through the ignorance and barbarism of its government, as well as by the discovery of the passage to India round the Cape of Good Hope. This is not only a favourite subject of speculation with the politicians of Cairo, but also engages deeply the attention of the viceroy, who, now that he has acquired Syria, and extended the frontier of his dominions almost to the Euphrates, will assuredly employ every expedient to which he can resort in order to accomplish this object.

In the meanwhile, Egypt can, either from its own produce or by means of its transit trade, supply the states on the shores of the Mediterranean with wax, hides, coffee from Mokha, myrrh, frankincense, cocculus indicus, assafœtida, ivory, rhinoceros-horns, tortoise-shell, sal ammoniac, senna, tamarinds, ostrich feathers, incense, balsam of Mecca, gum arabic, gum copal, benzoin, Socotrine aloes, coloquintida, gum ammoniac, galbanum, sagapenum (from a nondescript *umbellate*), epopanax, shishm seed (*cassia absus*), spica celtica (a kind of spikenard), mahleb (dried fruit of *prunus mahaleb*), shebb or native alum, sulphur, musk, and gold dust. It also exports natron, which is less liable to spoil than artificial salts of the same description; but the extravagant price set on this article by the Egyptian government has greatly narrowed the demand, by compelling the merchants to make their returns in specie, which is done at a very considerable loss. The principal imports into Egypt are, the French cloths called mahouts and londrins, Florentine silks, scarlet skull-caps called *fez*, gold lace, blotting-paper, glass, earthenware, hardware; watches from England; and similar articles from Germany and Italy, especially the caps called *fez*. The imports are from France, England, Holland, Germany, Russia, Sweden, and the Mediterranean states; whilst the exports are produced in Egypt, India, Arabia, Abyssinia, Nubia, Sennaar, and Kordofân. The commodities imported from Europe indicate not only an increase of wealth amongst the subjects of Mehemmed Ali, but also considerable progress in taste and refinement.[1] We have not been able to ascertain the actual rates of the import, export, and transit duties; and the tables of Mengin, which reach no later than 1821, are already antiquated.

The intercourse by land with the countries to the south and west is carried on by means of kafilas or caravans. Those from Sennaar and Darfûr usually arrive in September or October, and depart as soon as they have sold their goods and completed their purchases. The sacred caravan of pilgrims bound to Mecca reaches Egypt about the time of the Ramadan, or Mahommedan lent, and sets off immediately after the commencement of the Beïram, or Mahommedan carnival, in order that it may reach the holy city before the month of the festival (*ahh'l hijjah*) has expired. In March and October caravans from Mount Sinai bring dates and charcoal; from time to time small caravans arrive from the Oases, laden with dates; and when the ships from Djidda reach Suez, the same mode of conveyance is employed to transport their cargoes, consisting of the products of Arabia, Persia, and Hindustan, to the capital of Egypt. The caravans from Abyssinia, which travel northward through the desert east of the Nile as far as Esneh, bring ivory, ostrich feathers, and slaves of both sexes, destined for Cairo, the place where sales of live human stock are usually effected; and they carry back, as a sort of return cargo, manufactured articles of Venetian glass, woollen dresses, cotton and linen stuffs, shawls, and some other commodities purchased at Siout and Kenneh. The Ababdeh and Bicharis tribes also descend to Esneh, where, in exchange for metals, utensils, and grain, they give slaves, camels, and the gum which they gather in their deserts, as well as the charcoal which they prepare from the acacia trees; but the most valuable commodity they import into Egypt is senna, which they collect in the mountains between the Nile and the Red Sea, where it is produced without culture. The trade of Cosseir, a port on the western shore of the Arabian Gulf, is now only a trifling remnant of that commerce by which Egypt was once enriched. The exports consist of wheat, barley, beans, lentils, sugar, flowers of carthamon, lettuce oil, and butter; the imports are coffee, cotton cloth, Indian muslins, English silks, spices, incense, and Cashmere shawls.

The custom-house duties are, upon the whole, moderate. European goods pay an import duty of three per cent.; but Turkish produce is charged five per cent. at Alexandria, and four per cent. at Boulak, the port of Cairo. For goods brought by land from the interior nine per cent. is exacted in one payment. The export duty is three per cent. to Europe, and five per cent. to Turkey;[2] but goods sent by the Red Sea pay ten per cent. each way. Every camel-load from the Saïd, or Upper Egypt, pays twenty-five piastres, or seven shillings, at old Cairo; slaves are charged twenty-seven piastres, or nine shillings a head, at Deraweh, and six piastres twenty paras, two shillings, at Cairo; ivory pays fifty piastres, or seventeen shillings, per quintal (*cantar*), and five at Cairo; rhinoceros-horns are charged ten per cent. *ad valorem*, and again at Cairo; gum arabic pays sixteen piastres, five shillings, per quintal, and twenty paras per pound; tamarinds and natrons are charged six piastres thirty paras, two shillings and three pence, per quintal, and six piastres at Cairo; and white ostrich feathers pay six piastres, two shillings, black one piastre, between three pence and four pence, per rotl, and ten per cent. *ad valorem* at Cairo. Of the latest fiscal arrangements of the viceroy consequent on the great accession of territory which he obtained from the Porte as the price of the pacification which followed the victory of Koniah, no authentic information has yet reached us; and this is not a subject which admits of conjecture or speculation.[3]

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[1] See *Tableau du Commerce de l'Egypte avec l'Europe.*

[2] All goods sent from Damietta to Syria used to pay two per cent. additional; but since the latter country has been ceded in full sovereignty to Mehemmed Ali, this duty has been withdrawn.

[3] In Mengin's work, already so often referred to, and also in the *Tableau du Commerce de l'Egypte*, are contained very full details respecting the exports and imports of Egypt; but in the former the tabular returns do not come farther down than the year 1821, and

The revenue of Egypt in the year 1821 was estimated at L.2,249,379, derived from various sources, as, first, the miri or land-tax; secondly, the customs; thirdly, the resumed lands, comprehending nearly the whole of the cultivable soil; fourthly, the conquered territories, namely, Darfûr, Sennaar, Nubia, and part of Arabia; fifthly, the monopoly of Egyptian commerce; and, sixthly, an excise on provisions. But from the more recent data furnished by Rifaud and others, it may be inferred, as already stated, that the actual revenue of the viceroy, exclusively of that which may be derived from his recent territorial acquisitions, cannot fall much short of L.4,000,000 sterling; whilst, on the other hand, if these be included, and if the resources of Syria with its dependencies, and of the island of Candia, be taken into account, there can be little doubt that in a few years hence it will be augmented to five, six, or even seven millions sterling; a sum not more than sufficient for the support of the establishments which Mehemmed has created, and of late so greatly extended. The expenditure of Egypt in 1821 was calculated at L.1,757,840; thus leaving a surplus of income, after defraying all charges, of more than half a million sterling. But when we call to mind that, since the period to which this estimate applies, the viceroy has created a regular army amounting to between 70,000 and 80,000 men; that he has acquired a fleet of twelve sail of the line, besides frigates and smaller vessels; and that all his other establishments must have been increased on a scale of proportional magnitude, we must at once perceive that such an estimate can have no application to the present time. Of the above sum, however, upwards of one third was required for the support of the armed force, the erection of barracks, and the purchase of arms; about L.90,000 was remitted to Constantinople in name of tribute; a sum of L.14,000 was devoted to the support of the church and the law, and nearly as much expended on the pilgrimage to Mecca; and the remainder, amounting to about L.200,000, was required for the support of the viceroy's household, including his guards and yeomen of the palace. Formerly the revenue of Egypt passed through the hands of the Beys, who, after charging it with the expenses of government, were theoretically understood to remit the surplus to Constantinople. But, practically, no such remittance was almost ever made; for the different agents and collectors generally contrived so to manage matters that the expenditure overbalanced the income, and thus the Porte, instead of receiving any portion of the produce of the taxes, was frequently called upon to pay for the repairs of buildings and canals, which, as may readily be supposed, were never executed. Whilst the Mamlukes had the ascendency, they extorted, publicly and privately, about a million and a half annually; but when the French were in possession of the country, the imposts varied from year to year according to the state of the war, averaging upon the whole about nine hundred thousand pounds sterling.[1]

There is the best reason to believe that, anciently, Egypt was much more densely peopled than at present. This fact, attested by all the ancient historians, may likewise be inferred from the monuments by which the Pharaohs sought to perpetuate the remembrance of their greatness, and still more from the works by which they endeavoured to extend as well as to maintain the productiveness of the soil. Where food is abundant, population seldom fails to increase in rapid progression; and, on the other hand, where population is already pressing on the means of subsistence, the policy of nations so circumstanced is naturally, or we might perhaps say necessarily, directed towards augmenting the absolute quantity of food. At a very early period Egypt appears to have passed through the former and to have entered the latter state; whilst every fact mentioned in history, and every circumstance of real evidence supplied by the monuments still extant, conspire to prove that the ancient population of the great valley of the Nile exceeded its present amount in the proportion of nearly three to one. Before the Persian conquest, the inhabitants of all classes who acknowledged the authority of the Pharaohs were estimated at seven millions; nor, when we consider the natural fertility of the soil, and the extensive system of artificial irrigation employed at once to increase its productiveness and extend the limits of cultivation, will this calculation appear exaggerated or improbable. Besides, it is certain that the desert now covers large tracts of soil which were anciently under cultivation, and which even yet might perhaps be reclaimed from the wilderness by means of canals for the purpose of irrigation derived from the upper sections of the Nile.[2] At present the population of Egypt, divided and classed as already stated at the commencement of this section, is thought not to exceed two millions and a half; but this number, being apparently restricted to the inhabitants of towns and villages, together with such of the peasantry as are subject to taxation, does not apparently include the Arabs who occupy the deserts between the Nile and the Red Sea; and hence we shall probably be nearer the truth if we estimate the actual population of Egypt, all classes included, at three millions. No census has ever been taken of the inhabitants of this country; but as the number of houses has been ascertained for the purpose of taxation, Baron de Sacy, Mengin, and others, proceeding on this ground, and reckoning eight persons to a house in Cairo, and four in the provinces, have arrived at the following results:

	Houses.	Inhabitants.
In Cairo there are	25,000 and	200,000
In Alexandria, Rosetta, Damietta, Old Cairo, and Boulak, which are estimated at the same rate as the capital, there are............	14,532........	58,128
In fourteen provinces, containing three thousand four hundred and seventy-five villages.........	564,168......	2,256,272
Total...........	603,700...	..2,514,400

But, as already stated, this estimate does not appear to include the Arabs who inhabit so considerable a part of the country.

In a country like Egypt, the inhabitants of which are composed of so many different races, each professing a separate creed, there must necessarily exist a correspond-

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the latter contains little or no information of a subsequent date. The same observation also applies to the general statistics embodied in the *Histoire de l'Egypte sous le Gouvernement de Mohammed-Aly.* But as Egypt, during the last ten or eleven years, has made more rapid advances than some countries do in a century, we have for this reason abstained from loading our pages with details which, however accurate with reference to the time when they were prepared, would nevertheless convey a very imperfect notion of the progress in industry, commerce, and the arts, which has actually been made within the last few years.

[1] Malte-Brun; Mengin; Rifaud; *Encyclopædia Metropolitana*, art. *Egypt.*

[2] As the present viceroy has already caused an extensive cut to be made near Elephantine, in order to avoid the inconvenience and danger occasioned by the Cataracts, it seems highly probable, if he live, that he will make an attempt of the kind hinted at in the text.

ing diversity of customs and manners. The habits of the Turk, for instance, easily distinguish him from the Mamluke or the Bedouin; the Copt can never be mistaken for the Jew, nor the Syrian for the Greek; and the wild tribes of the upper country have also each their peculiar modes and habits of life. But amidst all the diversity by which the different races are distinguished, many points of resemblance may also be detected; and the principal features of the oriental character are nowhere more strongly marked than in Egypt. It is impossible indeed to live long in any country without yielding in some degree to the influence of its national character; and though the individuality of race may still be preserved with sufficient distinctness to be easily recognised, yet all classes will be found, on examination, to have received strong impressions from the predominant modes. Our present object is to endeavour to verify by a few examples the truth of this observation.

The condition of women in Egypt is much the same as in all other oriental countries, particularly those where Islamism prevails. They are for the most part kept in a state of strict seclusion; and in this the Copts imitate the Moslemins. When they go abroad or receive visits they are always veiled. A piece of cloth, varying in texture according to the rank of the individual, covers the head and face, allowing only the eyes to see and be seen through apertures provided on purpose. This usage is of very ancient origin, and is so intimately associated with the idea of female modesty, that it is never dispensed with excepting in very peculiar circumstances. "When any of the Egyptian women," says Napoleon, "found themselves by accident surprised without their veils, and covered only with that long blue shift which forms the clothing of the Fellahs' wives, they used to take up the lower part of the shift to hide their faces, preferring the exposure of any other part."[1] Amongst the orientals, wives are sacred; and hence, in their intestine wars, the latter are always respected. Whilst the Mamlukes, for example, were carrying on war against the French, their wives remained at Cairo. Women decay very early in Egypt; and there are more of them brown than fair. In general their faces display a little complexion, but the predominant hue is a light and transparent bronze. The most beautiful are either Greeks or Circassians, and with the latter, particularly, the bazars of the merchants who deal in female slaves are for the most part abundantly provided. The Ethiopian women brought to Egypt for sale by the caravans from Darfûr and other parts of the interior, though jet black, are exceedingly beautiful; their features being perfectly regular, and their eyes full of animation. The Circassians are more highly prized by the orientals than the Europeans, who, having formed their standard of beauty on different models, are at a loss to reconcile the specimens they have actually seen with those high-flown descriptions which fill the pages of eastern romance, and attribute all the charms of female loveliness to the natives of one favoured spot on the Persian side of the Caucasus.

Marriage takes place amongst the Moslemins without either party having ever seen the other, excepting by accident. This results from the seclusion in which females are kept throughout the whole of the East. Sometimes, indeed, the bride may have seen the bridegroom, but the latter can never have beheld his betrothed, or at least the features of her face, and for her charms and qualifications must therefore depend entirely upon report. Marriage, in fact, which is always negociated by the elder females of families, is merely a civil contract prepared by the mutual friends of the parties, and signed by the bridegroom and his guardian. Amongst the Copts, who are even more rigid than the Moslemins in the seclusion of their females, matrimonial alliances are contracted in a similar manner, and have precisely the same character. The ceremonial usually observed in both cases has often been described, and need not therefore be repeated in this place.[2] Mahommedan wives have certain privileges, of which they are very tenacious, and which their husbands cannot refuse them without passing for brutes and barbarians, and enraging every body against them. Of these, the principal is that of going to the bath, which may be described as the women's coffee-house. Thither they repair as often as they feel inclined, and the bath is the place where political and other intrigues are contrived, and where marriages are planned. But, notwithstanding this indulgence, they feel deeply the restraint under which they are kept, and, from all that can be learned, would willingly conform to the Frank customs, if permitted to do so. Where women are excluded from society, refinement of manners must be wholly unknown. In the house of an Osmanlee, the apartments allotted for the women are generally furnished with the richest and most expensive articles; but those of the men are remarkable only for a plain style of neatness.

The dress of the orientals bears no resemblance whatever to ours, and is in all respects more ample and voluminous, allowing greater freedom of motion and exertion. The turban is a much more elegant and convenient headdress than a hat; and being susceptible of great variety in form, colour, and arrangement, discovers at the first glance the differences of nations and ranks. As the neck and limbs are not confined by bandages or ligatures, a native of the East may remain a month in his clothes without feeling fatigued by them. The different races and classes are of course differently dressed; but they all agree in wearing papooshes or wide pantaloons, large sleeves, and every other part of their dress full and ample. To protect themselves from the sun, they wear shawls; and a great quantity of silks, Indian stuffs, and cachemires, is introduced into the dresses both of men and of women; but they wear no linen. The Fellahs are covered with a blue shirt fastened round the middle. The Arab chiefs who traverse the desert during the scorching heat of the dog-days cover themselves with shawls of all colours, which they also wrap round their heads, and thus protect the different parts of their bodies from the sun. Instead of shoes, both men and women wear slippers, which they leave on the edge of the carpet when they enter an apartment.[3] It ought to be mentioned, however, that, since the military changes introduced by the present viceroy, European modes have been gradually gaining ground, and that even the dress on which the Osmanlee not un-reasonably prides himself is in some danger of experiencing some curtailments and abridgments little calculated to improve its picturesque effect.

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[1] *Memoirs*, vol. ii. p. 274. When Napoleon was in Egypt, he had several opportunities of seeing some of the most distinguished women in the country, to whom he granted audiences. "These were either the widows of beys or kiachefs, or their wives, who, in their absence, came to implore his protection. The richness of their dress, their noble deportment, their little soft hands and fine eyes, a dignified and graceful carriage, and very elegant manners, distinguished them as women of education and rank superior to the vulgar……Many of them stated their requests with perfect grace, and an enchanting tone of voice, displaying all the intelligence and sweetness of the most accomplished women of Europe. The propriety of their demeanour, and the modesty of their dress, gave them additional fascinations; and the imagination delighted in guessing at charms of which they did not even allow a glimpse." (*Memoirs*, ubi supra.)

[2] See *Travels in Africa, Egypt, and Syria*, p. 76.

[3] Napoleon's *Memoirs*, vol. ii. p. 278, 279.

When the French occupied Egypt, there was neither coach nor cart in the country, excepting one which Ibrahim Bey had received from France, and which was accounted a very remarkable thing. Water-carriage being so abundant and easy, coaches and other vehicles are perhaps less necessary there than in any other country of the world. Horses are used for traversing the capital by all except women and lawyers, who, being apparently considered as equally effeminate, ride on mules or asses, surrounded by their attendants.[1] When women have occasion to travel any distance, they are usually conveyed in panniers placed on the backs of camels. There is an immense quantity of asses in Egypt; they are large and of a fine breed, and at Cairo they in some measure supply the place of hackney coaches. In the capital no one in the Frank costume dares to appear in the streets on horseback. The style of living is much the same as that which prevails generally throughout Turkey; but as the viceroy, notwithstanding the prohibition in the Koran, does not scruple to drink wine, his example has introduced some degree of laxity into the manners of the capital, where there are many persons disposed to think that the practice of the pasha in this particular is entitled to more respect than even the prohibitory injunction of the Prophet. Among Europeans, however, who are under no restraint of any kind as to their mode of living, all sorts of indulgences are common; and at their tables may be found the most *recherchés* efforts of foreign cookery, garnished with the wines of Europe and the fruits of the East. Nor is it likely, now when the intercourse between them and the Turks is much more frequent and intimate than formerly, that their example can be without effect upon their guests and visitors; more especially as it is evidently the policy of the viceroy to break down Turkish customs, and to destroy the attachment of his countrymen to those modes and habits which have so powerfully contributed to keep them in ignorance, and nurse a spirit of intolerance. As to Mehemmed himself, he labours under the imputation of being a freethinker,[2] notwithstanding all he has done for the deliverance of the holy cities; and his character in this respect has not failed to produce a marked impression upon the sentiments of the higher classes in Cairo. As the viceroy himself cares for no man's religious creed, and is content to be served by a Christian, a fire-worshipper, or a votary of the Grand Lama, as well as by the most devout professor of Islamism, it may easily be supposed that those about his person or his court will not be slack in imitating his example in neglecting such distinctions.

The festival of opening the Kalidji, or admitting the water of the Nile into the canal of Cairo, by cutting the dike or embankment raised to exclude it until the river has attained a given height, is annually observed with every demonstration of joy, and forms one of the customs which have descended from the most ancient times. In Egypt there is no subject of such general and engrossing interest as the overflow of the Nile, upon which the productiveness of the country wholly depends; and, accordingly, on the occasion in question, the sounds of festive rejoicing, intermingled with music, songs, and cries of "Allah illah Allah," are heard all over the capital. The river god, the beneficent genius of Egypt, is then pouring abundance out of his watery urn. Besides, the inhabitants of Cairo, like the populace of all great cities, are fond of pageants and shows, and, upon such occasions, amuse themselves with feats of strength and dexterity, as also with singing and dancing. Buffoons exhibit for the entertainment of the multitude, whose ready laugh responds to their stale jests and coarse pleasantries. But the almehs, or improvisatrices, who are performers of a different class, reserve the exercise of their talents for the amusement of the affluent. These females, being called in to relieve the solitude of the harem, teach its inmates new airs, repeat verses or poems, initiate the Egyptian ladies in the mysteries of improvisation, and perform dances, which are often of a very unbecoming and lascivious character. Some of these women, however, are persons of cultivated minds and agreeable conversation; they perform their recitations with considerable effect, and possess a great command over their native language, which they speak with purity and grace. The practice of hiring women to utter lamentations for the dead is still observed at Cairo, to the great annoyance of the Frank population, who detest the doleful howlings of these professional mourners. In the capital, and also in some of the large towns, charmers of serpents occasionally exhibit their extraordinary feats, to the amazement and horror of the bystanders, brandishing live reptiles of the most poisonous description, and then tearing them with their teeth. But the practitioners of this perilous art do not always escape with impunity.

A printed book was a rare sight in Egypt until Mehemmed Ali introduced, along with other improvements, an European press, and founded a printing establishment. A class of men, similar to the copyists and caligraphers of the middle ages, earned a subsistence by making transcripts of the Koran, the Arabian Nights, and other works in demand, some of which were beautifully executed in inks of various colours.[3] But the occupation of these artists is now in a great measure gone, and the penman will soon be altogether superseded in such work by the compositor. In fact, the publication of a newspaper was some time ago commenced under the auspices of Mehemmed Ali; and although the *Egyptian Moniteur* does not enjoy, and indeed cannot be permitted to exercise, that freedom of speculation and boldness of remonstrance for which the press is distinguished in the free countries of Europe, yet it is apparently more unfettered than most of the journals in Germany, and contains much useful information respecting the remoter parts of the Egyptian dominions, as well as in regard to the improvements from time to time introduced with a view to continue the movement in advance which has already been communicated by the viceroy to almost all classes of the people under his sway.

In contemplating the improvements which have already been effected in Egypt, and the still more extensive and complete renovation which that country seems destined to undergo from the combined operation of the various causes presently at work, it is impossible not to be struck with admiration of the man by whom alone all these wonders have in fact been achieved, and who has written his name in such indelible characters upon the face of the interesting land where he has laid the foundations of a new empire. Comparing Egypt as it was at the commencement of the present century with its actual condition as described in the latest accounts which have reached us, we could almost persuade ourselves that, instead of thirty years, we had passed over three centuries, and that the striking contrast which is thus presented must be altogether unreal, a creation of oriental genius in its most imaginative mood, rather than the work of a mere human agent wholly unprovided with supernatural means. Anarchy has given place to order, and violence to the empire of the law. Arabs, Turks, Mamlukes, and Albanians have all been reduced into the most complete subjection to a government which has arisen from a chaos of discordant elements, and out of these gradually formed the "fair state," which is perhaps destined to become the centre of a new system of civilized nations. At the period of his accession to power Mehemmed found the soldiery mutinous and disorganized, the finances exhausted, property insecure, agriculture neglected, commerce annihilated; and, surrounded by ignorance, cruelty, treachery, and fanaticism, he knew that he could not attempt to advance a step except at the hazard of his life. Yet, endowed with invincible energy and perseverance, he has surmounted all obstacles, and compelled every class and order of men to yield implicit obedience to his government; and even in the depths of the Arabian desert he is feared and obeyed. Having destroyed a licentious and ungovernable militia, he has created a powerful army, which is controlled and governed by a stern system of discipline; his finances are in the most prosperous condition; new articles of produce have been raised; agriculture in all its branches has been improved and extended; works of the greatest magnitude and importance have been executed; commerce is carried on to an extent formerly unknown; ample security is afforded both to person and to property; and that confidence which is the first condition of prosperity universally prevails. From Alexandria to Assouan the road is as open and the security as complete as in the most civilized nations of Europe; at the Cataracts as well as at Cairo the traveller may repose in peace. But the moral change which he has wrought is much more extraordinary than all his military, political, commercial, agricultural and other improvements put together, and will, in its consequences, be productive of results still more important to the cause of civilization. He has attacked bigotry and fanaticism at their very source; and by frowning down ignorance, and letting in perforce the lights of knowledge amongst his subjects, he has done more to subvert the empire of a creed essentially adverse to human improvement than all its declared enemies put together. That in his character many dark spots may easily be detected, it would be ridiculous to conceal, far less deny. He has both failings and vices as a ruler, which, although it would be vain perhaps to regret them, it is nevertheless instructive to point out for the benefit of those who study human nature under all its varied aspects. But, on the other hand, these are so completely eclipsed by his great and splendid achievements in almost every field where a superior mind can display its native energy, that we may perhaps be excused for having dwelt more on the bright than the shaded part of his character.[1]

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[1] An Egyptian lady mounted on a mule or an ass, and wrapped up from head to foot in a black mantle, has not inaptly been compared to a coffin placed upright on a saddle and covered with a pall.

[2] The celebrated Sheikh Ibrahim (Burckhardt), with whom Mehemmed was very fond of conversing, presented himself one day before the viceroy. "Pasha," said he, "I want to go and see the holy city, and pray at the prophet's tomb; give me your leave and firman for the journey."—"You go to Mecca and our blessed prophet's tomb!" said the prince; "that's impossible, Ibrahim; you are not qualified: you know what I mean: nor do I think you are a true believer."—"But I am, pasha," was the reply; "you are mistaken, I assure you; I am qualified, too, in every respect; and as to belief, have no fears about that; tell me any part of the Koran that I will not believe."—"Go to the holy city; go, Ibrahim," said the pasha, laughing heartily; "I was not aware you were so holy a man. Do you think I'll vex myself with questions from the Koran? Go and see the prophet's tomb, and may it enlighten your eyes and comfort your heart." (Carne's *Recollections of Travels in the East*, p. 248.)

[3] Clarke's *Travels*, vol. v. p. 111.

SECTION V.

MONUMENTAL AND OTHER ANTIQUITIES OF EGYPT.

Plan of description.—Philæ; its temples and monuments.—Obelisk removed by Belzoni for Mr Bankes.—Importance of the inscriptions on this monument.—Elephantiné; its quarries.—Syené or Assouan.—Measurement of a degree of the meridian by Eratosthenes.—Ombos or Koum Ombo.—Edfou or Apollonopolis-Magna.—Elethya; its college of priests.—Esneh or Latopolis.—Hermonthis or Hermont.—Thebes.—Medinet-Habou.—Temples and monuments in this division of the ancien capital.—Biban-el-Moluk or gates of the kings.—Catacombs or tombs of the kings.—Discoveries of Belzoni among these *hypogæa*.—Sarcophagus of alabaster.—Kourah.—Characteristics of Egyptian architecture.—The palace of Luxor.—The temple of Karnak.—Site and dimensions of Thebes.—Origin of the name.—Kous or Apollonopolis-Parva.—Coptos or Kebto.—Ghenneh or Kenneh.—Tentyris or Denderah; its monuments and antiquities.—Planisphere or zodiac of Denderah.—Speculations to which this planisphere has given rise refuted both by the calculations of science and the dates fixed by the inscriptions.—Abydos.—Genealogical tablet discovered by Mr Bankes.—Importance of this document to the historiography of Egypt.—Diospolis-Parva.—Djirjeh.—Ikhmim, Eckmoum, or Panopolis.—Antæopolis or Kau.—Lycopolis or Siout.—Schmoum or Hermopolis-Magna.—Antinoë.—Oxyrynchus.—Heracleopolis.—Crocodilopolis.—Aphroditopolis.—Labyrinth.—Memphis.—Mechanical labours of the Egyptians.—Pyramids.—Lake Mœris.—Other antiquities.

As any attempt to classify the monumental antiquities of ancient Egypt would lead to the greatest confusion in topography, there are only two modes in which these remains can be described without creating embarrassment to the reader; namely, by taking them either in an ascending or descending order, with reference to the course of the river, on or near the banks of which they are almost all situated. But as we conceive that civilization, flowing from the interior, originally descended along the valley of the Nile, and as either method is equally conducive to perspicuity, we prefer the latter; more especially as it will bring us at once in contact, as it were, with some of the most extraordinary monuments in this land of wonders and prodigies.

Supposing, then, that we enter Egypt from Nubia on the south, and follow the course of the Nile downwards, the first place of note which occurs is the island of Philæ,[2] about six miles to the south of Syene or Assouan, and nearly thirty-four to the north of the tropic of Cancer. Occupying an area of barely nine hundred yards in circumference, and a hundred in breadth, this diminutive island nevertheless presents a variety of objects deserving of admiration, and calculated to revive a multitude of historical and classical recollections. Independently of other considerations, the etymon of its name affords presumptive evidence of the remoteness of the period at which this celebrated spot first formed the southern boundary of Egypt, or, as it were, the Nubian gate of the kingdom of the Pharaohs. But being considered as the burial-place of Osiris,[1] and adorned with temples, one of which was believed to have been erected by Isis in honour of her husband-brother, it has higher and more interesting claims to our attention; and as every thing which antiquity or sanctity could offer to warm the imagination or kindle the devotion of the votary seemed concentrated on this hallowed islet, it had accordingly become a favourite place of pilgrimage among the worshippers of Osiris at a period long anterior to the commencement of history. One of the names by which it is at present known, Djeziret-el-birba or the Temple-Island, sufficiently indicates the character and the magnitude of the ruins with which it is covered; ruins which the neighbouring Arabs denominate Anas-el-Wojud, or the sociality of Wojud, who, according to their traditions, built these palaces as a retreat to which he might betake himself for the purpose of social or convivial enjoyment.[2] Though the surrounding cliffs are of a dark-brown granite, the temples are all built of a bright white sandstone; and nearly the whole island is cased with walls of hewn stone, forming quays concave towards the stream, but convex towards the land, which give it the appearance of a modern escarpment.[3]

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[1] In effecting his improvements, Mehemmed had not to contend with a privileged aristocracy, inheriting historical names, and intrenched behind the prejudices of centuries. The incessant revolutions of which Egypt was the theatre, and the long-continued sway of the Mamlukes, whose power was based, not on opinion, but on force, had, even amongst the Arabs, destroyed much of the *prestige* in favour of the distinctions of hereditary rank, and worked incredible injury to the science of genealogy. How indeed could it be otherwise in a country where all respect was reserved for the purchased slave, whose relations were unknown, but whose bravery or other personal qualities had raised him to the highest honours? "I have heard," says General Regnier, "both Turkish and Mamluke officers say of a person who occupied great posts, 'He is a man of the best connections; he was purchased.'" (Regnier, *De l'Egypte*, p. 68.)

[2] The Arabic name of Philæ is *Bilak*, which is merely the old Egyptian name *Pi-lakh*, signifying "the end or extremity," spelled in the Arabic fashion.

This island is entirely covered with temples in large groups, and in a high state of preservation; and from a rocky eminence at its southern extremity the whole of the ruins may be seen at once. On the south-west side are two large temples, adorned with and connected by long colonnades, but manifestly of different ages; on the right is a small temple of Isis, with an isolated, unfinished building, having no remains of the cella, nor any appearance of an interior cornice; and on the left are an obelisk, and long porticoes leading to a large temple of Isis, near a smaller one dedicated to Hathôr or the Egyptian Venus, which Champollion has pronounced the best in the island. The great temple of Isis,[4] which is the southernmost of all, has two colossal pyramidal propyla, one between the dromos and pronaos, and another between the pronaos and portico, with a smaller one leading into the sekos or adytum. But none of these propyla are in lines parallel to each other, all of them, as well as the dromos, turning from the body of the temple, each about one point towards the east; an irregularity probably owing to the form of the island or the varying state of the rocky foundation, but which renders the building exceedingly complex. None of the existing monuments of Egypt is better calculated to convey an adequate idea of the magnificence by which they are characterised than the portico of this temple, which consists of twelve columns, four in front and three deep. The capitals, which are in pure Egyptian taste, represent varied forms and compositions of the palm branch, the domm leaf, and the lotus. These, as well as the sculptures on the columns, the ceiling, and the walls, have been painted in the most vivid colours, which still retain much of their original brightness; and there is reason to believe that the same was the case in the interior of this as well as of the other temples, although the damp and the nitrous quality of the confined air have entirely destroyed the colours. One of the majestic pylons of this temple, flanked by two square, tower-like masses of masonry rising pyramidically to the height of fifty-four feet, leads to the second court, and towers above everything around, being the loftiest building on the island; and both are richly ornamented with sculpture and hieroglyphics, the number of which is immense. Three large and several smaller chambers lead to the adytum or sanctuary, in one corner of which there is a granite block, containing a niche for the bird (a kind of hawk) venerated as the emblem of Osiris, and entirely covered with hieroglyphics. Bas-reliefs, representing processions, festivals, sacrifices, and other scenes connected with the worship of the gods of Egypt, cover the walls within and without; and on the ceiling of the portico are sculptured a human figure, with a mitre on the head and a serpent in the hand, three female figures with the arms and legs extended, two canoes with paddles, two winged globes, a flying scarabœus with hands, Osiris in his boat, and two birds flying with palm branches in their claws. Fragments of obelisks and lions consisting of red granite are strewed about upon the ground in front of the temple. According to the most probable calculation, this temple was commenced by Philadelphus, continued under Euergetes I. and Epiphanes, and completed by Euergetes II. and Philometor.[5]

On the left of the great temple of Isis is an uncovered enclosure formed by a colonnade, the intercolumniations of which are filled to nearly two thirds of their height; but to make amends for this, the plinths are raised to a disproportionate thickness. This structure, which has evidently been left in an unfinished state, was by the French architects called "the eastern" or "temple of Isis," from a supposition, now proved to be erroneous, that the great temple had been dedicated to Osiris. Before it lay a small obelisk of granite, which, though displaced, had sustained but little injury. This monument, which eventually proved of so much importance in regard to the deciphering of hieroglyphics, was first noticed by Mr W. J. Bankes in 1815; and two years afterwards Mr Belzoni, acting on his account, succeeded, in spite of numerous difficulties and even dangers, in transporting it along the Nile to Rosetta,[1] whence it was conveyed to England. The hieroglyphics on the shafts and the Greek inscription on the base of the obelisk were faithfully copied under the superintendence of Mr Bankes; and when the principles of interpretation applied by Dr Young to the triple inscription on the Rosetta stone were extended to the double inscription on the obelisk of Philæ, it was ascertained that the Greek was merely a version of the Egyptian text; a discovery to which, as will afterwards be shown (see HIEROGLYPHICS), we are in a great measure indebted for the formation of the phonetical alphabet. The Greek text has been ably illustrated and explained by the celebrated French Hellenist, M. Letronne.[2] At some distance from these temples, and near the water's edge, there is a large hall, the walls of which are covered with sculptures relating to the death of Osiris; and over these are scattered inscriptions of different ages, and in various characters, recording the names of pilgrims who had visited the temple-island in order to pay their devotions to the presiding deities of the place. At the northern extremity of the island there are the remains of a triumphal arch, and other works of Roman architecture; and on the north-east side an unfinished temple, exhibiting many peculiarities of structure, and showing that the arts were not always stationary in Egypt. In a word, within the compass of this little island, Nubian cabins, Arab huts, Christian chapels, Roman fortifications, and Egyptian temples, are crowded together in such a manner as to produce a painful sense of the lapse of ages, the transitory nature of empires, and the destructibility of human works, however colossal in magnitude or solid in construction.[3]

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[1] This honour was disputed by Abydos, Memphis, Busiris, and Teph-Osiris.

[2] Burckhardt, *Nubia*, v. p. 130.

[3] *Description de l'Egypte*, Antiquités, tom. i. p. 12. *Encyclopædia Metropolitana*, art. *Egypt*.

[4] To this temple, which all travellers except Champollion have uniformly spoken of with enthusiastic admiration, the *minuit præsentia famam* is fully as inapplicable as to any other monument in this land of wonders. (Hamilton's *Egyptiaca*, p. 45.) The Frenchman, however, admits that the sculpture is altogether worthy of the epoch which produced it, namely, the Greek, which he nevertheless considers as "une époque de décadence." (*Lettres*, p. 115.) In fact, he is of opinion that everything at Philæ is *modern* ("tout y est *moderne*") except the small peripteral temple of Hathôr, and a propylon connected with the first pylon, which, according to him, was constructed and dedicated by Nectanebo I. (*Lettres*, ubi supra.)

[5] The rows of lions in front of this temple, and the occurrence of the same figure among the hieroglyphs, led the French savans to conclude that this emblem was meant to mark the sign Leo, in which the sun once appeared at the summer solstice, when the inundation commenced. But the sun ceased to be in Leo at that season 2500 years before the beginning of our era; and hence M. Fourier concluded that this temple must have been built *before* that period, and *within* the limits of the 2163 years during which the sun was in Leo at the summer solstice. Similar inferences were drawn from the zodiacs found at Denderah and other places; so that "on travelling back," say the French philosophers, "for upwards of three thousand years, we can scarcely see a trace of the infancy of Egyptian architecture." (*Description de l'Egypte*, Antiq. i.) But, unfortunately for these speculations, Delambre has shown (*Nouvelles Annales des Voyages*, tom. viii. p. 389) that they furnish no data for determining the age of the buildings which they adorn; and from the style of the sculptures, particularly on the propylon, and still more from the hieroglyphic texts, the epoch of the erection of the temple must be that which we have assigned. If the Greek inscriptions over the entrance and on the walls had received the attention which they deserve, several erroneous theories would have been avoided, and the extravagant antiquity ascribed to this and other buildings would have been at once disproved. (*Encyclopædia Metropolitana*, art. *Egypt*.)

Immediately below the Cataracts there is another small island in the river, which enjoys a celebrity scarcely inferior to that of Philæ; we mean Elephantiné, now called by the Arabs Djeziret-el-zahir or the Flowery Island, by reason of its luxuriant vegetation. In the time of Psammeticus this islet formed the last fortified place in his dominions, and under the Romans it was garrisoned by three cohorts. In point of size, it is so diminutive that, according to Champollion, "il formerait à peine un parc convenable pour un bon bourgeois de Paris.[4]" Heaps of rubbish mark the site of the town supposed to have given birth to the head of the Elephantine dynasty, and until recently there were remains of two temples covered with hieroglyphics, and approaching in design to the earliest temples of Greece. But within the last few years both these monuments have been destroyed in order to construct a barrack and magazine at Syene; and a little temple, dedicated to Knuphis by Amenophis III., has also disappeared.[5] The only remnants left are two steps of a granite gateway, belonging to another temple of Knuphis, Saté, and Anuké,[6] dedicated under Alexander, the son of Alexander the Great. A wall of the quay, however, exhibits, intermingled and mutilated, the wrecks of several ancient edifices of Elephantiné, constructed under Mœris, Mandoueï, and Rhamses the Great; and in the remains of a chamber adjoining the stair of the quay are several curious hieroglyphic *proskynemata*, as well as in the inscription of a mutilated stelé originally erected in honour of Mandoueï. The quarries of Elephantiné were worked in a very early age, and furnished the materials for many celebrated monuments. Amongst these may be mentioned the famous monolithic temple at Saïs, formed of a single block of granite, the removal of which from Elephantiné to the Delta employed two thousand men for the space of three years. On the wall of an ancient quay, over a flight of steps leading to the river, may still be seen the nilometer which is mentioned by Strabo. Physically considered, Elephantiné is more properly the southern extremity of Egypt than Philæ; for it is the last projection of the granite rock which forms the natural division between Egypt and Nubia, and beyond it the limestone tract of country commences.[7]

On the eastern or right bank of the Nile, nearly opposite to Elephantiné, stands the town of Assouan or Ossouan, the Syené of the Greeks, and the Souan of the Copts, in whose language the word signifies "the opening." From its proximity to the northern tropic it was fixed upon by Eratosthenes as the point of departure for his admeasurement of a degree of the meridian in order thence to calculate the circumference of the earth; and here also, according to Strabo, was the well which, as the gnomons cast no shadows at noon, marked the summer solstice.[8] At Syene may still be seen the ruins of a temple consecrated to Knuphis and Saté, under the Emperor Nerva. This monument, though it indicates an extreme decline of art in Egypt, is nevertheless exceedingly interesting, first, because it is the only one which bears the hieroglyphic legend of Nerva; secondly, because it contains the phonetico-hieroglyphic name of Syené, viz. *Souan*, the same with the Coptic, and the root of the Syene of the Greeks and the Assouan of the Arabs; and, lastly, because the symbolic name of this town, resembling the plummet line of an architect or mason, seems to allude to the position of Syene under (or nearly under) the tropic, and to the famous well into which the sun's rays descended vertically at noon on the day of the summer solstice. On some granite rocks in the neighbourhood, Champollion discovered the homage of an Ethiopian prince called Memosis, to Amenophis III. and Taia his queen; an act of adoration to Knuphis, the local god, for the safety of Rhamses the Great and his children; and several *proskynemata* of private individuals, as well as public functionaries, to the divinities of Syené and the Cataract.[9] For several centuries after the Arabian invasion, Assouan continued in a flourishing condition; but under the Fatemite caliphs it became a prey to intestine divisions, and has long been reduced to a state of the utmost wretchedness.[1]

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[1] Belzoni's *Travels*, p. 347, et seqq. where an interesting account will be found of this difficult, and, as the result proved, perilous operation.

[2] *Recherches*, p. 279. The inscription consists of a petition from the priests of Isis to Ptolemy Euergetes II. (B. C. 125 or 126), praying him to release them from the exactions of the magistrates and military officers stationed in the Thebaid, and to permit them to erect a *stelé* or *cippus* in commemoration of the equity and beneficence of their sovereign; a prayer which the existence of the commemorative obelisk proves to have been granted.

[3] *Encyclopædia Metropolitana*, art. *Egypt.*

[4] *Lettres écrites d'Egypte et de Nubie*, p. 171.

[5] *Lettres*, ubi supra; also, pp. 111 and 382.

[6] Each city and place of Egypt had its patron. Knuphis and Saté reigned at Elephantiné, Syené, and Begheh, and their jurisdiction extended over all Nubia; Phré presided at Ibsamboul, Derri, and Amada; Phtah, at Ghirscheh; Anuké, at Maschaket; Thoth, the superintendent of Knuphis, over the whole of Nubia, having his principal fiefs at Ghebel-adheh and at Dakkeh; Osiris was lord of Dandour, Isis queen at Philæ, Hathôr at Ibsamboul, and Malouli at Kalabschir.

[7] *Description de l'Egypte*, Antiq. p. 8. Girard, *Mém. de l'Acad. des Sciences*, tom. ii. p. 185, 1817. *Encyclopædia Metrop.* art. *Egypt.*

[8] This is not strictly correct, as the ancient town of Syené, though somewhat to the south-west of the modern town of Assouan, is 37′ 23″ north of the tropic; so that, during the summer solstice, there must be some shadow at noon, though it is scarcely perceptible.

[9] Namely, Knuphis, Saté, and Anuké. (Champollion, *Lettres d'Egypte*, p. 171.)

Descending the Nile about twenty-seven or twenty-eight miles below Assouan, we reach Koum-Ombo, which stands on the site of the ancient Ombos, upon the right bank of the river. All the lower part of the ancient town, however, excepting that which has been washed away by the river, is now covered with a mound of sand, as its modern name indeed implies. But two temples, surrounded by a brick wall of great thickness, have escaped the general destruction, and both belong to the Greek epoch. The larger, which is of beautiful architecture, and has a fine effect, was commenced by Ptolemy Epiphanes, continued under Philometor and Euergetes II., and appears to have been completed during the reign of Soter II., whose name, with that of Cleopatra his queen or sister, may still be detected on some of the bas-reliefs. This temple, which is formed of a greyish sandstone, differs from every other building of the same kind in Egypt, in having two entrances, and consisting of two connected though distinct and perfectly symmetrical structures. It appears to have been consecrated to two triads, each of which had a distinct division or compartment allotted to it; the one, composed of Sevek-Ra, with the crocodile's head (the primordial form of Kronos or Saturn), Hathôr or Venus, and their son Khons-Hôr; the other, consisting of Aroëris, the goddess Tsonenufré, and their son Pnevtho; and both together constituting the saviour gods of Ombos. The crocodile observed on the Roman medals of the Ombite nome is the sacred animal of the principal god Sevek-Ra. In the dedications, and in the cartouches or elliptical rings sculptured on the cornice of the pronaos, Cleopatra the wife of Philometor has a surname which can only be the Greek *Tryphœne* or *Dropion*,[2] but the former is considered as the more probable interpretation. This surname is repeated thirty times. The smaller temples of Ombos, like one of those at Philæ and the temple of Hermonthis, was a *Mammisi*, or sacred edifice representing the birth-place of the young god of the local triad; in other words, a terrestrial image of the spot where the goddesses Hathôr and Tsonenufré had given birth to their sons Khons-Hôr and Pnevtho. From ignorance of the local mythology, the authors of the *Description de l'Egypte* supposed that this temple had been dedicated to Isis and her son Horus.

Edfou or Edfu, the *Apollinopolis Magna* of the Greeks, is situated on the western or left bank of the Nile, about thirty-three miles below Koum-Ombo, and two miles from the water's edge. An ancient quay, with a flight of steps down to the river, and two temples at right angles to each other, but half buried in the sand, still remain. The larger of these is twice as long as it is broad, measuring about 440 by 220 feet; its largest columns are six feet four inches in diameter, twenty-one feet in circumference, and forty-two feet in height; and, as at Philæ, Denderah, and other places, its roof is covered with peasants' huts, whilst the openings originally intended for the admission of light serve as sinks for the reception of filth. The two lofty pylons, which are conspicuous from the river, and the thirty-two columns of the peristyle to which they lead, form altogether a magnificent perspective.[3] But this temple, the massive grandeur of which is so imposing, bears, nevertheless, several indications of the decay of Egyptian art under the Ptolemies, to whose epoch it entirely belongs; no trace of the ancient simplicity is discernible; and a profusion of elaborate but ill-conceived ornaments marks the transition from the noble gravity of the Pharaonic monuments to the fatiguing and endless *papillotage* of later times. The most ancient part of the decorations, namely, the interior of the naos and the right exterior side, belong to the reign of Philopater: the work was continued under Epiphanes, whose legends cover part of the shafts of the columns and the interior tablets of the right partition of the pronaos; and it was at length completed under the reign of Euergetes II. The sculptures of the exterior frieze and on the exterior walls of the pronaos were executed under Soter II. to whose reign also belongs the gallery on the right of the court before the pronaos: the gallery on the left, and indeed all the sculptures upon the two massive pylons, are of the age of Philometor. The wall of the enciente which surrounds the naos is entirely covered with sculptures, which (particularly those of the interior face) date from the reign of Soter II. and of Ptolemy-Alexander I. and contain the names of their respective queens, Cleopatra and Berenice. This magnificent edifice was consecrated to a triad composed of the god Harhat, or celestial science and light personified, the goddess Hathôr, the Egyptian Venus, and their son Harsont-Tho or Horus, answering to the Eros of the Greek and Roman mythologies. The lesser temple of Edfou, called the Typhonium,[4] is one of those smaller edifices called *Mammisi*, which were always erected beside the great temples where a triad was adored. The Mammisi of Edfou represents the infancy and education of Harsont-Tho, with whom flattery has associated Euergetes II. as sharing the caresses of the gods of every order. The large temple of Edfou is dedicated to Aroëris, the Apollo of the Greeks.[5]

Six miles lower down the river, on the opposite or right bank, is El-kâb, the ancient *Elethya*; but the remains of its two temples have disappeared, these structures having lately been demolished in order to repair the quay of Esneh, or for some other recent erection. Not so much as a column has escaped; and the entire temple, situated outside the town, has shared the same fate. It appears, however, from fragments of inscriptions, that the temple of Elethya, dedicated to Sevek or Saturn, and Sowan or Lucina, belongs to different Pharaonic epochs, and that those included in the city had been constructed and decorated under the reign of Queen Amenseh, under that of her son Thouthmosis III., called also Mœris, and under the Pharaohs Amenophis-Memnon and Rhamses the Great. Amyrteh and Achoris, two of the last kings of the Egyptian race, repaired these ancient edifices, and added some new constructions; but nothing attributable to the Greek or Roman periods has yet been discovered. The small peripteral temple which stood in the sandy plain about a mile and a half to the north of the town belonged to the age of Mœris. But by far the most remarkable antiquities of Elethya are the sepulchral caverns or *hypogœa*, excavated in an insulated hill, of the common sandstone of the country, at the distance of about four hundred yards to the south-south-west of the town. These tombs belong to a very remote period, and in the variety and richness of their decorations rival those of Thebes; with this difference, however, that, instead of religious and military subjects, those of a familiar and domestic kind are alone represented. The first of these visited by Champollion and his party was the one whose painted bas-reliefs, relative to agricultural labours, fishing, and navigation, have been published by the Egyptian Commission in the French national work.[1] This tomb, which is of high antiquity, had been excavated for the family of a hierogrammatist named Phapeh, attached to the college of priests at Elethya.[2] A second *hypogœum*, which proved to be that of the high priest of the goddess Ilythia or Elethya, from whom the town originally derived its name, bears the date of the reign of Rhamses-Meiamoun,[3] and exhibits a multitude of family details, with some agricultural scenes, not in the purest taste.[4] The tomb adjoining this is still more interesting in an historical point of view. It belonged to a person named Ahmosis, son of Obschneh, chief of the boatmen of the Nile, who appears to have been a great personage in his day. In the remains of an inscription, this Ahmosis recounts his history for the benefit of all persons present and future, and states some particulars which fix the date at which he lived, namely, under the last king of the seventeenth dynasty, who overthrew the cruel tyranny of the Shepherds, and delivered Egypt from those remorseless barbarians. Another *hypogœum*, nearly in ruins, made Champollion acquainted with four generations of great personages who governed under the title of princes of Elethya during the reigns of the first five sovereigns of the eighteenth dynasty, viz. Amenoph or Amenoftep I. Thouthmosis I. Thouthmosis II. Thouthmosis III. or Mœris, and Ranofreh, daughter of Queen Amenseh, and sister of Mœris. All these royal personages are successively named in the inscriptions on the tomb, and form as it were a supplement in confirmation of the genealogical table of Abydos discovered by Mr Bankes.[5]

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[1] Burckhardt, *Nubia*, pp. 131, 395, 516.

[2] "Un fait curieux, c'est le surnom de *Tryphœne* donné constamment à Cléopâtre, femme de Philométor, soit dans le grande dédicace hiéroglyphique sculptée sur la frise antérieure du pronaos, soit dans les bas-reliefs de l'intérieur; c'est à vous autres Grècs d'Egypte d'expliquer cette singularité." (Champollion, *Lettres d'Egypte*, p. 110.)

[3] Hamilton's *Egyptiaca*, p. 86, et seqq. *Encyclopædia Metropolitana*, art. *Egypt*.

[4] Jomard, *Description de l'Egypte*, i. 5, 30.

[5] Champollion, *Lettres d'Egypte*, pp. 109 and 191. Both the temples at Edfou are in a high state of preservation; but Mr Hamilton, in his learned work upon Egypt, has entirely mistaken the meaning of the sculptures (*Egyptiaca*, p. 87); and the same thing may be observed of Jomard in the *Description de l'Egypte*.

Esneh or Esné, the ancient *Latopolis*,[6] and the present capital of Upper Egypt, is about thirteen miles below El-kâb or Elethya, and stands in a plain where the valley is nearly four miles and a half in width. Owing to the neglect of the canals requisite for the irrigation of the soil, which is not now reached by the inundation, the surrounding country had been reduced almost to a desert, and the town itself would probably have been abandoned, but for its port and the trade carried on by means of the Nile. Under the vigorous administration of Mehemmed Ali, however, the canals have latterly been repaired, and various products, including cotton, raised on ground which was not long ago a sandy waste, apparently irreclaimable for the purposes of cultivation. At Esneh there are two temples; one of vast dimensions, which, the great Ammon be praised, has escaped destruction from having been converted into a cotton magazine; and another, much smaller, but remarkable for the peculiarity of its hieroglyphics. Both contain some of those symbolical zodiacs which have so greatly perplexed the whole tribe of Egyptian antiquaries. According to conjectures founded on a particular mode of interpreting the zodiac on the ceiling of the large temple, this monument has been regarded as the most ancient in Egypt; but the style of the sculptures, and, above all, the hieroglyphical inscriptions, prove that, in reality, it is one of the most modern to be found in that country. The latter, indeed, leave no doubt that the masses of the pronaos were raised under the reign of the emperor Claudius,[7] to whom there is a dedication in large hieroglyphics on the entrance, and that the corner of the façade, and the first row of columns, were sculptured under the emperors Vespasian and Titus; the posterior part of the pronaos bears the legends of the emperors Antoninus, Marcus Aurelius, and Commodus; some columns of the interior were decorated and sculptured under Trajan, Hadrian, and Antoninus; and, with the exception of some bas-reliefs, which belong to the epoch of Domitian, all those on the partitions of the right and left of the pronaos contain images of Septimius Severus, and of Geta, the brother of Caracalla.[8] The construction of this temple dates from the time of Claudius, and its sculptures come down as late as that of Caracalla. The remains of the naos, however, belong to the epoch of Ptolemy Epiphanes; but that is only as yesterday compared with the date which some fanciful antiquaries had assigned to this monument. On one of two columns, however, whose shafts were almost entirely covered with hieroglyphics arranged artificially, Champollion discovered a commemorative record of a dedication of an ancient temple by Mœris, otherwise called Thouthmosis III.; and in the quarter of the town known by the name of Sheikh-Mohammed-Ebbedri, he also found a dedication of Thouthmosis II. which, like the former, must have belonged to some old Pharaonic monument of Esneh. The great temple of Esneh was dedicated to one of the chief forms of the divinity Knuphis, who is described as *neven-tho-Sné*, or lord of the country of Esneh.[9] This place is also remarkable on account of a large Coptic convent, supposed to have been founded by the disciples of Pachomius, and to possess the bones of the martyrs who suffered during the persecutions of Diocletian.

At a small distance from the Nile, in the third expan-

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[1] *Description de l'Egypte*, p. 7.

[2] In Egyptian *Sowan-kah*, or priests of Lucina, the goddess who was worshipped at Elethya.

[3] *Meiamoun* is an epithet, and means literally "beloved by Ammon," or Jupiter.

[4] Among the scenes represented on this *hypogœum* is one of the threshing or treading out of sheaves of corn by oxen, below which, in hieroglyphics, almost all of which are phonetic, is a chançon which the conductor of the oxen on the threshing-floor is supposed to sing. The ditty is addressed to the animals, and is as follows:—

Tread out the grain, ye oxen, tread it faster;
The work is yours, the bushels go to master.

This is not very brilliant poetry, we admit, and, probably, our translation has not improved it; but what occupies five lines in the original hieroglyphics we have found no difficulty in compressing into two; and the specimen is at least curious.

[5] Champollion, *Lettres d'Egypte*, pp. 109, 194, 382. Hamilton, *Egyptiaca*, p. 90, et seqq.

[6] *Esné* or *Sné* is the pure Egyptian name, and may be still read on all the columns and bas-reliefs of the temple. The Greek name of *Latopolis*, or *Letopolis* (for it is spelled both ways), is supposed to have been formed from *latus*, a species of fish held in veneration at this place. (*Egyptiaca*, p. 106.)

[7] In the hieroglyphic ovals or rings the name is *Cæsar Tiberius Claudius Germanicus*.

[8] When Caracalla assassinated his brother Geta, he caused the name of the latter to be proscribed throughout the whole empire; and this proscription appears to have been executed to the letter even in the depths of the Thebaid; for the ovals containing the name of this unfortunate prince have almost all been carefully defaced and hammered out. "Mais ils ne l'ont pas été au point (says Champollion) de m'empêcher de lire très-clairement le nom de ce malheureux prince: L'EMPEREUR CESAR-GETA *le directeur*." (*Lettres d'Egypte*, p. 200.)

[9] The titles by which the Knuphis of Esneh is qualified are "lord of the country of Esneh, creator of the universe, vital principle of the divine essences, support of all worlds," &c. With this god are associated the goddess Neïth, and the young Hâké, who complete

sion of the valley, is situated Ermont or Erment, upon the site of the ancient *Hermonthis*, the capital of a nome or department of the same name, and the see of a Coptic bishop. A temple of moderate dimensions, but of peculiar design, and distinguished for the beauty of its columns and sculptures, still remains. This temple is a *Mammisi* consecrated to the goddess Ritho, and, as the bas-reliefs prove, constructed and sculptured in honour of Cleopatra the daughter of Ptolemy Auletes, when she gave birth to Cæsarion, her son by Julius Cæsar. The triad here adored consisted of the god Mandou, the goddess Ritho, and their son Harphreh; and Cæsar, no doubt, wished to be the Mandou of the new Ritho, as Cæsarion was the Harphreh of both. "Du reste," says M. Champollion, who waxes facetious on the occasion, "c'était assez l'usage du dictateur Romain de chercher à compléter la triade, lorsqu'il non contrait surtout des reines qui, comme Cleopâtre, avaient en elles quelque chose de divin, sans dédaigner pour cela les joies terrestres." The body of the temple is still entire, and its cella consists of two compartments, a larger and a smaller, but some of the columns have been overturned. The import of the hieroglyphical inscriptions is very fully stated by Champollion.[1] This temple also contains a zodiac, the epoch of which, if it were considered determinable by such fanciful calculations as those we have already alluded to, would be altogether incredible.[2] Near to these ruins is a Christian church, which has been constructed out of the spoils of Grecian as well as Egyptian temples.

In the broadest part of the section of the valley forming its third enlargement, where the Nile is about four hundred and fifty yards in width, and runs from south-west to north-east, between Kournah or Gournah on the north, and El-Nahariyah on the south, the splendid remains of Thebes, the wonder of antiquity, a city the date of whose destruction was long anterior to the foundation of most other cities, are spread over a large area occupied by nine distinct townships, viz. El-Akaliteh, Nacah-Abu-Hamud, Konm el-baïrat, and Medinet-Habou to the west; Kournah or Gournah to the north; Luxor or El-oksor close to the river's edge; and Kafr-Karnak and Medamud on its eastern side.[3] The most remarkable of these places, with the Titanian ruins which are spread over their surface, we shall now endeavour as shortly as possible to describe.

At Ákaliteh the remains of an ancient hippodrome or race-course are visible, and at its northern extremity is Medinet-Habou, or the Town of the Father, containing the remains of a castellated palace with embattled walls,[4] and a temple with propyla of gigantic dimensions, besides majestic colossal figures, caryatides, and long rows of columns richly ornamented. This temple, which may be the Memnonium of Strabo, is in size and massiveness inferior only to that of Diospolis, but fully equal to it in the richness and variety of its sculptures. An outward inclosure or brick wall seems to have contained three distinct though connected buildings, to which have been arbitrarily assigned the respective names of the chapel, the palace, and the temple. A small pronaos, a propylon, and a portico, conduct as usual to the adytum of the chapel, which, from its size, would in any other place deserve to be classed amongst the temples. The palace was only approached by a side doorway from the pronaos of the chapel until the principal entrance from the plain, which had been blocked up with sand, was opened by the indefatigable Belzoni.[5] Of this building one tower only remains. It is divided into three stories, in each of which are two apartments. The stone pavement of the lower rooms is still perfect, but the upper floors and the wooden beams which supported them have entirely disappeared. The interior walls are not covered with such a profusion of sculptures as those without. The great gateway of the temple, which faces the palace at the distance of about three hundred feet, is covered with the usual sculptures; it is about a hundred and fifty feet in length and sixty in height, and conducts into a court which is about a hundred and twenty feet square. On either side there runs from this gateway to the next a colonnade; that on the right consisting of eight pilasters, to each of which is affixed a mitred statue of Thoth or Hermes, and that on the left of as many columns, each richly sculptured. The soffites and walls of these colonnades are also crowded with sculptures, the forms and colours of which are well preserved.[6] In the chapel, which appears to have been a work of the fourth century before our era, all the bas-reliefs still extant represent king Nectanebo, of the thirtieth or Sebennytic dynasty, adoring Ammon-Ra, the sovereign of the gods, and receiving the gifts and benefactions of all the other divinities of Thebes. But adjoining to it there is a pylon of moderate dimensions and fine proportion, which, having been erected under the domination of the Ethiopian king Taharaka (the Tirhakah of Scripture), in the seventh century before our era, contains, in the inscriptions and bas-reliefs which decorate the faces of the masonry, and also the gateway which separates them, the names, titles, and praises of this invader, which were afterwards proscribed when the Saïtes ascended the throne of the Pharaohs. On the masonry of the

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the triad adored at Esneh. "C'est aux mêmes divinités," says Champollion, "qu'était dédié le temple situé au nord d'Esnéh, dans une magnifique plaine, jadis cultivée, mais aujourd'hui hérissée de broussailles qui nous déchirèrent les jambes, lorsque nous allâmes le visiter, en faisant à pied une très-longue course du Nil aux ruines, que nous trouvâmes tout nouvellement devastées; ce temple n'est plus tel que la Commission d'Egypte l'a laissé; il n'en subsiste qu'une seule colonne, un pétit pan de mur et le soubassement presque à fleur de terre; parmi les bas-reliefs subsistants, j'en ai trouvé un d'Evergète Ier. et de Bérénice sa femme; j'ai reconnu les légendes de Philopator sur la colonne, celles de Hadrien sur une partie d'architraves; et sur une autre en hiéroglyphes tout-à-fait barbares, les noms des empéreurs Antonin et Vérus." (*Lettres d'Egypte*, p. 204.)

[1] See *Lettres d'Egypte*, p. 105.

[2] Jomard, *Description de l'Egypte*, Antiq. i. c. viii. p. 9, plates 91, 96. See also Hamilton's *Egyptiaca*, p. 111. With reference to the materials with which the Egyptian temples were constructed, the author last quoted observes, "It is singular that the ancient Egyptians do not appear to have employed granite in any of the buildings in Upper Egypt, except the obelisks and some few of the propyla, as at Thebes, Elephantiné, &c. The rest are all of the common sandstone. Granite pillars seem to have been introduced so late as the time of the Christian emperors, as they are only found in the ruins of Greek churches. Their proportions and their sculpture testify the want of taste, and the decline of the arts, which characterized the age in which they were raised. In Lower Egypt, we find granite to have been in use from the earliest times; whole temples, columns, propyla, &c. were constructed exclusively of this stone, as being the only one which could resist the *frequent* and *violent* rains in the Delta, and the moisture of the air." (*Egyptiaca*, p. 112.) This is very loose and inaccurate. In Upper Egypt the nearest and most accessible materials were used; and in the Delta, though the air be moist from its proximity to the sea, the rains are neither frequent nor violent.

[3] *Plan des Ruines de Thébes; Description de l'Egypte*, Antiquités, tom. ii. plate 1.

[4] This peculiarity is confined to the edifice in question, and is not to be found in any other Egyptian building. (*Encyclopædia Metropolitana*, art. *Egypt.*)

[5] *Researches and Operations in Egypt and Nubia*, p. 121.

[6] Hamilton's *Egyptiaca*, p. 137, et seqq. See also Denon's *Travels in Egypt* under the head of Medinet-Habou.

right there is also an inscription relative to embellishments which were executed under Ptolemy Soter II.[1] The foundation of the palace dates as far back as the commencement of the eighteenth century before Christ; but several restorations are indicated by the inscriptions, which also fix the period at which they were made. 1. All the sculptures of the upper façades south and north were executed under the reign of Rhamses-Meiamoun in the fifteenth century before our era. 2. The columns of the protodoric order which support the ceilings of the galleries were repaired under the Mendesian Pharaoh, Acoris, about four centuries before Christ. 3. The restoration of the gates, and a portion of the ceiling of the grand hall, took place under Euergetes II. between the years 146 and 118 before our era. But the principal decoration of the edifice was executed under the reigns of Thouthmosis I. Thouthmosis II. and Thouthmosis III. called Mœris by the Greek historians, particularly the last, in whose name all the dedications have been made.[2] The sculptures are executed with remarkable accuracy and with exquisite fineness of detail, and the bas-reliefs are of the very best age of the art. War and battles form the principal subjects of the hieroglyphical tablets and inscriptions.[3]

On the edge of the desert to the north and west of Medinet-Habou there are almost innumerable fragments of statues, columns, and other parts of buildings; and a quadrangular enclosure of brick walls is filled with broken remains of colossal figures and hieroglyphical tablets finely executed, whilst in a grove of mimosas or acacias similar relics of ancient sculpture occur at every step. In the plain, about half way between the desert and the river, are two statues called by some the statues of Memnon. They are about fifty feet in height, and seated each on a pedestal eighteen feet long, fourteen feet broad, and six feet high. The stone of which they are formed is a hard reddish sandstone, which, from the action of the weather, is in many places discoloured, and hence appears of a black, gray, brown, and even whitish hue. Few monuments of ancient magnificence have more interest attached to them than "Memnon's statue which at sunrise played," or at least that statue from which a certain mysterious sound was believed and reported to proceed every morning at sunrise;[4] and no question has been more keenly agitated among Egyptian antiquaries than that which relates to the identification of the statue said to have possessed this wonderful property. The French have adopted the opinion of those who regard as the vocal statue of Memnon the fallen colossus in front of the temple which they call the Memnonium. But Pococke has decided in favour of the northernmost of the two statues above described; and Mr Hamilton is inclined, on what appear to be good grounds, to prefer the opinion of our countryman. Strabo declares that the sound issued every day, resembling that of a slight blow; Pausanias agrees as to the statue uttering a sound daily at sunrise, but likens the sound uttered to that of the bursting of a string in a lyre or harp; Pliny relates the same extraordinary phenomenon, though his description of the vocal statue differs from that given by Strabo and Pausanias; and Philostratus says that it uttered a sound when the rays of the sun touched its lips.[5] In addition to these testimonies, which, from the particulars respecting the statue mentioned collaterally, seem, on the whole, to favour the opinion of Pococke, we have those of the numerous Greeks and Romans who at different times visited this statue, and engraved their names on its legs and feet, declaring that they had heard the sound or voice of Memnon at a certain hour, generally, a short time after sunrise.[6] Strabo, too, visited the statue, and heard the mysterious voice. These statues, when entire, might be seen at a distance of twelve miles, towering like solitary rocks in the midst of the plain; and the surprising length of their shadows at sunrise long rendered them an object of curiosity at that hour; but, like the kindred oracles which once inhabited the adjoining fanes, they had become mute. The hieroglyphical inscription on the throne of the vocal colossus proves that it represents Amenophis or Phamenoph II. who reigned about seventeen centuries before the commencement of the Christian era.[1]

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[1] The change of a few stones by the Ptolemy above named is thus pompously lauded in a hieroglyphic inscription which he caused to be cut on the masonry of the right side: "This beautiful repair was executed by the king lord of the World, the grand germ of the great gods, he whom Phtah has approved, living image of Ammon-Ra, the son of the sun, Ptolemy ever-living, the god beloved of Isis, the saviour god (*soter* NT-NOHEM), in honour of his father Ammon-Ra, who has granted him the periods of the national assemblies upon the throne of Horus." The Ethiopian, who was the real founder of the pylon, has however, been content with a simple intimation of his existence. On the entablature of the gateway is sculptured this brief inscription: "King Taharaka, the well-beloved of Ammon-Ra, lord of the thrones of the world, lives." (Champollion, *Lettres d'Egypte*, p. 327.)

[2] The dedication under the gallery on the right, which is one of the best preserved, will give an idea of all the rest. It is as follows: "*First line.* Life: Horus powerful, beloved of Phré, the sovereign of the higher and the lower region, grand chief of all parts of the world, Horus resplendent, great by his force, he who has struck the nine bows (the nomadic tribes), the gracious lord of the world, the sun that gives stability to the world, the son of the sun, Thouthmosis, benefactor of the world, vivified now and for ever. *Second line.* He has caused these structures to be erected in honour of his father Ammon-Ra, king of the gods, to whom is dedicated this great temple, in the western part of the Thouthmoseion of Ammon, in beautiful sandstone; this is what the king ever-living has done." (Champollion, *Lettres*, p. 329.)

[3] Of the subjects of these battle-pieces a very correct idea may be formed from the following description of the contents of two tablets given by Champollion in the only memorial he has left of his Egyptian labours:

"1^er^ *Tableau.* Grande bataille: le héro Egyptien, debout sur un char lancé au galop, décoche des flèches contre une foule d'ennemis fuyant dans la plus grande désordre. On apperçoit sur le premier plan les chefs Egyptiens montés sur des chars, et leurs soldats entremêlés à des alliés les Fekkaro, massacrant les Robou epouvantés, ou se liant comme prisonniers de guerre. Ce tableau seul contient plus de cent figures en pied, sans compter les chevaux.

"2^e^ *Tableau.* Les princes et les chefs de l'armée Egyptienne conduisent au roi victorieux quatre colonnes de prisonniers: des scribes comptent et enregistrent le nombre des mains droites et des parties génitales coupées aux Robou morts sur le champ de bataille. L'inscription porte textuellement: 'Conduite des prisonniers en présence de sa majesté; ceux-ci sont au nombre de mille; mains coupées, trois mille; phallus, trois mille.' Le Pharaons, aux pieds duquel on dépose ces trophées, paisiblement assis sur son char, dont les chevaux son retenus par des officiers, adresse une allocution à ses guerriers; il les félicite sur leur victoire, et prodigue fort naïvement les plus grands éloges à sa propre personne…En dehors de ce curieux tableau existe une longue inscription malheureusement fort endommagée, et relative à cette campagne, qui date de l'an cinquième du règne de Rhamses-Meiamoun." (*Lettres d'Egypte*, p. 341, 342.)

[4] *Dimidio magicæ resonant ubi Memnone chordæ.* JUVENAL.

[5] Hamilton's *Egyptiaca*, p. 168, et seqq. Pococke's *Travels.*

[6] One of the numerous Greek inscriptions upon the legs and feet of the vocal colossus of Memnon has been restored as follows:

Ἔκλυον αὐδησάντος ἐγὼ Ποβλιος Βαλβίνος
Φωνὰς τὰς θειὰς Μέμνονος ἢ Φαμενωφ.
Ἦλθον ὁμοῦ ἐρατᾷ βασιλῆϊδι τῇδε Σαβίνᾳ,
Ὥρας δὲ πρώτας ἅλιος ἔσχε δρόμον
Κοιρανῳ Ἁδριανῷ πέμπτῳ δεκάτῳ ἐνιαυτῷ.
Ἅματα δ' ἔσχεν Ἄθυρ εἴκοσι καὶ πισυρα.

The history of the vocal statue of Memnon has lately been written by M. Letronne, in a paper inserted in the *Mémoires de l'Académie des Inscriptions et Belles-Lettres*, new series, tom. x. "Ce sujet, curieux seulement en apparence, est devenu, sous la plume de M. Letronne, l'un des plus piquants et des plus utiles à étudier dans la recherche des rapports et du mélange des opinions de la Grèce avec celles de l'Egypte." (*Lettres*, ubi supra.)

Between Medinet-Habou and El-ebek or Kournah there is another mass of ruins as stupendous in their dimensions as they are admirable in their execution. They have been supposed by some to mark the site of the Memnonium, probably on account of the broken colossal statue of red granite which lies overturned within their precincts, while, according to others, they are the remains of the tomb of Osymandyas, the mighty conqueror whose sepulchre was to surpass every thing upon earth.[2] This last denomination originated with the French Egyptian Commission; and several travellers still persist in employing that of the Memnonium, which is equally ill applied and incorrect. The real name of the structure whose ruins yet attest its stupendous magnificence is, the Rhamesseion, so called from Rhamses the Great, to whom Thebes was indebted for the edifice; and this name, accordingly, is found sculptured in a hundred places, and repeated in the legends of the friezes, architraves, and bas-reliefs, which decorate the palace. "L'imagination s'ébranle," says Champollion, "et l'on éprouve émotion bien naturelle en visitant ces galeries mutilées et ces belles colonnades, lorsqu'on pense qu'elles sont l'ouvrage et furent souvent l'habitation du plus célèbre et du meilleur des princes que la vieille Egypte compte dans ses longues annales."[3] No part of the Rhamesseion remains entire; but what has escaped the barbarism of the Persians and the ravages of time is sufficient to give a pretty exact idea of the whole. Within the walls, which inclose a space of more than two hundred feet in breadth by six hundred in depth, the whole area is a forest of pillars, interspersed with fragments and fallen statues. The body of the palace was approached by a noble propylon, fronting the fertile plain, and resting upon it; but the remainder of the edifice rests on the adjoining mountain, the rock of which has been levelled to form the floor. In the propylon there are passages leading to several chambers and to the roof; and this propylon is separated from the first wall of the palace by a distance of a hundred and sixty feet. In the court behind the propylon are the fragments of the enormous statue already alluded to. It has been broken off at the waist, and the upper part is now laid prostrate on the ground. This enormous statue measures sixty-three feet round the shoulders, thirteen feet from the crown of the head to the top of the shoulders, thirteen and a half from the shoulder to the elbow, and nearly seven feet over the foot. The face has been so entirely obliterated that nothing even of its general expression can now be discerned. "Next to the wonder excited by the boldness of the sculptor who made it," says Mr Hamilton, "and the extraordinary powers of those who erected it, the labour and exertions that must have been used for its destruction are most astonishing."[4] The court which intervenes between the statue and the opposite quarter is about a hundred feet in width. Four square columns formerly stood on the opposite side of the door-way, making a row of eight, which faced a like number, some of which are still to be seen. Two sides of the court were bounded by a double row of enormous pillars, parts of the capitals of which, thirty-two feet in circumference, yet remain; and behind the square columns there were others of a similar description; so that, when the whole was roofed, it must have been a truly magnificent piazza. The fronts of the square columns have been carved into statues in full relief, measuring twenty feet to the shoulder; and below the figures, which are all shaped like a soros, are rows of hieroglyphics. The pillars form the ruins of a central hall, the roof of which was supported by forty-eight columns; beyond this is a second hall entered by a door-way, and divided from the other by a cross wall; and the remains of a third, which are seen farther on, terminate the magnificent ruins of the Rhamesseion. The side walls which inclose this edifice have been removed, and many columns and statues have been destroyed; but the remnants, which have escaped all sorts of ravages, are sufficient to awaken boundless admiration of the power as well as genius which presided in the construetion of the mighty fabric.[5] The architecture throughout is perhaps in the purest and noblest style of any at Thebes. It would be endless to attempt any detailed description of the hieroglyphics, pictorial tablets, and bas-reliefs of this wonderful monument. They relate principally to the achievements and conquests of Sesostris, and the adoration of the gods of Thebes by that mighty potentate. The following is the dedication of the great hall, sculptured in name of the founder, in beautiful hieroglyphics, upon the architraves of the left side: "Haroëris all powerful, the friend of truth, the lord of the upper and lower regions, the defender of Egypt, the castigator of foreign countries, Horus the resplendent possessor of the palms, the greatest of conquerors, the king-lord of the World, sun guardian of justice approved by Phré, the son of the sun, the well-beloved of Ammon, RHAMSES, has caused these structures to be erected in honour of his father Ammon-Ra, king of the gods: he has caused to be constructed, in good white sandstone, the Great Hall of Assembly, supported by large columns with capitals imitating full-blown flowers, and flanked by smaller pillars with capitals imitating a truncated bud of the lotus; and he has dedicated the Hall to the lord of gods, for the celebration of his assemblies; this is what the king ever living has done."[6]

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[1] A large temple, and a great number of fine statues, have since been discovered near the same spot in the course of the excavations which were made under the direction of Mr Salt and other recent travellers in Egypt.

[2] Diodorus Siculus, i. 47.

[3] *Lettres écrites d'Egypte et de Nubie*, p. 261.

[4] *Egyptiaca*, p. 167, 168. Mr Hamilton adds, "Its fall has carried along with it the whole wall of the temple [palace] which stood within its reach. It was not without great difficulty and danger that we could climb on its shoulder and neck; and in going down from thence on its chest I was assisted by my Arab servant, who walked by my side in the hieroglyphic characters engraven on the arm."

[5] Captain Head's *Eastern and Egyptian Scenery, Ruins, &c.* p. 22. The excellent lithograph view of the Rhamesseion given in this work was taken from the back of the prostrate colossus. There also remain the fragments of a statue of black granite, represented in Captain Head's plate, which has been absurdly styled the brother of the younger Memnon, which Mr Belzoni conveyed hence to England, and placed in the British Museum. Like its exported companion, it has a benignant expression of countenance, with the full Ethiopian expansion of nostril and lip by which the sphinxes in the neighbourhood are characterized. The features are somewhat elongated, but remarkably regular. For an account of Mr Belzoni's achievement, see *Researches and Operations*, p. 40, et seqq.

[6] Champollion, *Lettres écrites d'Egypte*, p. 273. In concluding his observations on this wonderful ruin, Champollion observes, "Le Rhamesseion est le monument de Thèbes le plus degradé, mais c'est aussi, sans aucune doute, celui qui, par l'élégante majesté de ses ruines, laisse dans l'esprit des voyageurs une impression plus profonde et plus durable." P. 291.

Having shown by the legends and other evidence that the magnificent ruin which has been considered by some as the remains of the Memnonium, and by others as those of the Tomb of Osymandyas, is in reality the wreck of the Rhamesseion, we shall now endeavour to ascertain the exact site of that celebrated edifice of Thebes called Amenophion by the Egyptians, but known among the Greeks by the name of the Memnonium. And here we may observe, that if what has been stated above respecting the statue of Memnon, or of Amenophis the third of that name, whom the Greeks call Memnon, be well founded, the position occupied by this and the corresponding colossus must in some measure determine the site of the Memnonium. Accordingly, the legends discovered on the ruins scattered about, such as the débris of architraves, portions of colossal figures, shafts of columns, and fragments of enormous bas-reliefs, together with the hieroglyphical inscriptions found in the *hypogœa* of the neighbourhood, which contained the mummies of the great officers charged, during their lifetime, with the guardianship of this edifice, all lead to the same conclusion which Jollois and Devilliers, in their excellent description of these ruins, had arrived at from other considerations; namely, that the ruins towards the extremity of which, on the side of the river, appear the two enormous monolith statues, about sixty feet in height, commanding the whole plain of Thebes, mark out the site of the Amenophion or Memnonium. These two figures, which are formed each of a single block of grey breccia, transported from the quarries of the upper Thebaid, and placed in a sitting posture on immense bases of the same material, with the hands extended on the knees in an attitude of repose, seem to have decorated the exterior façade of the principal pylon of the Amenophion; and, in an inscription on the seat of one of the figures, we find the names and titles of the third Amenophis of the eighteenth dynasty, called Memnon by the Greeks, who occupied the throne of the Pharaohs in the seventeenth century before the Christian era, most distinctly and accurately enumerated. The following is the concluding portion of this legend: "The lord sovereign of the upper and lower region, the reformer of manners, he who holds the world in repose, Horus, who, great by his power, has smitten the barbarians, the king sun lord of truth, the son of the sun, AMENOTHPH, moderator of the pure region, beloved of Ammon-Ra, king of the gods." The dedication of this palace, which is altogether dramatic, being in the form of a dialogue between Amenoph or Amenothph and Ammon-Ra, "king of the gods," is entirely in accordance with the inscription of which we have here quoted a part: the king appears in the character of founder of the edifice, and the Jupiter of the Egyptian Pantheon thus responds to the invocation of his representative upon earth: "Approach, my son, sun lord of truth, of the germ of the sun, son of the sun, *Amenothph;* I have heard thy words, and I perceive the structure which thou hast executed; I who am thy father rejoice in beholding thy good works." The identity of the Memnonium of the Greeks and the Amenophion of the Egyptians is therefore no longer doubtful; and it is still less so, that "when the Memnonium was in all its glory," it formed one of the greatest wonders of the old capital of Egypt.[1]

Situated behind the Amenophion, in a valley formed by the rocks of the Libyan mountain and a large mamelon detached from them on the side of the plain, is a small temple in a state of perfect preservation, which the French Egyptian Commission has described under the name of the Little Temple of Isis. It is entered by a small propylon of sandstone attached to the enceinte, and covered on the exterior side with sculptures heavily elaborated. Its situation is dreary and dismal. The tablets upon the bandeau of the gateway represent on the one side Ptolemy Soter II. presenting offerings to Hathôr and the great triad of Thebes, Ammon-Ra, Mouth, and Chons; and on the other, the goddess Thmé or Themeï (Themis), and a triad formed of the hieracocephalous god Mandou, his wife Ritho, and their son Harphré. The temple was therefore dedicated to Hathôr or Venus, identified with Themeï or Themis; in other words, the principle of beauty was here worshipped mythologically in conjunction with that of truth and justice. This is completely confirmed by the hieroglyphical inscription sculptured along the frieze of the pronaos, part of which has been translated by M. Champollion. The naos is divided into three contiguous halls, forming as many sanctuaries, the principal of which, being that in the middle, is entirely covered with sculptures of an import similar to those already described. The sanctuary on the left was consecrated to Themeï, and all the tablets with which it is decorated relate to the functions performed by that goddess in Amenti, or the Egyptian Tartarus.[2]

The palace of Kournah, though also of small dimensions compared with the great and important edifices we have described, is nevertheless an interesting monument, as it belongs to the Pharaonic times, and dates from the most glorious epoch in the annals of ancient Egypt. Besides, its appearance presents a character altogether new; and if its general plan suggests the idea of a private habitation, and seems to exclude that of a temple, the magnificence of the decoration, the profusion of the sculptures, the beauty of the materials, and the perfection of the execution, prove that this habitation formerly belonged to a rich and powerful sovereign. The remains of this palace occupy only the extremity of an artificial mound or bank of earth, on which there were formerly other structures connected with that which still exists; at least all the fragments scattered over the ground bear royal names belonging either to the last Pharaohs of the eighteenth or the first of the nineteenth dynasty. In the same line with these remains rises a portico a hundred and fifty feet in length and thirty in height, supported by ten columns, whose shafts are composed of wreaths of lotus-stems, whilst the capitals are formed of buds and flowers of the same plant, truncated so as to admit the coping. On the four faces of the capitals are sculptured with much care the royal legends of Menephtha I. and also those of Rhamses the Great; and the names of these Pharaohs are likewise inscribed on the shafts of the columns, but joined together and included in a square tablet. The dedicatory legend which adorns the architrave of the portico, occupying its whole length, establishes two principal facts; first, that the palace of Kournah was founded and erected by Menephtha I.; and, secondly, that his son Rhamses the Great, having completed the decoration of the edifice, surrounded it with an enceinte ornamented with propylons, and similar to that within which each of the great royal monuments at Thebes is contained. In fact, all the bas-reliefs which decorate the interior of the portico, and the exterior of the three gates which lead to the apartments of the Menephtheion, represent Menephtha I. and more frequently still Rhamses the Great, rendering homage to the Theban triad and to the other divinities of Egypt, or receiving from the munificence of the gods royal powers and precious gifts in order to embellish and prolong life. And the only sculptures of the edifice posterior to the time of Rhamses the Great consist of some royal onomastic inscriptions, placed either on the sides or basement of the gates, but wholly unconnected with the primitive decoration; all of them, with the exception of one which contains the names and titles of Rhamses-Meiamoun, belonging to the reign of Menephtha II. the son and immediate successor of Rhamses the Great.[1]

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[1] Champollion, *Lettres écrites d'Egypte et de Nubie*, p. 303, et seqq. Among the ruins of the Amenophion, on the side of the Libyan mountains, on the border of the desert, are two blocks of grey breccia, each about thirty feet in length, which exhibit the form of enormous *stelæ* or pillars, and are covered with hieroglyphical tablets, which, according to Champollion, "nous montrent toujours le roi *Amenophis-Memnon*, accompagné ici de la reine Taïa son épouse, accuillis par le dieu Amon-Ra, ou par Phtah-Socharis." P. 309.

[2] The two sovereigns of this terrible place (where, according to the Egyptian mythology, the souls of men were judged), Osiris and Isis, receive at first the homage of Ptolemy and Arsinoë, gods Philopators; and on a cross or partition wall is sculptured the grand scene of the psychostasis. This vast bas-relief represents the hypostyle hall called in Egyptian *Oskh*, or the court of Amenti, with suitable decorations. The grand judge, Osiris, occupies the further extremity of the judgment-hall; and at the foot of his throne appears the lotus, the emblem of the material world, surmounted with images of his four children, the directing genii of the four winds or cardinal points. The forty-two judges, assessors of Osiris, are ranged in a double line, each having his head surmounted with an ostrich feather, the symbol of justice; whilst, on a bench before the throne, the Egyptian Cerberus, or *Teouôm-enement*, a triple monster, at once crocodile, lion, and hippopotamus, opens his horrid jaws, ready to devour guilty souls. Towards the door of the tribunal appears the goddess Thmeï redoubled, or twice represented, by reason of her twofold function of goddess of truth as well as of justice; and the first form, qualified as Thmeï, ruler of Amenti (truth), presents the soul of an Egyptian, under a corporeal form, to the second personation of the goddess (justice), whose legend is as follows: "Thmeï, who resides in Amenti, where she weighs the hearts of all men in a balance, and whom the wicked cannot escape." In the neighbourhood of him who is here undergoing his final trial are the words, "arrival of a soul in Amenti;" and further on is an infernal balance, into the scales of which Horus, the hawk-headed son of Isis, and Anubis the shakal-headed son of Osiris, are placing, the one the heart of the arraigned, and the other a feather, the emblem of justice; whilst, between the fatal instrument which is to decide the fate of the soul, and the throne of Osiris, is placed the biocephalous god Thoth, described as "thrice great, the lord of Schmoun (*Hermopolis Magna*), the lord of the divine words, the secretary of justice to the other gods in the hall of justice and of truth." This divine recorder writes the result of the trial to which the heart of the deceased Egyptian has just been subjected, and goes to present his report to the sovereign judge who presides in Hades. (Champollion, *Lettres écrites d'Egypte*, pp. 319, 320.)

The catacombs in the western mountains are not less abundant than the monuments we have described, in treasures illustrative of the ancient history of Egypt. In the valley of Biban-el-Molouk, a rocky ravine to the south-west of Kournah, are the sepulchres of the kings of the three Diospolitan or Theban dynasties, being the eighteenth, nineteenth, and twentieth.[2] The site chosen for the royal necropolis appears to be eminently suited to its melancholy destination; for a valley or ravine, encased, as it were, by high precipitous rocks, or by mountains in a state of decomposition, presenting large fissures, occasioned either by the extreme heat or by internal sinking down, and the backs of which are covered with black bands or patches, as if they had been in part burned, is a spot which, from its loneliness, desolation, and apparent decay, harmonizes well with our ideas as to the most fitting locality for a place of tombs. No living animal, it is said, frequents this valley of the dead; even the fox, the wolf, and the hyena shun its mournful precincts; and its doleful echoes are only awakened at intervals by the foot of the solitary antiquary, led by inquisitive curiosity to pry into the very secrets of the grave. The catacombs or *hypogœa* are all constructed on nearly the same plan, yet no two of them are exactly alike: some are complete, others appear never to have been finished, and they vary much in the depth to which they have been excavated. In general, the entrance is by the exterior opening of a passage twenty feet wide, which descends gradually about fifty paces, then expands whilst the descent becomes more rapid, and is continued for some distance farther. On either side of this passage is a horizontal gallery, on a level with the lowest part of the first descent; small chambers also branch off sides of the second descent; at the interior extremity there is a spacious and lofty apartment, in the centre of which is placed the royal tomb; and beyond this there are commonly other small chambers at the sides, whilst in some cases the principal passage is continued a long way into the rock. The royal tomb is for the most part a sarcophagus of red or grey granite, circular at the one end and square at the other; but where there is no sarcophagus a hole or grave is discovered, cut in the rock to the depth of from six to thirty feet, and which appears to have been covered by a granite lid. Almost all the lids, however, belonging to the graves excavated in the rock, have either been removed or broken. In those sepulchres which have been finished, the walls from one end to the other are all covered with sculptures and paintings executed in the best style of ancient art; and, owing to the unparalleled dryness of the atmosphere in Egypt, the colours, where they have not been purposely damaged,

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[1] Champollion, *Lettres*, 380, et seqq. It may perhaps conduce to perspicuity, or at least serve to prevent mistakes, if we introduce here the eight reigns anterior to that of Rhamses-Meiamoun, in their chronological order. They stand thus: 1. Amenophis II. or Memnon; 2. Horus; 3. Rhamses I.; 4. Menephtha 1. or Ousireï; 5. Rhamses the Great, or Sesostris; 6. Menephtha II.; 7. Menephtha III.; 8. Rhamerreh; and, 9. Rhamses-Meiamoun. The monuments of different orders having clearly demonstrated that Rhamses the Great, the Sesostris of Herodotus, must be included in the eighteenth dynasty, as answering exactly to the Rhamses called *Ægyptus* in the extracts of Manetho, it follows that in Rhamses-Meiamoun, the Rhamses-Sethos of the same lists of Manetho, we recognise the head or chief of the nineteenth dynasty.

[2] The following is Manetho's catalogue of the Diospolitan dynasties and kings.

XVIII. Dynasty. Diospolitan.

		Years.	B. C.
1.	Thouthmosis or Amosis, reigned	24	1874
2.	Chebron his son	13	1750
3.	Amenophthis	20	1737
4.	Ammosis, sister	18	1717
5.	Mesphres, son	16	1699
6.	Misphragmuthosis	23	1683
7.	Thmosis or Thouthmosis, s.	9	1660
8.	Amenophis, s. (Memnon)	31	1651
9.	Horus, s.	41	1620
10.	Acenchres, d.	23	1579
11.	Rathotis, sist.	15	1556
12.	Acencheres, s.	17	1541
13.	Acencheres II. s.	11	1524
14.	Armais	6	1513
15.	Ramesses or Rhamses s.	68	1507
16.	Armesses Meiamoun, s.		
17.	Amenophis or Amenophth	15	1439

XIX. Dynasty. Diospolitan.

		Years.	B. C.
18.	Rhamses the Great or Sesostris	53	1424
19.	Rapasces	63	1371
20.	Ammenophthes	60	1308
21.	Rameses or Rhamses		
22.	Ammenemes	15	1248
23.	Thuoris	7	1233

XX. Dynasty. Diospolitan.

		Years.	B. C.
24...35.	Twelve kings	125	1226

are as fresh as when first laid on.[1] The labours of Belzoni in exploring these tombs, and the success with which they were rewarded, are well known. Strength and resolution as herculean and inflexible as his were required to overcome the suspicions of the Arabs, the want of mechanical aid, and the heat and closeness of the caverns; but his perseverance was amply recompensed by the discovery of six tombs in this hypogean city of the dead. The most remarkable of these, with all its galleries, is upwards of three hundred feet in length, and is called by Belzoni the tomb of Apis, from his having found the mummy of a bullock in one of its chambers. In another apartment there was a magnificent sarcophagus of white alabaster, almost as transparent as crystal; and the whole excavation, sculptured and painted in the most finished style of art, was in the most perfect preservation.[2] These catacombs, as already stated, were the sepulchres of the kings of the three Diospolitan dynasties; and accordingly, by means of the hieroglyphical inscriptions, Champollion discovered the tombs of six kings of the eighteenth dynasty; that of Amenophis-Memnon, the most ancient of all, in an isolated part of the valley towards the west; and, lastly, those of Rhamses-Meiamoun, and six other Pharaohs, his successors, belonging either to the nineteenth or the twentieth dynasty. No sort of order, either in regard to dynasty or succession, appears to have been observed in the choice of situations for the different royal tombs; on the contrary, each sovereign seems to have caused his own to be dug wherever he found a vein of stone adapted for the purposes of sepulture and the immensity of the projected excavation. The royal catacombs, however, which have been thoroughly completed and finished are but few in number: these are, the tomb of Amenophis III. or Memnon, the decoration of which has been almost entirely destroyed; that of Rhamses-Meiamoun, that of Rhamses V., probably also that of Rhamses the Great, and, lastly, that of Queen Thaoser. All the others are incomplete. The tomb of the great Rhamses or Sesostris still exists, according to M. Champollion, and is the third on the right of the principal valley; but it has sustained greater injury than almost any others, and is filled nearly to the ceiling with rubbish. That of Rhamses V. is remarkable for a large tablet and an inscription on a cross wall in the apartment at the further extremity of the catacomb, containing images or delineations of the forty-two assessors of Osiris, intermixed with justifications which the king is supposed to offer to these severe judges, each of whom appears to be charged with investigating a particular offence or sin, and with punishing it in the soul of the sovereign subjected to their jurisdiction. The royal justification amounts merely to a negative confession, which, whatever may have been its effect in the Egyptian Amenti or Hades, would, in judging kings, certainly go a great way upon earth. It is somewhat in this strain: The son of the son Rhamses has *not* been guilty of great iniquities; he has *not* blasphemed; he has *not* been a drunkard; he has *not* been indolent or lazy; he has *not* seized upon the offerings devoted to the gods; he has *not* told falsehoods; he has *not* been a libertine; he has *not* stained himself with impurities; he has *not* hung down his head when hearing the words of truth; he has *not* been prolix in his talk; he has *not* had to devour his heart, or, in other words, to repent of any wicked action; and so on through the remaining thirty-one negations.[3]

Having thus described the Diospolitan monuments on the western bank of the Nile, we now turn to the still grander and more magnificent remains with which the eastern bank of the river is adorned. No people, ancient or modern, can boast of an architecture approaching in magnitude and sublimity, not to mention elaborate decoration, to that of the old Egyptians, who conceived men a hundred feet in height, and not only planned, but erected temples and palaces larger than some modern cities. In Europe the imagination is easily transported beyond the dimensions of our proudest and most magnificent porticoes, and it can readily conceive something of the kind upon a still grander scale; but in Egypt it sinks abashed, overawed, and powerless at the base of the hundred and forty columns of the hypostyle hall of Karnak. The first sight of the wonderful structures on the right bank arrested the march of the French army; the troops, suddenly overpowered with awe and wonder, stood motionless, and it was only after a time that they could whisper to each other, "This is Thebes."[4] The monuments on the eastern bank of the Nile are the palace of Luxor and the temple of Karnak.

In approaching the palace of the Pharaohs from the north, the first object which meets the view is a magnificent propylon or gateway two hundred feet in length, the top of which is elevated about sixty feet above the present level of the soil. And in front of this entrance are the most perfect obelisks in the world, each formed of a single block of red granite from the quarries of Elephantiné: they are between seven and eight feet square at the base, and about eighty feet in height, and many of the hieroglyphical figures with which they are covered are cut an inch and three quarters deep, exhibiting at the same time the greatest nicety and precision of execution. Between these obelisks and the propylon are two colossal statues, also of red granite, measuring forty-four feet from the ground, and supposed, from the difference of the dresses, to have been, the one a figure of a male, and the other that of a female. Another propylon of similar proportions guards another approach, and from both gateways magnificent peristyles lead to the main body of this palace of the Pharaohs. Some of the columns of the peristyles are eleven feet in diameter. The sculptures on the pylons, like those at Medinet-Habou, represent the victories of Sesostris, with the greatest amplitude of detail. "It was impossible," says Mr Hamilton, "to view and to reflect upon a picture so copious and detailed, without fancying that I here saw the original of many of Homer's battles, the portrait of some of the historical narratives of Herodotus, and one of the principal ground-works of the narratives of Diodorus; and, to complete the gratification, we felt that, had the artist been better acquainted with the rules and use of perspective, the performance might have done credit to the genius of a Michael Angelo or a Julio Romano." In regard to the general plan of the palace and its environs, as well as the distribution of the entrances and of the interior of the building, the delineations of Pococke and Denon, to which may be added those contained in Captain Head's work, will serve to convey a more distinct and accurate idea of the magnificent design than can be communicated by any verbal description. "But without personally inspecting this extraordinary edifice," says Mr Hamilton, "it is impossible to have any adequate notion of its immense size, or of the prodigious masses of which it consists. In both these respects, and, combined with them, in respect to the beauty and magnificence of its several parts, it is, I should imagine, unique in the whole world."[1] The founder of this marvellous palace is conjectured, from the inscriptions, to have been Amenophis-Memnon, or Amenophth III., who is supposed to have erected the series of edifices extending south and north from the Nile as far as the fourteen columns of forty-five feet in height, which also belong to the same reign. The dedication by this Pharaoh may be read on all the architraves of the columns, a hundred and five in number, and for the most part entire, which adorn the courts and inner halls. The bas-reliefs which decorate the palace of Amenophis relate chiefly to the religious acts performed by that prince in honour of the divinities of this portion of Thebes; namely, Ammon-Ra, Ammon-Ra-Generator, his secondary form, the goddess Tamoun, one of the forms of Neïth, the goddess Mouth, companion of Ammon-Ra, and the young gods Khons and Harké, the two great triads adored at Thebes. The two obelisks of red granite in front of the northern pylon were erected by Sesostris in order to decorate his Rhamesseion. This is proved by the hieroglyphic inscription on the obelisk on the left, which is in these terms: "The lord of the world, sun guardian of truth (or justice), approved by Phré, has caused this edifice to be built in honour of his father Ammon-Ra, and has also erected these two great obelisks of stone before the Rhamesseion of the city of Ammon."[2]

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[1] Hamilton, *Egyptiaca*, pp. 155, 156.

[2] Belzoni, *Researches and Operations*, p. 123 and 224, et seqq. Mr Salt observes that the colours are generally pure and brilliant, but intermixed with each other nearly in the proportions of the rainbow, and so subdued by the proper introduction of blacks as not to appear gaudy, but to produce a harmony that in some of the designs is really delicious. "One would think it was in Egypt," says Mr Bechey, "that Titian, Giorgione, and Tintoret, had acquired all that vigour and magic of effect which distinguishes them so remarkably from all other painters in point of arrangement, and principally in the happy disposition of their darks." (Young, *View of the latest Publications relating to Egypt*.)

[3] Champollion, *Lettres écrites d'Egypte*, p. 221, et seqq.

[4] Napoleon's *Memoirs*, vol. ii. Denon's *Travels in Egypt*.

The palace at Luxor communicates with the temple at Karnak, an edifice not less Titanian in its dimensions, nor less marvellous in its structure. This temple has twelve principal entrances, each of which is composed of several propyla or colossal gateways, besides other buildings attached to them larger than most temples. The sides of some of these gateways are equal in dimensions to the bases of the greater part of the pyramids in the Heptanomis, and they are built in the same style, each layer of stone projecting a little beyond that immediately above it. One of the propyla is built entirely of granite, and adorned with hieroglyphics of the most finished execution; and on each side of several of these there have been colossal statues of basalt, breccia, and granite, some in a sitting posture, some erect, and varying from twenty to thirty feet in height. Avenues of sphinxes lead in several directions to the propyla, and correspond to the magnificence which they promise. The principal of these, continued across the plain to the palace at Luxor, establishes a communication to which there is no parallel upon earth.[3] For the space of nearly a mile and a quarter (1026 toises, or about 6200 feet), a broad raised causeway, bordered by more than six hundred colossal sphinxes, representing lions with rams' heads, leads from the one edifice to the other; and another similar road, branching off from this, passed between figures of rams on lofty pedestals to a triumphal gateway leading to a temple, apparently the most ancient in Thebes. "On approaching the avenue of sphinxes which leads to the great temple, the visitor," says Belzoni, "is inspired with devotion and piety; their enormous size strikes him with wonder, and respect for the gods to whom they were dedicated."[4] The body of the temple, which is preceded by a large court, at the sides of which are colonnades of thirty columns in length, and through the middle two rows of columns fifty feet in height, consists principally of a grand hypostyle hall or portico, the roof of which is supported by a hundred and thirty-four columns, some of them twenty-six and others thirty-four feet in circumference; and four beautiful obelisks mark the entrance to the adytum or sanctuary, near which the sovereign of the gods is represented as embraced by Isis. The adytum itself consists of three apartments, formed entirely of granite. The part of the edifice at which the branch of the avenue of sphinxes terminates is the most surprising of all amongst these astonishing monuments. From most points of view it appears a boundless, confused wreck of splendid buildings, scattered in every direction, without any perceptible order or design; but, when viewed from the north-west end of the principal group, the whole may be surveyed by the eye at once, and the extraordinary dimensions and magnificence of the great entrance from the west in some measure appreciated. An unfinished pylon, succeeded by an avenue of columns more than seventy-five feet in height, all of one block, but only one of them standing; a second pylon, leading to a hall three hundred and thirty-eight feet in length by a hundred and sixty-eight feet in breadth; a third pylon, opening into a court in which there are two obelisks more than seventy-two feet in height; and a fourth pylon, leading to a court in which is the largest obelisk ever formed of one stone; all these magnificent objects are seen following exactly in the same line, and forming a perspective, the effect of which cannot be conveyed by any drawing, much less by any description. The great obelisk is nearly a hundred feet in height, and, as already stated, is formed of a single block.[5] The walls are everywhere covered with hieroglyphics or sculptures representing the battles, triumphs, sacrifices, processions, and festivals of the ancient Egyptians; and the colours with which they were decorated are still, in many places, extremely fresh and vivid. On the northern side of these gigantic edifices there were also triumphal arches, colonnades, sphinxes, and other monuments of Egyptian art and magnificence in vast numbers; but they have also suffered more or less from the ravages of fanatical invaders, or the slower but not less certain havoc committed by naturalized barbarians. On the great dwelling of Ammon,

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[1] Hamilton's *Egyptiaca*, p. 121.

[2] Champollion, *Lettres écrites d'Egypte*, p. 215. In a letter dated from Thebes, Champollion, speaking of the Egyptian architecture, observes: "It is evident to me, as it must be to all who have examined Egypt, or have an accurate knowledge of the Egyptian monuments existing in Europe, that the arts commenced in Greece by a servile imitation of the arts in Egypt, much more advanced than is commonly believed, at the period at which the first Egyptian colonies came in contact with the inhabitants of Attica or the Peloponnesus. Without Egypt, Greece would probably never have become the classical land of the fine arts; such at least is my belief touching this great problem. I write these lines almost in presence of bas-reliefs which the Egyptians executed with the most refined elegance of workmanship seventeen hundred years before the Christian era. What were the Greeks doing then?"

[3] Hamilton's *Egyptiaca*, p. 122.

[4] *Researches and Operations in Egypt and Nubia*, p. 152. From the ruins within the area of the ancient temple ascribed to Osymandyas, Belzoni recovered many fine specimens of Egyptian art, which are now in the British Museum, and amongst these a statue which is supposed by some to represent that great conqueror, in other words, Sesostris.

[5] *Encyclopædia Metropolitana*, art. *Egypt*.

Champollion observed real portraits of most of the old Pharaohs renowned for their great actions, each with his appropriate physiognomy, and therefore distinguishable from the others. In the colossal tablets, which are as finished in execution as they are heroic in design, may be seen Mandoueï combating the enemies of Egypt, and returning in triumph to his native country; the campaigns of Rhamses the Great are also represented with much fulness of detail; and Sesonchis may likewise be observed dragging to the feet of the Theban trinity (Ammon, Mouth, and Khons) the chiefs of more than thirty conquered nations, including amongst the last the Israelites or Jews. One of the bas-reliefs, representing Judah personified, contains, in hieroglyphic characters, the IUDAHAMELEK, "the kingdom of the Jews, or of Judah," and thus forms a sort of commentary to the fourteenth chapter of the second book of Kings, which records the arrival of Sesonchis at Jerusalem, and the success of that invader, at the same time establishing the identity of the Egyptian Scheschonk, the Sesonchis of Manetho, and the Sesak or Scheschôk of Scripture. This, it will be admitted, is a very remarkable and interesting discovery.[1]

That the magnificent ruins of Medinet-Habou, Luxor, and Karnak, are the remains of the Thebes described by Homer, the earliest capital of the world,

> That spread her conquests o'er a thousand states,
> And poured her heroes through a hundred gates,

cannot possibly be doubted. According to the admeasurement made by the French, the distance of these ruins from the sea amounts to eight hundred and fifty miles, and from Elephantiné two hundred and twenty-five, thus corresponding pretty exactly with the 6800 and 1800 stadia respectively mentioned by Herodotus. Exclusively of the hippodrome and of Medamoud, the circumference of the ruins is from fourteen to fifteen thousand mètres, which agrees with the 140 stadia, or seventeen miles and a half, mentioned by Diodorus Siculus as the circumference of the ancient capital of Egypt. The origin of the name of this celebrated city, as well as the date of its foundation, is unknown. It has been conjectured, however, that the word *Thebæ* is derived from the Egyptian word *Thbaki*, signifying "the city;" and hence the *Diospolis* of the Greeks is, in this view, a mere translation of the Thbaki-antepi-Amoun, or the city of Ammon the most high god. The No-Ammon of the Hebrews, though identical in import with the Greek name, applies not to *Diospolis Magna*, but to *Diospolis Parva*, in the Delta.[2]

Kous, called Kous-birbir by the Egyptians, occupies the site of the *Apollonopolis Parva* of the Greeks. Of its ancient edifices there exists only a propylon, half buried in the sand. This propylon was dedicated to the god Aroëris; and his images, sculptured on all the faces, are adored on that which looks towards the Nile, being the principal one. The upper face towards the temple is covered with sculptures, amongst which may be discovered the royal legends of Ptolemy-Alexander I., who also takes the surname of Philometor. With respect to the Greek inscription, the restitution of ΣΩΤΗΡΕΣ, at the commencement of the second line, proposed by M. Letronne, is undoubtedly right; but the proposed substitution of ΗΛΙΩΙ for ΑΡΩΗΡΕΙ is not equally fortunate, the words ΑΡΩΗΡΕΙ-ΘΕΩΙ being still distinctly legible.[3] At Keft, Kebt, or Coptos, which, like Kous, is near an opening into the valley of Cosseir, nothing remains entire. The temples were demolished by the Christians, and the materials employed in building a large church, in the ruins of which may be found numerous portions of Egyptian bas-reliefs. Amongst the royal legends were recognised those of King Nectanebo, and of the Emperors Augustus, Claudius, and Trajan; from which it may be inferred that the city of Coptos contained few monuments of high antiquity. It is first mentioned in history under the Ptolemies; it attained its greatest prosperity in the time of Strabo; it began to decline about the beginning of the eleventh century; it was greatly reduced in the fourteenth, and is now a wretched Arab village, distinguished only by the remains which we have mentioned.[4] Kenneh or Ghenneh[5] has now succeeded Keft and Kous as the entrepôt for the Arabian and Indian commerce with Egypt, and it is the place where all the caravans and pilgrims travelling eastward usually assemble.

Opposite to Kenneh is the village of Denderah, on the left bank of the Nile, surrounded by groves of date, palms, and domms; the latter of which is seldom or never seen farther northward. About a mile and a half to the east of this village lie the ruins of *Tentyris*, occupying an area of more than a mile in length, about half a mile in breadth, and rather more than two miles and a half in circumference. Amidst the high mounds and dilapidated walls of this ancient city are the remains of a small hypæthral temple, about sixty feet square, consisting of twelve columns placed at the sides, and connected by a wall reaching to within sixteen feet of their capitals, but entirely free from hieroglyphical sculptures, and with capitals which in form approach to those of the old Tuscan order. The entrances, two in number, are in a line with the other approaches to the great temple, and seem to mark out this small edifice as having formed one of its appendages. At a short distance from the building in question is the principal propylon of the great temple, that magnificent edifice which has rendered Denderah so long famous among the cities of Egypt. This propylon is one of the most perfect models of Egyptian architecture; and, notwithstanding one side has in part fallen down, it still retains the true Egyptian character of grandeur and simplicity.[6] "Je n'essaierai pas

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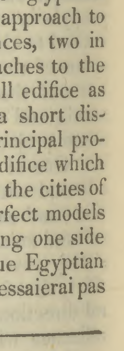
[1] Champollion, *Lettres*, p. 99. According to the Bible, Sesonchis attacked and took Jerusalem in the fifth year of the reign of Rehoboam; and it is this victory, accordingly, which the bas-relief of Karnak commemorates. The personification of the kingdom of Judah represents the physiognomy of the Jewish people, as it was conceived by the Egyptians in the tenth century before our era; and it is not impossible that Rehoboam himself may have sat for the portrait. The hieroglyphic legend which fixes the character of the tablet is given on the margin. The personification we have been obliged to omit; it appears, however, to have been executed with that fidelity of physiognomy which is remarkable in all the ancient Egyptian works of art referable to the foreign nations whom they have represented on their monuments. Upon the whole, if this discovery be taken in connection with others, particularly the delineations of captive Jews found by Belzoni in the catacombs of Biban-el-Molouk, and the deciphering of the name of Tirhakah king of Ethiopia by Mr Salt, it will not be disputed that Scripture history may receive illustrative confirmation from the study of Egyptian antiquities.



[2] Champollion, *Egypte sous les Pharaons*, tom. i. p. 218, and tom. ii. pp. 132, 133.

[3] The error of M. Letronne, in the latter case, appears to have been caused by the figured design in the *Description de l'Egypte* which distinctly bears ΗΛΙΩΙ, instead of ΑΡΩΗΡΕΙ, as read by Mr Hamilton and others.

[4] Jollois and Devilliers in *Description de l'Egypte*, tom. ii. ch. 10, p. 63.

[5] Probably the Kani of the *Mamluk Territorial Register*. Abd-el-latif, 704.

[6] Hamilton's *Egyptiaca*, p. 194.

de décrire l'impression," says Champollion, " que nous fit le grand propylon et surtout le portique du grand temple. On peut bien le mesurer, mais en donner une idée c'est impossible. C'est la grace et la majesté reunies au plus haut degré."[1] The height of this gateway is forty-two feet, the width thirty-three, and the depth seventeen; each front, as well as the interior, is covered with sculpture beautifully executed;[2] and upon its roof was the celebrated planisphere now at Paris, and so long the subject of extravagant speculations connected with the chronology of Egypt. For some reason, whether arising from war, revolution, or deficiency of money, the flanks have been left unfinished. The portico, which so particularly attracted the admiration of Champollion, and is indeed most beautiful, consists of twenty-four columns, disposed in three rows, each being above twenty-two feet in circumference, thirty-two in height, and covered with hieroglyphics. The capitals of the columns are square, with a front face of Hathôr, to whom the temple was dedicated, on every side. These pictures fill a space of eight feet each; the plinth that crowns the capital is high; and the whole is completed by a rich entablature, surmounted with the bold cornice which is always so striking in Egyptian architecture. This beautiful structure, if clear of rubbish, would present a front of a hundred and sixty feet, with a height of sixty feet; the whole exhibiting a magnificent picture of nearly a thousand square feet, relieved by processions and other decorations.[3] Several chambers, attached to the interior of the temple, are covered with astronomical, or perhaps rather astrological decorations; and the calculations deduced from these occasioned at one time so powerful a prepossession in favour of their extreme antiquity, that some very obvious proofs of the contrary were overlooked. Comparatively speaking, the edifice is modern. As its basis rests on a terrace which is still nearly fifteen feet above the level of the neighbouring country, whilst similar terraces at Thebes are only on a level with the surface of the Nile, above which they were once greatly elevated, it may therefore be inferred generally, that the great temple at Denderah was not older than the time of the Ptolemies, or perhaps than that of the Romans. Such was the conclusion deduced by Visconti, and after him by Belzoni, whose practical investigations enabled him to ascertain the fact upon which the inference rests. But, on the other hand, Jollois, judging, as he says, from the style and execution of the sculptures, maintains that they cannot have been finished subsequently to the time of Cambyses.[4] Unfortunately for this opinion, however, the hieroglyphics upon the walls of the temple completely confirm the evidence afforded by the Greek inscription over the entrance of the pronaos, and establish the correctness of Visconti's conclusion. The epochs of the decoration may be very briefly stated. The most ancient part is the exterior wall at the extremities of the temple, where are figured in colossal proportions Cleopatra and her son Ptolemy Cæsar. The superior bas-reliefs belong to the time of Augustus, as also the exterior lateral walls of the naos, with the exception of some small portions, which only date from the reign of Nero. The pronaos is entirely covered with imperial legends of Tiberius, Caius, Claudius, and Nero; but in the interior of the naos, as well as in the chambers and edifices constructed upon the terrace of the temple, there does not exist a single sculptured oval or cartouch. None of the sculptures in these apartments go farther back than the time of Trajan or Antoninus; and they resemble that of the propylon on the south-east, which dates from the reign of the latter, and, being dedicated to Isis, conducted to the temple of that goddess, which is placed behind the great temple, dedicated, as already mentioned, to Hathôr or Venus. The grand propylon above described is covered with images of the emperor Domitian. With regard to the Typhonium, it appears to have been decorated under Trajan, Hadrian, and Antoninus Pius; but, from a Greek inscription, it would seem that one of the propylons was erected by the inhabitants of the nome in the thirty-first year of the reign of Augustus, A. D. 23.[5]

At, or rather a little below, Denderah, the Nile suddenly changes its course, and for about nine miles runs nearly due west, after which it resumes its original direction. Near the bend or elbow formed by the return of the river to its course, lay the town of Abydos, once the second city of the Thebaid; and at a small distance from the Nile, near the western mountains, was the residence of an ancient king, called Ismandis by the Egyptians, and Memnon by the Greeks. At the latter place are the remains of a fine building, which some antiquaries have agreed to denominate a Memnonium, but which is now known by the name of El-Berba or the temple. In one of the inmost chambers of the edifice Mr W. J. Bankes, in 1818, discovered a large hieroglyphical tablet, containing a long series of royal names, which have since been deciphered conformably to the principles first expounded and exemplified by Dr Young, and found in the main to correspond with those in the Royal Canon of Manetho. The interesting relic of antiquity thus discovered, and which has become so celebrated in hieroglyphical literature under the name of the tablet of Abydos, exhibits a genealogical table of the immediate predecessors of Rhamses the Great, the Sesostris of Herodotus, and, from the data which it furnishes, compared with other documents, enables us to ascertain, with some degree of probability, that Sesostris, under whom the sculptures were executed, must have ascended the throne of Egypt about the year before Christ 1473.[6] Further, the epoch thus determined, though certainly liable to some objections, is nevertheless supported by numerous concurring and independent testimonies, which, from their striking coincidence, warrant a reasonable expectation that the true era of Sesostris, which is the grand key to so many other important dates, will ultimately be fixed beyond the possibility of controversy.[1] The population of Abydos, as well as that of *Diospolis Parva* or Hô, appears to have been transferred to Ptolemais, the capital of the Thinite nome, at or near Syis, the Psoi or Soi of the Egyptians.[2]

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[1] *Lettres écrites d'Egypte*, p. 90.

[2] " Non deplaise à personne," says Champollion, " les bas-reliefs â Dendérah sont *détestables*, et cela ne pouvait être autrement; ils sont d'un temps de décadence. La sculpture s'était déjà corrompue, tandis que l'architecture, moins sujette à varier puisqu'elle est un art chiffré, s'était soutenue digne des dieux d'Egypte et de l'admiration des tous les siècles." (*Lettres*, p. 91.) Mr Hamilton's opinion is diametrically opposed to that which is here expressed (see *Egyptiaca*, p. 193); and indeed it is not easy to conceive how architecture could sustain itself in a state of perfection " worthy of the gods of Egypt, and the admiration of all ages," if the other kindred arts had fallen into such a " detestable" condition as M. Champollion seems to intimate.

[3] Mr Hamilton speaks of this temple with unusual enthusiasm. " After seeing innumerable monuments of the same kind throughout the Thebaid," says he, " it seemed as if we were now arrived at the highest pitch of architectural excellence that ever was attained on the borders of the Nile. Here we found concentrated the united labours of ages and the last efforts of human art and industry, in that regular uniform line of construction which had been adopted in the earliest times." (*Egyptiaca*, p. 195.)

[4] *Description de l'Egypte*, Antiq. iv. § 2, p. 62.

[5] Letronne, *Recherches*, p. 180; Champollion, *Précis du Système Hiéroglyphique*, p. 387. *Lettres*, pp. 91, 92.

[6] Champollion, *Précis du Système Hiéroglyphique*, pp. 244, 245. See also *Lettres à M. le Duc de Blacas d'Aulps*, dated from the Egyptian Museum at Turin.

Girgé or Djirdjeh, the present capital of the Saïd, is situated half way between Abydos and Ptolemais, and about twelve miles south of the latter; and on a rising ground, distant nearly a mile from the river, lies Ikhmim, the ancient *Panopolis*, where the great dispenser of the generative, fructifying, and productive powers was devoutly worshipped.[3] The temples of Ikhmim, once so splendid, are now reduced to a few fragments. This place has about four thousand inhabitants, many of whom are Copts, and about one half Roman Catholics, principally engaged in the manufacture of coarse woollen cloths. Cau or Gau-el-kebir, or Great Gau,[4] the ancient *Antæopolis*, was at some distance from the river in the time of Ptolemy, but, owing to a change in the bed of the stream, which is constantly encroaching on the eastern side of the valley, it is now close to the Nile. Here was the pronaos or vestibule of a fine temple, which, by the encroachment of the river, had been severed from the eastern shore and insulated; but in 1819 it became a complete mass of ruins, in consequence of an unusually powerful inundation. The inscription on the pronaos proves that it was dedicated to Antæus, and the other gods worshipped in the same temple,[5] by Ptolemy Philometor, and Cleopatra his sister and queen, about 150 years before Christ; and it appears that the cornice was repaired by the Emperors Aurelius, Antoninus, and Verus, in the year 164 of our own era. The Siout of the Copts is the *Lycopolis* of the Greeks. The latter name was derived from the worship of the jackal, to which its inhabitants were peculiarly devoted. The only monuments of antiquity near Siout are some mounds of rubbish outside the town, and numerous sepulchres or catacombs in the neighbouring mountains. At Manfalout was an ancient city not mentioned by the Greek or Roman writers, and a little lower down the stream the catacombs are very extensive; whilst at Tarut-el-Sherif, still further north, the canal called Bahr Yussuf, or Joseph's River, branches off from the Nile, and passing along the base of the Libyan chain of hills, at length falls into the Birket-el-Keroun or Lake Mœris. The Shmoun of the Copts and the Ashmouneïn of the Arabs is the *Hermopolis Magna* of the Greeks. The ruins of Hermopolis cover an area of nearly four miles in circumference; but a portico, with a double colonnade, in a massive and uncommon style of architecture, forming one of the finest monuments of Egypt, and serving to convey some idea of the former splendour of this seat of the Egyptian muses, has recently been destroyed. The temple of Ashmouneïn was dedicated to Thoth, the Egyptian Hermes or god of wisdom, and the reputed inventor of the arts and sciences. The decline of Hermopolis may be dated from the building of Antinoë, now Sheikh Abadeh, on the opposite side of the river; a city founded by Hadrian in honour of his favourite Antinous. Its remains, consisting of colonnades, triumphal arches, baths, and ampitheatres, form a singular contrast to all the surrounding objects, and are quite foreign to the soil on which they stand. There are few columns standing; and those which are of granite have evidently been taken from more ancient edifices.[6]

Few remains of the cities which once flourished in the Heptanomis or northern part of Middle Egypt can now be discovered, yet quarries and catacombs continually mark out the spots on or near which they must have stood. At Beni-Hassan, on the eastern side of the Nile, are some remarkable excavations, many of which are adorned with paintings as fresh as when the colours were newly laid on; in the northernmost of these the ceilings are covered with planispheres similar to those at Thebes and Lycopolis, and the clustered columns which support the roof are formed in imitation of the trunks of palm trees. Most of the scenes and objects depicted in these *hypogæa* relate to domestic life, and some of the designs are said to be in the Etruscan style.[7] On the opposite side of the river, lower down, and close to the Bahr Yussuf, is Belmeseh, on

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[1] The ruins at El-Kherbeh are supposed by Jomard to be those of the Memnonium. (See *Description de l'Egypte*, Antiq. tom. iv. pl. 35, p. 8.)

[2] De Sacy, *Abd-el-latif*, pp. 316, 571.

[3] The Egyptian name of Panopolis was Khemmo or Khemmis, whence the Coptic Khmim or Shmim. (Diodorus Sic. i. 18, p. 30; and Strabo, xvii. i. p. 457.)

[4] The Coptic name of this place, Tkoü, has been preserved in the Arabic. (Legh's *Travels*, p. 40.)

[5] This inscription has been skilfully restored by Letronne. (*Recherches*, pp. 42, 51.) At Cau or Gau, which is now a dirty Arab village, there are large quarries and numerous sepulchres. Here, too, the fabulous battle was fought in which Typhon and his adherents were defeated. (Diodor. Sicul. i. 21, p. 34.)

[6] Belzoni, *Researches*, &c. p. 29.

[7] Jomard, *Description de l'Egypte*; Hamilton's *Egyptiaca*, p. 297, et seqq.; Legh's *Travels*, p. 34. M. Champollion spent fifteen days at Beni-Hassan, during which time he was principally occupied in copying some of the designs in the catacombs. The subjects of these hypogæan delineations are, Agriculture; Arts and Trades; the Military Caste; Song, Music, and Dancing; the Training of Domestic Animals; Portraits; Games, Exercises, and Diversions; Domestic Justice; Family Circles; Historical and Religious Monuments; and, lastly, Zoology; the whole being calculated to throw much light on the manners, customs, habits, and pursuits of a singular people, who, both above ground and below it, sought to perpetuate the memorials of their civilization. The following descriptive details give us as it were an insight into the private life and habits of the ancient Egyptians.

"1. AGRIÇULTURE. Dessins représentant le labourage avec les bœufs ou à bras d'hommes; le semage, le foulage des terres par les béliers, et non par les *porcs*, comme le dit Hérodote; cinq sortes de charrue; le piochage, la moisson du blé; la moisson du lin; la mise en gerbe de ces deux espèces de plantes; la mise en meule, le battage, le mesurage, le dépôt en grenier; deux dessins de grands greniers sur des plans différents; le lin transporté par des ânes; une foule d'autres travaux agricoles, et entre autres la récolte du lotus; la culture de la vigne, la vendange, son transport, l'égrenage, le pressoir de deux espèces, l'un à force de bras et l'autre à mécanique, la mise en bouteilles ou jarres, et le transport à la cave; la fabrication du vin cuit, etc.; la culture du jardin, la cueillette des bamieh, des figues, etc.; la culture de l'ognon, l'arrosage, etc.; le tout, comme tous les tableaux suivants, avec légendes hiéroglyphiques explicatives; plus *l'intendant de la maison des champs* et ses secrétaires. 2. ARTS ET METIERS. Collection de tableaux, pour la plupart coloriés, afin de bien déterminer al nature des objets, et représentant le sculpteur en pierre, le sculpteur sur bois, le peintre de statues, le peintre d'objets d'architecture; meubles et menuiserie; le peintre peignant un tableau, avec son *chevalet*; des *scribes* et commis aux écritures de toute espèce; les ouvriers des carrières transportant des blocs de pierre; l'art du potier avec toutes les opérations; les *marcheurs* pétrissant la terre avec les pieds, d'autres avec les mains; la mise de l'argile en cône, le cône placé sur le tour; le potier faisant la panse, le goulot du vase, etc.; la première cuite au four, la seconde au séchoir, etc.; la coupe du bois; les fabricants de cannes, d'avirons et de rames; le charpentier, le menuisier; le fabricant de meubles; les scieurs de bois; les corroyeurs; le coloriage des cuirs ou maroquins; les cordonnier; la filature; le tissage des toiles à divers métiers; le verrier et toutes ses opérations; l'orfèvre, le bijoutier, le forgeron. 3. CASTE MILITAIRE. L'éducation de la caste militaire, et tous ses exercices gymnastiques, représentés en plus de 200 tableaux, où sont retracées toutes les poses et attitudes que peuvent prendre deux habiles lutteurs, attaquant, se défendant, reculant, avançant, debout, renversés, etc.; on verra par là si l'art Egyptien se contentait de figures de profil, les jambes unies

the site of the ancient *Oxyrynchus;* and still farther north, at the entrance of Fayoum, was *Heracleopolis Magna*, the Hnes of the Copts, and the Almas of the Arabs; but no trace of either city can now be discovered. The hatred of the crocodile, for which the inhabitants of Heracleopolis were noted, and their feuds with their neighbours the Arsinoites, have been recorded by ancient poets and historians. This city was sacred to the Egyptian Hercules, the founder and patron of irrigation by means of canals. Here the Nile passes close under the base of the Arabian hills, and leaves the most extensive as well as the richest tract of corn lands in all Middle Egypt.[1] The nome of Arsinoë is now called Fayoum, the Arabs having in this as in other instances preserved the Egyptian name. Its principal city was originally called *Crocodilopolis;* but this name was exchanged for that of *Arsinoë* by Ptolemy Philadelphus, who imposed the latter in honour of his sister. Medinet-el-Fayoum, or the city of Fayoum, is built from the materials, and is partly on the site, of the ancient capital Crocodilopolis; but the principal remains of the ancient city lie to the north of the present town, and occupy a space of two miles and a half by about two. Two ancient pedestals of colossal dimensions, and separated about a hundred yards, are called by the natives Pharaoh's feet; they are about thirty-three feet every way. A fallen obelisk of red granite, covered with hieroglyphical inscriptions, is also another monument of the ancient Arsinoë. To the north of Heracleopolis or Ahnas was *Aphroditopolis*, the capital of a nome bearing the same name, and situated between those of Heracleopolis and Memphis. Its Coptic name is Tpêh or Petpieh, whence the Arabs have formed Atfih, Atfieh, or Atafieh. Between Aphroditopolis and Memphis, but nearer to the latter, and at some distance from the western bank of the river, was the town of *Acanthus*, and a celebrated temple of Osiris situated in a grove of the Thebaic thorn, whence probably the town derived its name. But at none of these places are there any remains deserving particular description.[2]

According to the concurring testimony of ancient writers, the Labyrinth was a structure equal in magnitude to the Pyramids, and still more wonderful in its design. It was the work of several kings at that early period when there were almost as many sovereigns as nomes; and adjoining to it was the tombs of the princes by whom it had been erected. "I have seen that building," says Herodotus, referring to the Labyrinth, "and it exceeds all description. The same may indeed be said of the Pyramids, each of which, taken separately, is equal in value to many of the greatest works of the Greeks taken together; but the Labyrinth in truth excels even the Pyramids." It consisted of twelve courts, surrounded by covered porticoes, having their gates opposite to each other, six of them being turned to the north and six to the south, and the whole included within the same outer wall or enceinte; and there were two suites of chambers, the one under and the other above ground, and immediately over the former. These chambers were three thousand in number, namely, fifteen hundred above and as many below ground. The Greek historian went through and examined the chambers above, but he was refused admission to those below, which, it was alleged by the priests, were used as sepulchres for the sacred crocodiles, and for the kings who had erected the Labyrinth; a strange enough association, though not uninstructive with re-

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et les bras collés contre les hanches. J'ai copié toute cette curieuse série de militaires nus, luttant ensemble; plus, une soixantaine de figures représentant des soldats de toute arme, de tout rang, la petite guerre, un siége, la *tortue* et le *bélier*, les punitions militaires, un champ de bataille, et les préparatifs d'un repas militaire; enfin, la fabrication des lances, javelots, arcs, flèches, massues, haches d'armes, etc. 4. CHANT, MUSIQUE, ET DANSE. Un tableau représentant un concert vocal et instrumental; un chanteur, qu'un musicien accompagne sur la harpe, est secondé par deux chœurs, l'un de quatre hommes, l'autre de cinq femmes, et celles-ci battent la mesure avec leurs mains: c'est un opéra tout entier; des joueurs de harpe de tout sexe, des joueurs de *flûte traversière*, de flageolet, d'une sorte de conque, etc.; des danseurs faisant diverses figures, avec les noms des pas qu'ils dansent; enfin, une collection très-curieuse de dessins représentant les danseuses (ou filles publiques de l'ancienne Egypte), dansant, chantant, jouant à la paume, faisant divers tours de force et d'adresse. 5. Un nombre considérable de dessins représentant L'EDUCATION DES BESTIAUX; les bouviers, les bœufs de toute espèce, les vaches, les veaux, le tirage du lait; la fabrication du fromage et du beurre; les chevriers, les gardeurs d'ânes, les bergers et leurs moutons; des scènes relatives à l'art vétérinaire; enfin, la basse-cour, comprenant l'éducation d'une foule d'espèce d'oies et de canards, et celle d'une espèces de cigogne qui était domestique dans l'ancienne Egypte. 6. Une première base du recueil ICONOGRAPHIQUE, comprenant les *portraits* des rois Egyptiens et de grands personnages. 7. Dessins relatifs aux JEUX, EXERCICES, et DIVERTISSEMENTS. On y remarque la *mourre*, le jeu de la *paille*, une sorte de *main-chaude*, le *mail*, le jeu de *piquets plantés en terre*, divers jeux de force; la chasse à la bête fauve, un tableau représentant une grande chasse dans le desert, et où sont figurées 15 à 20 espèces de quadrupèdes; tableaux représentant le retour de la chasse; le gibier est porté mort ou conduit vivant: plusieurs tableaux représentent la chasse des oiseaux au filet; un de ces tableaux est de grande dimension, et gouaché avec toutes les couleurs et le faire de l'original; enfin, le dessin en grand des divers piéges pour prendre les oiseaux; ces instruments de chasse sont peints isolément dans quelques hypogées; plusieurs tableaux relatifs à la pêche: 1, la pêche à la ligne; 2, à la ligne avec canne; 3, au trident ou au *bident;* 4, au filet; plus la préparation des poissons, etc. 8. JUSTICE DOMESTIQUE. J'ai réuni sous ce titre une quinzaine de dessins de bas-reliefs représentant des délits commis par des domestiques; l'arrestation du prévenu, son accusation, sa défense, son jugement par les intendants de la maison; sa condamnation et l'exécution, qui se borne à la bastonnade, dont procès-verbal est remis, avec le corps du procès, entre les mains du maitre par l'intendant de la maison. 9. LE MENAGE. J'ai réuni dans cette série, déja fort nombreuse, tout ce qui se rapporte à la vie privée ou intérieure. Ces dessins fort curieux représentent, 1, diverses maisons Egyptiennes, plus ou moins somptueuses; 2, les vases de diverses formes, utensiles et meubles, le tout colorié, parce que les couleurs indiquent invariablement la matière; 3, un superbe palanquin; 4, des espèces de chambre à portes battantes, portées sur un traîneau et qui ont servi de *voitures* aux anciens grands personnages de l'Egypte; 5, les singes, chats, et chiens, qui faisaient partie de la maison, ainsi que des *nains* et autres individus mal conformés, qui, 1500 ans et plus avant Jesus-Christ, servaient à désopiler le rate des seigneurs Egyptiens, aussi bien que, 1500 ans après, celle de nos vieux barons d'Europe; 6, les officiers d'une grande maison, intendants, scribes, etc.; 7, les domestiques portant les provisions de bouche de toute espèce; les servantes apportant aussi divers comestibles; 8, la manière de tuer les bœufs et de les dépécer pour le service de la maison; 9, une suite de dessins représentant des *cuisiniers* préparant des mets de diverses sortes; 10, enfin, les domestiques portant les mets préparés à la table du maitre. 10. MONUMENTS HISTORIQUES. Ce recueil contient toutes les inscriptions, bas-reliefs, et monuments de tout genre portant des legendes royales, avec une date exprimée, que j'ai vus jusqu'ici. 11. MONUMENTS RELIGIEUX. Toutes les images des différentes divinités, dessinées en grand et coloriées d'après les plus beaux bas-reliefs. 12. NAVIGATION. Recueil de dessins représentant la construction des bâtiments et barques de diverses espèces, et les jeux des mariniers, tout-à-fait analogues aux joûtes qui ont lieu sur la Seine dans les grands jours de fête. 13. Enfin, ZOOLOGIE. Une suite de *quadrupèdes*, d'*oiseaux*, de *reptiles*, d'*insectes*, et de *poissons*, dessinés et coloriés avec *toute fidélité* d'après les bas-reliefs peints ou les peintures les mieux conservées. Ce recueil, qui compte dejà près de 200 individus, est du plus haut interêt: les oiseaux sont magnifiques, les poissons peints dans la dernière perfection, et on aura par là une idée de ce qu'était un hypogée Egyptien un peu soigné. Nous avons dejà recueilli le dessin de plus de 14 espèces différentes de *chiens* de garde ou de chasse, depuis le *lévrier* jusqu'au *basset à jambes torses.*" (*Lettres écrites d'Egypte.*)

[1] Belzoni, *Researches*, &c. p. 242.

[2] *Encyclopædia Metropolitana*, art. *Egypt.*

ference to the origin and real nature of animal worship.[1] The chambers above ground, which he had himself seen and examined, the same historian describes as greater than all other human works. The communications between these multitudinous chambers, and the winding passages leading from one court into another, were so varied as to occasion infinite surprise and no little dismay. These passages led from the chambers into porches, from the porches again into other apartments, and from these chambers into other courts; the roof and walls of all of them were of stone, and covered with sculptures; each court was surrounded by a colonnade of white stone, the blocks of which were joined as closely as possible; and at the angle which terminated the Labyrinth was a pyramid of forty orgyias, or about two hundred and fifty feet, in height, on which was sculptured large figures of beasts, and the entrance to which was under ground. Such is the account of this extraordinary structure given by Herodotus, from whom Strabo does not materially differ; but other ancient writers seem to be at variance with both, probably from not attending to the circumstance that the work was executed at intervals by different princes. Commenced by Mendes, it was continued by Tithoes or Petesuccus, and finished by the twelve kings, and Socharis the son of Sesostris. The pyramid of the Labyrinth alone remains.[2]

Still descending the Nile, and passing, for the present, Birket-el-Keroun or Lake Mœris, we come to the ruins of Memphis, the second capital of Egypt, the foundation of which was ascribed to the first king of that country, named Menes.[3] After the successive generations of Persians, Greeks, Romans, and Arabs, who have plundered Memphis in the wantonness of victory, or for the purpose of transferring its monuments to Alexandria or to Cairo, we may well wonder that, exclusively of those eternal structures the pyramids, enough should still remain to enable us to determine the exact site of this capital of the Pharaohs. The temple of Phtha, the Hephæstus or Vulcan of the Egyptians, was, according to Herodotus, a most wonderful edifice; and adjoining to it was a temple dedicated to Osiris, in which the sacred bull Apis was kept, another consecrated to Hathôr or Venus, and a third to Serapis. The Serapeion stood in a place where the sand was so loose and deep that the sphinxes forming the avenue in front of it were buried, some one half, and others up to the neck, and a person proceeding to the temple ran some risk if overtaken by a tempest, owing to the columns of sand raised and drifted about by the wind. Of the great temple of Memphis nothing but débris remains; yet the blocks of granite and breccia scattered about attest its dimensions to have been nearly equal to those of the most gigantic monuments of the Thebaid; whilst the fragments of columns, colossal statues, obelisks, and propyla, are perhaps the relics of the great northern vestibule, which is usually enumerated amongst the works of Mœris.[4] In the time of Strabo, Memphis was second only to Alexandria in point of size and population; and there were ports for shipping both before the city and the palace. The latter had been built on a rising ground near to the lower part of the town, in a grove of its own, with a port adjoining; but at the period when Strabo wrote it was unoccupied and in ruins. The site and name of this ancient city were well known in the twelfth and thirteenth centuries,[5] as appears from the account of it given by El-Idrisi under the denomination of Menph or Memph, which is merely an abbreviation of the Egyptian word *Memfi* or *Memphi.* Amongst the antiquities specified by Abdu'l-latif may be mentioned the Beit-al-akhdar or Green Tabernacle, a monolithic temple thirteen feet and a half in height, twelve feet in length, and ten feet and a half in breadth, having a chamber formed within it ten and a half feet in height, nine feet in length, and seven feet and a half in breadth, and covered both within and without with sculptures, some cut into the stone and some in relief, and with inscriptions in ancient characters. On the outside there was a representation of the sun in the eastern quarter of the heavens, with many figures of stars and spheres; in front were two large statues of stone, and within was one of gold representing Aziz, the eyes of which were two valuable gems. This tabernacle or temple was fixed upon a basis of large massive blocks of granite, and the monolith out of which it had been formed was of the same description of rock. Another monument also mentioned by the Arabian geographer was an idol or statue, consisting of a single block of red granite, which, exclusively of its pedestal, was about forty-six feet in height, fifteen feet from side to side, and from back to front in proportion. "What talent, resolution, and patience must have been combined to produce such works as these; what various instruments and unremitting labour; and to what an extent must not the forms and proportions of bodies, especially those of the human body, have been studied, to enable the artist to determine so exactly the mutual relations, distance, and proximity, as well as the corresponding articulations of every limb!" Such is the natural and just remark elicited from Abdu'l-latif after surveying the ruins of Memphis, which even in his time occupied a space of about nine miles in every direction. Yet so rapid has the work of destruction proceeded, especially since the fourteenth century, that few points have been more debated in modern times than the site of this celebrated city; and, excepting its pyramids, and the great plain of mummies, which attest the vicinity of the spot whereon stood the second capital of Egypt, it might almost be said, *Etiam periêre ruinæ.* But its distance from the Pyramids and the apex of the Delta having been clearly pointed out by Strabo, Pococke and Bruce were hence led to fix upon the neighbourhood of Mokhnan and Monyet-Rahineh, two villages on the left or western bank of the Nile, as the ground on which Memphis had once stood; and this opinion was completely established by the French during their occupation of Egypt. At Monyet-Rahineh, about one league from Sakhara, they found so many blocks of granite covered with hieroglyphics and sculptures around and within an esplanade three leagues in circumference, inclosed by heaps of rubbish, that they were convinced these must be the ruins of Memphis; and the site of some fragments of one of those colossuses which, according to Herodotus, were erected by Sesostris at the entrance of the temple of Phtha, would have been sufficient to expel their doubts had any remained.[1] The position, the distance from the fork of the Delta, the vicinity of the pyramids and the plain of mummies, and, in particular, the gigantic nature of the ruins themselves, all unite to prove that the site fixed on by Pococke and Bruce is the right one.

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[1] On this subject see a chapter full of ingenuity and originality in Sir William Drummond's *Origines.*

[2] Herodotus, *Traduction de Larcher*, tom. ii. pp. 496, 505. *Encyclopædia Metropolitana*, art. *Egypt.*

[3] Herodotus, ii. 99.

[4] Hamilton's *Egyptiaca*, p. 315. Belzoni was so much occupied in exploring the interior passages and chambers of the Pyramids, that he entirely neglected Memphis; and the same observation applies to a later and much more gifted traveller, M. Champollion. The latter indeed promised to examine the whole plain of Memphis, from Monyet-Rahineh to Djizeh; "je pousserai de là (Monyet-Rahineh) des reconnaissances sur Sakharah, Daschour, et toute la plaine de Memphis, jusqu' aux grandes pyramides de Gizeh; et après avoir couru le sol de la seconde capitale Egyptienne, je mettrai le cap sur Thèbes." But if he carried his design into execution, the results have not been communicated to us. (*Lettres*, p. 62.)

[5] *Geographia Nubiensis*, p. 98.

In those countries where absolute temporal power is allied with and reinforced by spiritual dominion, and where a superstition inflexible in its sway over the many readily lends all its influence to give effect to the will of one, believed to be the earthly representative or vicegerent of the gods, we may expect to find works executed, which in point of magnitude far surpass any thing to be met with amongst nations otherwise more favourably circumstanced in regard to liberty. When men live under the double thraldom of a despotism which wields the powers both of earth and heaven, and is identified with a system of religious belief, which recognises in the head of the state a lineal descendent of the gods, all their labour and all their energies must necessarily be at the command of a ruler who can thus give to his most arbitrary decrees the authority of religion, and whose own will is his only law; and hence it is in the power of a sovereign so circumstanced to accomplish undertakings which baffle ordinary calculations, and transcend all ordinary means. When Stesicrates proposed to Alexander to convert Mount Athos into a statue of the victorious monarch, the left arm of which should form the base of a city containing ten thousand inhabitants, while the right was to hold an urn whence a river should discharge itself into the sea, he assumed, on the part of the conqueror, an exercise of power over human agents, the most reckless and unsparing of which there is any example out of Egypt. In the latter country, the principle assumed by the Greek projector appears to have been systematically reduced to practice; the whole labour and energies of the nation were made available for the execution of the designs of its monarchs; and hence, in the unparalleled magnitude and durability of the public works which were reared under the Pharaohs, we have conclusive evidence of the complete and total subjugation of the people to their authority. Such a prodigality of labour and expense is compatible only with the supposition that it was lavished under the decrees of a merciless and inflexible despotism; and the hands of slaves were no doubt employed in elaborating the inextricable intricacies of the Labyrinth, or realising the vast conception of the Pyramids. Herodotus, it is well known, ascribes the largest of the Pyramids, that of Cheops, to a profligate and tyrannical prince, who compelled the people at large to perform the work of slaves, and, in the enormous structure which he reared, left an eternal monument of the merciless energy to which it owed its origin.

The number of pyramids scattered over Egypt is very great; but by far the most remarkable are those at Djizeh, Sakhara, and Daschour; and the first of these places, situated on the western bank of the Nile, and nearly in the latitude of Cairo, is distinguished above the others by possessing the three principal pyramids mentioned by Herodotus, and which are still justly numbered amongst the wonders of human art. The largest of these pyramids, which goes by the name of Cheops (Kobts or Kopts?), stands on an elevation upwards of a hundred and fifty feet above the subjacent plain; and although it has suffered much from human violence, immense heaps of broken stones having fallen down each side, and formed a high mound towards the middle of the base, yet the corners remain pretty clear; and, as the accumulation of sand is, owing to the elevation of the site, less than round the other pyramids, the foundation is easily discoverable, particularly at the north-west angle, though it is impossible to see along the line of the base, on account of the heaps of rubbish, or to make any accurate measurement thereof. The entrance is on the north side, nearly in the centre, or about an equal distance from each angle, and the passage slopes downward at an angle of about twenty-six degrees, for about a hundred feet from the entrance, when it opens into an apartment seventeen feet long, fourteen feet wide, and twelve feet high. From this apartment a similar passage ascends, at nearly the same angle, to another chamber of larger dimensions, being upwards of thirty-seven feet in length, seventeen feet in width, and about twenty feet in height, which is lined all round with large slabs of highly polished granite, whilst the ceiling consists of nine immense flags stretching from wall to wall. In this chamber, which does not reach beyond the centre of the pyramid, stands a sarcophagus of red granite, highly polished, but without sculptures or hieroglyphics; it is seven feet six inches in length, three feet three inches in width, and about as much in depth; but it has no lid, nor was any thing found in it except a few fragments of the stone with which the chamber is decorated. A third chamber, still higher in the body of the pyramid than either of the two just mentioned, was discovered by Mr Davison about sixty years ago; and the same apartment was recently entered and more fully explored by Mr Caviglia, who found its sides coated with red granite highly polished, and ascertained that the unevenness of the floor was occasioned by its having been formed of the individual blocks of syenite which constitute the roof of the chamber below. Mr Davison also discovered and descended into the well, as it is called, of which Pliny has left a description. It consisted of three distinct shafts, the first of which was twenty-two feet in depth, the second twenty-nine, and the third ninety-nine, thus making the total descent one hundred and fifty feet, or, including five feet between the first and second shaft, one hundred and fifty-five. But the latest and most complete survey of the secret chambers or caverns of the Pyramid of Cheops is that made by Mr Caviglia, who, besides sounding the depths of the celebrated well discovered by Mr Davison with nearly similar results, cleared out the principal passage into the pyramid, and having advanced as far as two hundred feet, discovered a door on the right hand, which opened into the bottom of the well; after which, finding that the passage did not terminate at the door-way, he continued his advance to the distance of twenty-three feet beyond it, when it took a horizontal direction for about twenty-eight farther, and ultimately opened in a spacious chamber, sixty-six feet long by twenty-seven broad, immediately under the central point of the pyramid. Communicating with this spacious apartment on the south side is a narrow passage, which runs horizontally into the rock for upwards of fifty feet, and then abruptly terminates; another at the end, which commences with an arch, and runs about forty feet into the solid rock of the Pyramid; and a third, which, however, is so obscurely mentioned, that neither its direction nor dimensions can be ascertained. It is much to be regretted that none of those who have occupied themselves in exploring these interior passages and chambers, should have thought of publishing a plan of them, which indeed is quite essential to enable us to understand their various ramifications and bearings. The greatest discrepancy has prevailed both in ancient and in modern times as to the height and magnitude of the pyramid of Cheops; so much so, that either the standards referred to must have been different, or the summit of the enormous structure has been considerably lowered since the days of Herodotus. The following table exhibits only a small portion of the variation which applies to the measurement and estimated bulk of this pyramid:—

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[1] A plan of the ruins of Memphis, drawn by Jacotin, is given, along with a detailed account of them, in the *Description de l'Egypte.* The wrist of the colossus which M. Coutelle caused to be removed, and to which reference is made in the text, shows that, according to the ordinary proportions in such cases, it must have been about forty-eight feet in height.

Ancients.	Height of the Great Pyramid.	Length of the side.
Herodotus	800 feet	800 feet.
Strabo	625	600
Diodorus	600	700
Pliny	—	708
Mean	675	702
Moderns.		
Lebrun	616	704
Prosper Albinus	625	750
Thevenot	520	612
Niebuhr	440	710
Greaves	444	648
Davison	461	746
Trench	470	704
Mean	510	693
Mean of Ancient and Modern	592	697

Number of Layers or Steps.

Greaves	207
Maillet	208
Lewenstein	260
Pococke	212
Belon	250
Thevenot	208
Davison	206
Mean	221$\frac{4}{7}$.[1]

As an approximation, therefore, we may assume with safety that the Great Pyramid is four hundred and eighty feet in height, on a base about seven hundred and fifty feet each way; or, in other words, that it covers an area of nearly eleven acres, and rises to an elevation of a hundred and twenty-seven feet above the cross of St Paul's, whilst its solid contents exceed seventy millions of cubic feet.[2]

The second pyramid, called that of Cephrenes, was entered and explored in 1816, by the indefatigable Belzoni, who has given an interesting account of his labour in accomplishing this object, in his *Researches and Operations in Egypt and Nubia*, to which we refer for the details. His first attempt was not attended with success; but being convinced that this pyramid was similar in construction to that of Cheops, he minutely examined the exterior of the Great Pyramid; and having corrected his calculations as to the point of entry, he searched more to the east on the northern face, and at length succeeded in discovering a granite entrance four feet in height and three feet and a half in width, which dipped towards the centre for more than a hundred feet, at an angle of twenty-six degrees. Having removed the rubbish by which this passage was obstructed, he found his progress stopped by a block of granite, which proved to be a portcullis, and seemed to present an insuperable barrier to the prosecution of his researches. "It stared me in the face," he observes, "and said *ne plus ultra*, putting an end, as I thought, to all my projects." But on close inspection, he discovered that a regular groove or cavity had been formed to receive this portcullis; and as it happened to be elevated about eight inches from the lower part of the groove, thus leaving a considerable aperture underneath, he was enabled gradually to raise it. Here, however, the granite passage ceased, and a horizontal passage of nearly the same dimensions opened and extended about twenty-three feet, terminating at a shaft or well fifteen feet deep. Having descended the latter by means of a rope, the adventurous explorer found another passage with the same angle of inclination as that by which he had first descended, but running in a contrary direction, and off from the centre; and from the bottom of the well a passage also ran towards the centre of the pyramid. Following the latter, which proceeded in the direction just mentioned, Belzoni soon found that it terminated in a chamber at the centre of the pyramid. On entering this chamber, which he afterwards found to be forty-six feet in length, upwards of sixteen feet in width, and between twenty-three and twenty-four feet in height, he searched for the sarcophagus, which, after some delay, he found sunk into the floor. It was of the finest granite, about eight feet in length, three feet and a half in width, and above two feet in depth, and was surrounded by large blocks of granite, placed so as to prevent its removal; but the lid having been drawn to one side, was broken, and not a single sculpture or hieroglyph was to be found upon it. Some bones, said to be those of a bull, were discovered mixed with the rubbish. This chamber, which is nearly of the same dimensions as that of the Great Pyramid, and which is cut out of the solid rock, appears, from an Arabic inscription written in charcoal, and transcribed by a Copt employed by Belzoni for the purpose, to have been visited by the curious of a former age. The indefatigable explorer then returned to the well or shaft, and proceeding along the passage of the centre already mentioned, found that at the distance of forty-eight feet it communicated with a horizontal passage, also running outwards to the length of fifty-seven feet. A side passage led into a chamber, which however contained nothing save an inscription like that found in the first. From the extremity of the horizontal passage another was found to run inwards with a rise of twenty-six feet, until it terminated at the base of the pyramid, which thus appears to have had two entrances. In this last passage, as in the other, there is a groove for a portcullis.[3] The dimensions of the pyramid thus opened and explored were ascertained by Belzoni to be as follow :—

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[1] Russell's *View of Ancient and Modern Egypt*, p. 149.

[2] Vide Nouet's Report to the Institute at Cairo, published in the account of their proceedings; also Hamilton's *Egyptiaca*, p. 325. Captain Head's estimate, however, is considerably greater than that which is given in the text. "This pile, as it now stands," says he, "is in altitude nearly 150 feet above the cross of St Paul's, and is ascended on each side by steps, having their lower layer resting on a space equal in size to Lincoln's Inn Fields, one side being 780 feet....The solid contents of the Pyramid of Cheops exceed 75,000,000 cubic feet....Viewing these masses, the soul shrinks abashed and awe-stricken, and reflects upon the countless generations which have been swept from the earth, and how many more they are destined to survive." (*Eastern and Egyptian Scenery, Ruins*, &c. p. 46.)

[3] *Researches and Operations in Egypt and Nubia*, p. 267, et seqq. The opening of this pyramid had so long been considered an object of so hopeless a nature that, as Mr Salt has observed, it is difficult to conceive how any person could have been found sanguine enough to make the attempt; and even after the laborious discovery of an entrance which had to be forced, it required great resolution and

The base, each side	684 feet.
The perpendicular height	456
The coating, from top to where it terminates	140

These pyramids are said to have been coated or cased from top to bottom; and indeed forty feet of coating still remain on that of Cephrenes. But the Great Pyramid has no appearance of having been touched in this way; and on that of Cephrenes the coating was probably never completed, as no indications of it were discovered by Belzoni when removing the sand from its base. The next pyramid, called by the name of Mycerinus, and situated beyond that of Cephrenes, seems to have been cased with granite; at least fragments of that material were found amongst the rubbish. This pyramid still remains to be opened by some future traveller, Belzoni having failed in the attempt. It is only about a hundred and sixty feet in height; and beyond it is another of still smaller dimensions, having its summit crowned by one large block of stone, as if for a pedestal. The stability of these enormous piles is increased by the stones having been fixed so as to slope inwards; and so perfectly have they been adjusted, that not one of them has swerved from its position. As nothing but the solid rock itself could have formed a foundation for such structures, a sufficient space was levelled, part of the hill being escarped for the purpose. The pyramids of Sakhara are three miles south of those of Djizeh, and the pyramids of Daschour are beyond those of Sakhara, whilst many more of brick or of stone are scattered over the plain, intermixed with the excavations, cemeteries, and fragments of statues or edifices, extending over a space of several miles, and serving to mark out the site of the second capital of the Pharaohs. Fronting the river, and opposite the pyramid of Cephrenes, the colossal Sphinx reclines in ample majesty, a proper companion for the mighty piles which we have been considering. It is hewn out of the solid rock, and is covered with hieroglyphics and symbols of various kinds. Through the persevering exertions of Mr Caviglia, the whole statue was laid open to its base, and an area cleared to the extent of a hundred feet from its front. On the digits of the left paw are several indistinct legends and an inscription in verse, which Dr Young has restored; on those of the right are a few of the usual dedicatory phrases, which it is unnecessary to repeat here.

As the pyramids have neither inscriptions nor bas-reliefs or sculptures of any kind, we are left entirely to conjecture as to the period at which they were erected, or the uses to which they were appropriated. One circumstance, however, is most remarkable. In all the pyramids which have been opened, whether at Djizeh or Sakhara, amounting to at least six, the entrance has in every case been discovered near the centre of the base of the northern face; and the passage inwards from the exterior entrance has as uniformly been found to slope downwards at an angle which never varies. In the Great Pyramid, the inclination of the passage is stated by Greaves at twenty-six degrees; but Caviglia determined it at twenty-seven; and this angle is common to all the sloping passages in the edifice. The same conclusion was formed by Belzoni in regard to the pyramid opened by him, the angle in all the sloping passages or channels being about twenty-six degrees; and on opening one of the small pyramids towards the south, Caviglia found the inclination of the passage the same, whilst at the end of it were two chambers connected together, and both empty. Now, as it is scarcely possible that this coincidence could have been accidental, it has been concluded that these passages or tubes were connected with the celebration of some great festival, the time of which was determined by observing the transit of some particular star across the meridian below the pole, whence an accurate measure of sidereal time, an object in itself of great importance, might also be obtained. But, whilst it would not be easy to devise a method better adapted for observing the transit of a star with the naked eye, than watching its motion across the exterior orifice of such a lengthened tube, yet no safe conclusion can be deduced from the coincidence of inclination alluded to; first, because there is reason to suspect that we have not yet got the true measure of the angle which these passages form with the plane of the horizon; secondly, because it has not been ascertained whether the angle of inclination is the same in all the pyramids which have been opened, or whether there is a difference in the angles of the approaches of the pyramids of Djizeh, Sakhara, and Daschour, corresponding to the difference of latitude of these several places; and thirdly, because, from an expression made use of by Mr Caviglia, it would seem that in one at least of the pyramids opened, the angle of inclination was equal or nearly so to the elevation of the pole, or the latitude of the place. In short, the material facts on which alone any reasoning can be built have not yet been ascertained with sufficient accuracy and precision to warrant the inference which has been somewhat hastily drawn from them, although, as a mere conjecture or hypothesis, it has a reasonable degree of probability in its favour, especially if we consider the exact position of these structures with reference to the four cardinal points. At the same time, there is every reason to believe that these enormous piles were used for other than astronomical purposes. The bones found in the chamber of the pyramid of Cephrenes, not to mention other circumstances, seem to indicate some connection with the worship of Apis; and besides, from the care with which the entrances appear to have been concealed, it is not impos-

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confidence in his own views to induce the discoverer to continue the operation, when his predecessors, possessed of much greater means, had completely failed. It is not much to be wondered, therefore, that Belzoni should have felt disposed to resent conduct such as that which is described in the following extract:—" One thing more I must observe respecting the Count de Forbin. On his return from Thebes, I met him at Cairo, in the house of the Austrian consul. I had begun the task of opening the Pyramids, and had already discovered the false passage. The count requested, in a sort of sarcastic manner, when I had succeeded in opening the Pyramid, which no doubt he supposed I never would, that I would send him the plan of it, as he was about setting off for Alexandria the next day, and thence to France. I thought the best retaliation I could make was to send him the desired plan; and I did so as soon as I opened the Pyramid, which was in a few days after his departure. Would any one believe that the noble count, on his arrival in France, gave out that he had succeeded in penetrating the second pyramid of Djizeh, and brought the plan of it to Paris? Whether this be the fact or not, will appear from the following paragraph taken from a French paper now in my possession: —' On the 24th of April, Monsieur le Comte de Forbin, director-general of the Royal Museum of France, landed at the lazaretto of Marseilles. He came last from Alexandria, and his passage was very stormy. He has visited Greece, Syria, and Upper Egypt. By a happy chance, some days before his departure from Cairo, he succeeded in penetrating into the second pyramid of Djizeh. Monsieur Forbin brings the plan of this important discovery, as well as much information on the labours of M. Drovetti at Karnak, and on those which Mr Salt, the English consul, pursued with the greatest success in the valley of Beban-el-Malook, and in the plain of Medinet-Abou. The museum of Paris is going to be enriched with some of the spoils of Thebes, which Monsieur Forbin has collected in his travels.' Was this written," exclaims Belzoni, " by some person in France, in ridicule of the Count de Forbin, or is it an attempt to impose on the public by a tissue of falsehoods?" (Vol. i. p. 393.)

sible that, both in the pyramid of Cheops and in that of Cephrenes, there may yet be many undiscovered chambers. The chamber which contains the sarcophagus in the former is equal to a good-sized drawing-room; but there might be five thousand such chambers within the pyramid; and as structures so enormous must have been reared for some great object, or what was considered as such, it is probable that much still remains to be discovered in their interior. It is not impossible that the records of the kingdom of the Pharaohs may yet peradventure be found in some crypt "far ben" in these eternal register-houses.[1]

In speaking of the mechanical labours of the ancient Egyptians, it is impossible to pass unnoticed Lake Mœris, which is described by Herodotus as not less wonderful than the Labyrinth. Its circumference, he informs us, measured three thousand six hundred stadia, making sixty schœni or four hundred and fifty miles; an extent equal to the sea-coast of Egypt. Its greatest length stretched from north to south, and its greatest depth was not less than fifty orgyias, or thirty-six fathoms. He is of opinion that it was excavated by the hand of man; and his reason for this belief is, that about the middle of the lake there were two pyramids, each fifty orgyias, or two hundred and twelve feet above, and as much below the water, whilst on the summit of each there was placed a colossus of stone, in a sitting posture, or throned. The waters of this lake, he adds, were entirely derived from the Nile, and its fisheries paid one talent of silver, or L.225, to the crown, every day for six months during the decrease of the waters, and twenty minas, or L.75, for the remaining six months during their increase; thus yielding an annual revenue of L.54,000. Herodotus also states, on the authority of the inhabitants, that this lake has a subterraneous channel, or passage, westward into the Libyan desert, in the line of the mountain which rises above Memphis; and, from those who dwelt on its shores, he further learned that the earth dug out of the excavation which formed the lake was thrown into the river, and washed down by the current into the sea; an explanation with which he appears to have been perfectly satisfied. This account, exhibiting the characteristics of simplicity and truth, is substantially confirmed by the statements of Diodorus Siculus and Pomponius Mela, except that the latter makes the circumference five hundred miles instead of four hundred and fifty; and all coincide in the opinion that its object must have been to save the country from the effects of an excessive inundation, by affording a receptacle for the surplus flood, and at the same time to keep in reserve a supply of water for the parched lands in the vicinity, or to meet the wants of a dry season in the Delta. But, as the water of this lake has a disagreeable taste, and besides is almost as salt as the sea, contracting its saline property from the nitre with which the surrounding land is everywhere impregnated, it is probable enough that it was originally constructed rather to prevent an evil than to secure a benefit, to counteract an excessive rather than to eke out a deficient inundation.

The dimensions of this lake in modern times do not in any degree correspond with the statements which have been recorded by the ancients. According to Pococke, at the time when he visited Egypt it was only about fifty miles in length and ten in breadth; and Mr Browne, who travelled at a still later period, estimated the length at between thirty and forty miles, and the breadth at not more than six miles. It appears, therefore, that the limits of this inland sea have been much contracted; and further, that the process of diminution is going on at a rate distinctly perceptible. Anciently the waters of Lake Mœris covered a large portion of the valley of Fayoum, and, when the inundation exceeded a certain height, probably found an outlet from the north-eastern extremity, along the course of the Bahr-bilama or Waterless River, thus reaching the sea to the westward of Lake Mareotis and Alexandria. That the Nile originally flowed through the valley of the Natron Lakes, is now generally admitted; and the opinion is strengthened by the conformation of the adjoining country, the existence of the bed or channel of a river, extending to the sea, but now dry, and more especially by the escarpment of the chain of mountains, shutting the entrance of the valley north of the Pyramids, which appears to have been caused at some period by the action of the running water, as may indeed be observed in all the mountains at the base of which the Nile flows at the present day. In its present contracted dimensions, Lake Mœris is called by the Arabs Birket-el-Keroun, the Horn or Bow Lake, being so named either from its figure, or from the celebrated ruin near to its south-western extremity, denominated Kasr Keroun by the Arabs, and till lately supposed to form part of the Labyrinth. The canal called Bahr Yussuf, or Joseph's River, is about a hundred and twenty miles in length, and, on entering the province of Fayoum, is divided into a number of subordinate branches, supplied with a variety of locks and dams. Two other canals also communicated between the lake and the stream, and, by means of the sluices at their junction with the river, admitted or excluded the water, according as the Nile rose above or fell below a certain limit. These were the principal achievements of Mœris, whose works are to be sought for not so much in the lake which bears his name, and seems to be rather a natural basin skilfully appropriated to a purpose of great public utility than a work of labour and art, as in the immense cuts and excavations which connected this lake with the Nile, and in the mounds, dams, and sluices, which rendered it available for extensive and systematic irrigation, the prime cause of fertility in Egypt. We shall not attempt here to describe the reticulation of canals, and other works therewith connected, by means of which this beneficent object was in a great measure insured, and a sort of equilibrium established in the supply of the fluid so essential for the purposes of cultivation; but shall merely content ourselves with observing, that the author of such works of unquestionable utility is the real benefactor of his kind, and that the glory which encircles the name of Mœris-Thouthmosis is a thousand times more enviable, because more beneficent in its character, than that of the founder of the Labyrinth, or of the merciless taskmaster who reared the Great Pyramid.

In this land of wonders there are many other works and monuments well deserving of being described; but the limits assigned to the present section having been already exceeded, it is necessary to bring it to a close, without entering into details which would be found to possess only a secondary kind of interest. We cannot conclude, however, without expressing our deep regret that, under the comparatively enlightened government which has now been established in Egypt, the destruction of ancient monuments should be carried on with a systematic and calculating perseverance, which, unless checked, must in a few years annihilate the finest and noblest remains that have escaped the united ravages of time and barbarism. Let us hope, however, that the viceroy may be induced to interpose, and that present convenience or advantage will no longer be purchased at so heavy a cost to art and antiquity.[1]

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[1] Head, *Eastern and Egyptian Scenery, Ruins*, &c. pp. 46, 47. Russell, *View of Ancient and Modern Egypt*, p. 150, et seqq.

SECTION VI.

PANTHEON OF EGYPT.

Knuphis or Agathodæmon.—Phtha or Phthah.—Neïth.—Ré or Phré.—Rhea.—Ioh.—Apopis.—Kronos.—Thoth.—Osiris.—Aruëris.—Typhon.—Isis.—Nephthé.—Thueris.—Bebon.—Ares.—Shom or Somus.—Buto.—Horus, Hor, or Horsiêsi.—Harpocrates.—Anubis.—Arsaphes.—Athôr or Hathôr.—Amun or Amoun.—Mendes.—Busiris.—Macedon.—Bubastis.—Sarapis.—Shmun or Esmunus.—Paamyles.—Tithrambo.—Thermuthis.—Canopus.—Menuthis.—Besa.—Proteus.—Nilus.—Apis.—Mneuis or Mnyis.

In the selection of authorities respecting the principal deities worshipped by the Egyptians, it will be most convenient to consider the respective personages in their chronological, or rather genealogical order, as far as any evidence can be obtained to ascertain their places in the mythological system.

AGATHODÆMON, *Cneph*, *Chnuphis*, or *Knuphis*, appears to be the oldest representative of the divine power admitted by the Egyptians, although his attributes are not distinctly ascertained, except as the parent of Phtha, whose origin is referred, in the works of the spurious Hermes, to an egg of *Cneph* or *Kneph*, which is perhaps the Coptic IHHNIFI, or *genius of spirit*. Even before this Cneph we are told of the existence of an *Eicton* or *Icton*, which has been supposed to mean IHHTHO, or *genius of the whole world;* but this seems to have been a sort of chaos, and the personification is not generally admitted. Eusebius makes Cneph distinctly synonymous with Agathodæmon; and this interpretation seems to identify the term with the *Knuphis*, of whom Strabo mentions a temple in Elephantiné, since IHHNUFI would naturally mean *good genius*, the word NUFI occurring frequently in other compounds. In a Greek inscription now in the British Museum, the emperor Nero is called the good genius of the world, and the winged globe hovering over the inscription seems to allude to this piece of flattery; but the Knuphis or Knumis of the amulets of later times is a serpent or a dragon raising itself on its tail, having rays about its head, and surrounded with stars. The name of Agathodæmon is inserted by Manetho amongst the fabulous kings, immediately before Kronos.

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[1] It would perhaps be too much to expect that Mehemmed Ali, engrossed with objects of present ambition, should evince any very decided predilection for "Egypt's elder time," or give himself much trouble to conserve the monumental remains of twenty-five dynasties of kings. The viceroy, we fear, is too decided an utilitarian to concern himself about objects of antiquarian research or learned curiosity; and it is highly probable that a kaleidoscope, a magic disc, or any other ingenious scientific toy, would interest him much more deeply than the discovery of a new cella in an old temple, or a translation of a hieroglyphic inscription, enumerating the titles and narrating the campaigns of Sesostris. At the same time it would be exceedingly desirable if he could be made aware that, however little he may care about such matters, they are of importance to others; and that the wanton demolition of monuments which has of late years taken place under the eyes, and even by the directions, of some of his agents, is calculated to deprive the country over which he rules of its principal attraction to European visitants. Nothing, we should think, would be more easy than to make the pasha comprehend that he has a direct and tangible interest in at least preventing the continuance of the barbarity which has recently been in so many instances committed; and if the European residents in Egypt were to join in a representation on the subject, there can scarcely be a doubt that it would have the desired effect. In the year 1829, M. Champollion, whilst on the eve of quitting Egypt, transmitted to the viceroy a *Note* "pour la conservation des Monumens de l'Egypte," in which the conduct of his agents was very pointedly denounced, the extent of the havoc committed by them clearly detailed, and the precautions necessary to be adopted in order to arrest the progress of the evil distinctly specified; but this representation being unsupported, and many of the collectors of antiquities at Alexandria and Cairo secretly encouraging the dilapidations complained of, in the despicable view of giving a factitious value to their collections, it produced no sensible effect, and the work of destruction has since gone on with but little interruption. Accordingly, some of the finest monuments of ancient Egyptian civilization, which had outlasted the casualties of forty centuries, and the ravages of five conquests, have lately perished by the hands of destroyers more barbarous and unsparing than either the wild Persians of Cambyses or the fanatical Arabs of Amru.

Among the Europeans who visit Egypt there is annually a great number who, not being attracted thither by any commercial pursuit, are only actuated by a desire to contemplate on the spot the remains of ancient splendour and renown, and to examine for themselves the vestiges of the first form of civilization of which any trace has descended to modern times; and as these persons may now, under the protection of the viceroy's vigorous government, pursue their inquiries in perfect safety, it is obvious that their sojourn in the different provinces of Egypt and Nubia must entirely depend on the monuments which are scattered along both banks of the Nile, and that whilst science and literature may be enriched by their observations, the country itself must also be benefited by their personal expenditure, whether disbursed in the employment of labour to clear out monuments, in satisfying an active curiosity, or in the acquisition of divers products of ancient art. In short, as a large amount of capital is annually imported into Egypt by travellers of this description, it is clear that the government of the viceroy, if it consulted the real interest of the country, would devote its attention to the conservation of those edifices and monuments which form the principal, if not the sole objects for which such travels are undertaken by a crowd of individuals belonging to the most distinguished classes of European society; that, so far from permitting wanton and gratuitous destruction, it would adopt measures to arrest even the progress of ordinary decay; and that its subordinate functionaries, instead of being the destroyers, would be made the protectors and defenders of the Cyclopian works of ancient days. The actual case, however, is far different from this; and learned Europe now bitterly deplores the entire destruction of a crowd of ancient monuments, the demolition of which has been so complete that not the least trace of them remains.

But, to come to particulars, amongst those which have been recently destroyed are, *first*, all the monuments of Scheik-Abadeh, of which there now only exist some granite columns, that, from their dimensions and hardness, appear to have defied the efforts of the destroyers; *secondly*, the temple of Aschmuneïn, one of the finest monuments of Egypt; *thirdly*, the temple of Kau-el-Kebir, which the Nile had partially undermined, thereby facilitating the work of demolition; *fourthly*, a temple to the north of the town of Esneh; *fifthly*, a temple opposite Esneh, on the right bank of the river; *sixthly*, three temples at El-Kab or El-Eitz; and, *seventhly*, two temples in the island opposite Assouan, the ancient Syené, called Geziret-Assouan. From this enumeration, then, embracing only a short period, and excluding the destruction of the last two years, it appears that thirteen or fourteen ancient monuments, three of which in particular were of the very highest interest to travellers and learned men, have been entirely demolished. But the positive loss, great as it is, falls far short of that with which the learned world is threatened from the progress of this systematic dilapidation, which, if it continues to advance in a similar ratio, will in ten years hence level with the ground the principal edifices and monuments of Egypt and Nubia. We are not without hopes, however, that the viceroy may be induced to interpose his authority in order to arrest these deplorable devastations. M. Champollion laid before him a *catalogue raisonné* of the monuments both of Egypt and Nubia, at the same time indicating the means proper to be adopted for their future preservation; and other individuals of weight will, we trust, exert their influence with Mehemmed Ali in order to persuade him to take the necessary steps for accomplishing the object desired. If his highness would only take upon himself the character of conservator of

Those temples, palaces, and piles stupendous,
Of which the very ruins are tremendous,

he would entitle himself to the gratitude of all Europe, at the same time that he advanced his own real interest and glory; for, besides the advantages to which we have already alluded, it ought to be kept in view that the temples, palaces, tombs, and all other kinds of monuments, which still attest the power and greatness of the Pharaohs and the Ptolemies, are at the same time the noblest ornaments of modern Egypt.

The same authority attributes a still higher antiquity to PHTHA, whom it places as the first of the fabulous kings of Egypt; he is universally considered as the great ancestor of the other deities, and is especially called the father of the sun, as we learn from various chronologers, as well as from Callisthenes and others. He seems to have been a personification of the creative, and perhaps of the generative power, designated under the character of a workman or an architect. He is sometimes compared to Prometheus, as the discoverer of fire; but Hephæstus or Vulcan is his common representative in the Greek and Roman mythology; although it must always be remembered, that, *between the imaginary personages of different nations the identity must naturally be accidental and imperfect.* Cicero and Eusebius mention Phtha as the same with Vulcan; and Eratosthenes, on the authority of the Egyptian priests, interprets MOEPHTHA, *Philephæstus* or *loving Vulcan*, which in Coptic would be exactly expressed by MAIPHTHAH, as MAISON is *loving a brother.* Mr Akerblad quotes from a Coptic sermon of Sinnethi the words, "Hephæstus, who is Phtah;" and this remarkable passage proves, as he justly observes, how much Jablonsky was mistaken in his orthography of *Phthash*, on which he founded one of his fanciful etymologies.

NEITH, the Minerva of the Egyptians, had a celebrated temple at Saïs, in which was the well-known inscription respecting the goddess of universal nature, whose offspring, in the translation of the inscription, as preserved by Proclus, is said to be the sun. It seems therefore natural to call Neïth the wife of Phtha; as Plato also observes that arts were invented by Vulcan and his wife; but we are told that Neïth is to be considered as both male and female. The name is mentioned by Plato as synonymous with Minerva, and Eratosthenes explains Nitocris, Minerva the victorious.

RE, or PHRE, *the Sun*, otherwise called ON, is mentioned by Manetho as the son of Vulcan. He married Rhea, and having discovered her infidelity, condemned her to bear no offspring on any day or any night of the whole three hundred and sixty that then composed the year. Plutarch says that he was represented by a young child rising out of a lotus; but this emblem is more attributable to Horus, who is another of the forms of the solar power, and is sometimes improperly confounded with Apollo. The word *Phré* is often found in Greek letters on the amulets, accompanied by emblems of the sun.

RHEA, the wife of the Sun, may perhaps have derived her name from *Ré;* she appears to be identical with the *Urania*, or female Heaven, of Horus Apollo, the Coptic PHE being feminine. Jablonsky makes Rhea the same with Athôr or Hathôr, but he adduces no sufficient authority for the opinion. She is said to have been familiar both with Kronos and with Thoth; and Diodorus calls her the wife and sister of Kronos.

IOH, *the Moon.* Plutarch tells us that Hermes played at dice with the Moon, probably as presiding over the calendar, in order to gain a time for the birth of Rhea's children, and to evade her husband's curse; so that the Moon must be considered as one of the oldest deities. The Egyptian name being masculine, the Moon can scarcely have been worshipped as a goddess; and whatever relation may have been imagined to exist between Isis and the lunar influence, the two deities were certainly not identical.

APOPIS, a brother of the Sun, is mentioned by Plutarch as having made war against Jove. But the Jupiter of Manetho stands much lower on the list, the order being Vulcan, the Sun, Agathodæmon, Kronos, Osiris with Isis, Typhon, Horus, Ares, Anubis, Hercules, Apollo, Ammon, Tithoes, Sosus, and Jupiter; the last nine being denominated semigods.

KRONOS, or *Saturn*, is only known from his connection with Rhea, the wife of the Sun. His character probably bore some relation to a personification of Time and Antiquity.

THOTH, *Theuth*, or *Taaut*, one of the most celebrated of the Egyptian deities, is sufficiently identified with Hermes or Mercury, by the testimony of a variety of authors. Diodorus mentions him as the scribe or secretary, and privy counsellor of Osiris. He is generally considered as the inventor of letters and of the fine arts. Plutarch and Horus Apollo observe that he was typified by the ibis, which was sacred to him. Plutarch also says that he had one arm shorter than the other.

OSIRIS, properly OSHIRI or OUSIREI, meaning in Coptic *energetic* or *active*, which is precisely one of Plutarch's interpretations of the name, was the deity most universally adored throughout Egypt, and possessing the principal attributes of Bacchus, Adonis, and Pluto; besides being often compared to the Nile, and sometimes to the Sun. He was genealogically considered as the son of the Sun and of Rhea; and at his birth, on the first of the supplementary days of the calendar, a voice was heard, proclaiming that he was Lord of all. He married his sister Isis, and, according to Diodorus, left her to govern his kingdom during his military expeditions, resembling those of Bacchus, being accompanied by Pan, Hercules, and Macedon, having a ship which was the prototype of the Argo of the Greeks, with Canopus for his pilot. He was at last treacherously shut up alive in a coffin by Typhon, aided by seventy-two conspirators, together with an Ethiopian queen Aso. The coffin, being thrown into the Nile, was carried to one of its mouths, and there left on shore: it became afterwards inclosed in the trunk of an erica, which grew round it, and which constituted one of the columns of King Malcander's palace; but the body escaped from its confinement, and was found by Typhon as he was hunting; he divided it into fourteen parts, which were afterwards found scattered in different places by Isis, and buried separately. Osiris, however, returned from the dead to console his wife, and to conduct the education of his son Horus. There was a mystery in his identification with Pluto, of which the old authors affect to speak with reverence. His dress was generally white, but sometimes black. He is represented as carrying a whip, which is supposed to be intended for the punishment of Typhon. Plutarch says that he is typified by a hawk, and denoted hieroglyphically by an eye and a sceptre.

ARUERIS, a twin-brother of Osiris, and, like him, the son of the Sun and of Rhea, was born on the second supplementary day. He is also called the elder Horus, and is considered by some of the Greeks as their Apollo.

TYPHON, the spurious son of Rhea and Kronos, was born on the third supplementary day, and married his sister Nephthé. He is characterized by a red colour, and is supposed to have been a personification of the effects of scorching heat. He is also compared to the earth's shadow, as causing eclipses of the moon. The celestial habitation of his soul was supposed to be in the Great Bear. According to Plutarch, his Egyptian names were *Seth, Bebon*, or *Babyn*, and *Smy;* the word Typhon being apparently of Greek origin.

ISIS, ISI, or ESI, was supposed to be the offspring of

Thoth and Rhea, born on the fourth supplementary day; she was also sometimes called the daughter of Prometheus. She is generally compared to Ceres, or the Earth, and is made the deity of fertility and of maternal love. She was also esteemed analogous to Proserpine, as the queen of the lower regions, and the wife of Pluto; thus she is called by Aristides "the saviour and conductress of souls;" and, in some Roman inscriptions copied by Zoëga, she is made "the guardian of the ashes of the dead." Horus Apollo says that her head was sometimes adorned with vultures' plumes; but Herodotus tells us that she was represented with cow's horns, like Io; other authors however say that, after Horus, in revenge for his father's death, had made Typhon prisoner, Isis imprudently set him at liberty, and Horus, therefore, tore the regal diadem from her brow, but that Thoth or Hermes substituted for it a helmet made of a bullock's head. Her soul was supposed to have its residence in the Dog Star, the Sothis of the Egyptians. Her dress was of many colours. She is sometimes compared to the moon; but this idea appears to be foreign to the oldest mythology, as well as to the genius of the Egyptian language. She has also been somewhat arbitrarily confounded with Minerva by Plutarch, in speaking of the inscription of the temple of Sais, which confessedly related to the Egyptian Minerva, who was indisputably the goddess Neïth; although in consequence of this inattention, the "robe" mentioned in the inscription has been called the "robe of Isis," and the expression has been almost proverbially employed as denoting mystery and secrecy.

Nephthe, rather than *Nephthys*, the spurious daughter of Rhea and Kronos, was born on the fifth supplementary day. She is sometimes called by the Greeks *Teleuté*, that is, consummation; and sometimes Venus and Victory. She is mentioned by Firmicus as the sister and companion of Isis; and Plutarch says that the face of Isis was sometimes represented on the sistrum, and sometimes that of Nephthé.

Thueris, a concubine of Typhon, is only noticed as having been pursued, on her way to visit Horus, by a huge snake, which was killed by Horus' people.

Bebon, who is sometimes confounded with Typhon, is also mentioned as one of his companions.

Ares is inserted among the fabulous kings of Manetho. Vettius Valens says that the planet Mars was called by the Egyptians *Artes;* and Cedrenus makes the name *Ertosi.* Herodotus tells us that Mars was worshipped at Papremis.

Somus, or *Shom*, was probably the personage called the Egyptian Hercules by the Greek writers. Thus, the great Etymologicon has *Chon* for this deity, and Eratosthenes writes his name *Sem*, both of these having been probably intended to express the Coptic JOM or SJOM, *strength*, which seems sometimes to have been written JEM or SJEM. Diodorus mentions this Hercules as a general of Osiris, whom he left behind with Isis. He is said to have been killed by Typhon, but to have been revived by the smell of a quail. Herodotus asserts that the word Heracles is originally Egyptian; but in this, as in many other instances, his interpreters must have misinformed him, perhaps from misunderstanding his questions; for his Egyptian etymologies are almost uniformly erroneous. Thus, when the priests had shown him, or rather Hecatæus, whose original story he seems to have copied and disfigured, the statues of three hundred and forty-one successive generations of high priests, who were neither gods nor heroes, but each a PIROMIS, the son of PIROMIS, he tells us that PIROMIS means *beautiful and brave;* whilst, in fact, the literal sense of PIROMI, in the modern Coptic of Lower Egypt, which is simply *a man*, restores to the observation of the priests an intelligible and consistent sense.

Buto, the nurse of Horus and of Bubastis, compared to the Latona of the Greeks, must be considered as anterior to the birth of Horus.

Horus, *Hor*, *Or*, or *Horsiêsi*, was the son of Isis and Osiris. Jablonsky observes that a king *Ur* is mentioned by Manetho, and that *Or* was in later times the name of a certain monk, and *Taor* of a nun; the Egyptians have always, as Lucian informs us, had a propensity to adopt the names of their deities for their own, so that they may have become current in families without any immediate reference to their origin. Akerblad also found *Horsiêsi* as an Egyptian name, and conjectured, with much probability, that it originally meant Horus the son of Isis, SI being an abridgment of SHERI, as it appears also to have been in the name of *Siphoas*, or rather *Siphthas*, which is explained by Eratosthenes, *the son of Vulcan.* Horus is often confounded with the Sun, perhaps from the resemblance of his name to the Hebrew AOR, *light;* whilst Suidas makes him rather analogous to Priapus. He was nursed by Buto, in the city Butus. The most remarkable exploit of his youthful days was the pursuit and conquest of Typhon, in revenge for his father's death. The constellation Orion was supposed to be the habitation of his soul. His dress was white. Damascius, as copied by Photius, informs us that he was represented with his finger on his mouth.

Harpocrates was a son of Osiris, from a visit paid to Isis after his death. He was also born prematurely, and was weak in his lower limbs. Eratosthenes seems to have called him Phrucrates; and PHROKHRAT, in Coptic, means *dried* or *withered feet.*

Anubis was the offspring of Osiris and Nephthé, whom he had mistaken for Isis, and who exposed the child; but Isis recovered him, and he became her faithful attendant. He was considered as belonging both to the upper and the lower worlds, and was therefore compared to the horizon; and he seems to have been typified by a dog, or figured with a dog's head. He attended Osiris in his military expedition; and he is sometimes erroneously confounded with Mercury, and even with Saturn. A cock was usually sacrificed to him; and Pliny tells us that his images were properly made of gold, in allusion to his name; a remark which is amply explained by the Coptic word NUB, which still signifies *gold.*

Arsaphes is mentioned by Plutarch as a son of Isis; but the same name is said to have been sometimes applied to Osiris.

Athor, *Hathôr*, or *Athyr*, was the Venus of the Egyptians, according to the Great Etymologicon. Herodotus mentions a temple of Venus as Atarbechis, which might be translated the city of Venus, BAKI in Coptic meaning city; although Plutarch enumerates Athyri among the different names of Isis. Strabo informs us that at Momemphis a sacred cow was fed in honour of Venus.

Amun, or *Amoun*, the Jupiter of the Egyptians, though apparently a personage of much less importance than the Greek and Roman Jupiter, was worshipped by the Ammonians, under the form of a human figure with a ram's head. Hecatæus, as quoted by Plutarch, denies that this term is the proper name of the deity, and observes, very truly, that it is an Egyptian word meaning *come*, by which the god was supplicated to appear. The word, however, implies also *glory*, or *splendour*. If there was a more appropriate term for this deity, it may possibly, as Mr Akerblad has observed, have been *Ho*, which was the Egyptian name of the city called by the Greeks Diospolis Parva. It is remarkable that Manetho gives us a Zeus distinct from Ammon, interposing Tithoes and Sosus as intermediate kings.

Antæus, *Entes*, or *Mendes*, is said to have been left by Osiris as a viceroy or lieutenant-governor, together with Busiris, for the assistance of Isis during his absence. He is generally identified with Pan, though Diodorus mentions Pan as having accompanied Osiris on his expedition. At Mendes a goat was fed in honour of this deity, and Plutarch seems to say that this goat was called Apis, as well as the bull fed at Memphis. He was also generally represented with the face and legs of a goat. Herodotus calls him one of the eight gods, older than the twelve; but Diodorus makes the eight senior gods of the Egyptians the Sun, Kronos, Rhea, Ammon, Juno, Vulcan, Vesta, and Mercury. Out of these, however, Juno and Vesta cannot easily be identified in the Egyptian mythology.

Busiris, a name composed of *B-Ousirei*, or *Ph-Ousirei*, that is, Osiris with a prefix, is only mentioned by Diodorus as a colleague of Antæus in his government.

Macedon, according to Diodorus, was a companion of Osiris in his expedition.

Bubastis was a sister of Horus, preserved and nursed with him by Buto in the city of Butus. She is compared by various authors to Artemis or Diana; Apuleius gives us Bubasthis for the Egyptian name of the plant Artemisia; and Bubastis is addressed in a Greek epigram in the place of Diana, considered in her obstetrical capacity.

Sarapis, an ancient deity of the Greeks, was raised into a more distinguished rank by the honours paid him, as identical with Pluto, by Ptolemy Soter, who had found an image of Pluto at Sinope, accompanied by Cerberus and a dragon, which he brought to Alexandria, and established in the Serapeum there, as belonging to Sarapis. Some of the ancients were however of opinion that the word Sarapis meant only the "feast of Apis;" and, indeed, the Coptic SHAIIRI, which signifies to feast, agrees tolerably well with this etymology, however improbable the opinion founded on it may be esteemed. Sarapis is also supposed to have had some relation to the regulation of the Nilometer, which consisted of a column with different heights marked on it, in the centre of a bath or well, into which the water of the river was admitted.

Esmunus, or *Shmun*, was the eighth son of Sadycus by one of the Titanides, and brother of the Dioscuri and Cabiri; all of them names which seem as foreign to the Egyptian mythology as the word SHMUN is familiar to the language, meaning simply *eight*. He is, however, said by Damascius to have been the Egyptian Æsculapius, although Manetho gives the name Tosorthrus to this deity, making him a son of Pan and Hephæstobule.

Paamyles is mentioned by Hesychius and Plutarch as a Priapic deity; he is also made by Cratinus synonymous with *Socharis.*

Tithrambo, according to Epiphanius, was analogous to the Hecate of the Greeks.

Thermuthis, though generally understood to be only a name of the sacred serpents worn in the crown of Isis, is distinguished by Epiphanius as an independent deity; and if we may judge by the signification of the Coptic word, which means *mortiferus*, her character must have been somewhat analogous to that of Nemesis.

Canopus, or *Canobus*, had a temple which is mentioned by Dionysius Periegetes. The jars called Canopi were often made porous, to serve as filters, and are mentioned by Hesychius, in the word *Stactice;* but we are not exactly informed how far they were connected with this deity.

Menuthis was the wife of Canopus, and seems to have given her name to a village near the town Canopus, which is mentioned by Stephanus. Epiphanius calls her *Eumenuthis.*

Besa is only known from Ammianus Marcellinus, who mentions an oracle dependent on him.

Proteus, though noticed as a king of no very high antiquity, is said to have had a temple erected to him as a hero. Diodorus says that his Egyptian name was Cetes; though Herodotus, as in other instances, fancies, from some misapprehension, that the Greek and Egyptian names were identical; and he observes that similar honours were also paid to Perseus, another hero known to the Greeks.

Nilus, whether as a king or merely as a river, appears to have received divine honours. The Egyptian name of the Nile seems to have been simply PHIARO; the Ethiopians call it *Siris;* the AMEIRI of Kircher's vocabulary was probably a name of later date.

Apis, a bull consecrated to Osiris, was fed with divine honours at Memphis, the principal burying-place of that deity, of whose soul he was considered as the living image. He was all over black, except some small white spots, and some other particular marks not of common occurrence. He was sometimes said to be the offspring of a cow and a ray of moonlight.

Mneuis, or *Mnyis*, was also a black bull sacred to Osiris, kept at Heliopolis; although some authors assert that he was sacred to the sun. Ælian mentions also a black bull called Onuphis; and Macrobius speaks of a bull named Pacis, or Bacis, which was kept at Hermonthis. For the cow that was consecrated to Venus it does not appear that any particular name has been recorded.

SECTION VII.

OF THE EGYPTIAN CALENDAR.

Importance of the subject.—Its connection with the system of mythology.—Authorities.—Testimony of Eratosthenes.—Year of the Greeks of Alexandria no other than the Julian year.—Commencement of the ancient or moveable Egyptian year.—Sun's place in the zodiacal signs.—Consequences deduced therefrom.—Conditions of determining the date of a monument from the astronomical symbols.—Zodiacs of Esneh and Denderah.—Date of the latter.—Form of the sign Libra in the zodiac of Esneh.—Explanation of the beetles in the zodiac of Denderah.—No astronomical records of importance discovered, or perhaps discoverable, in hieroglyphical literature.—The months of the fixed or Alexandrian year.

From the mythology of Egypt we pass to the consideration of its calendar, which, besides being intimately connected with its system of religion, has often been a subject of speculation both with critics and with astronomers. The inquiry is no doubt in itself somewhat intricate; but the principal difficulties have arisen from the ignorance or carelessness of the Greek authors who have written on the Egyptian mythology. The Baron Alexander von Humboldt and M. Jomard have displayed great learning and research in collecting authorities on this subject; and nothing is wanting to establish the propriety of their acquiescence in the opinion of Petavius, except a little less indulgence for the extreme inattention of Plutarch, and a more marked deference to the important testimony of Eratosthenes, a writer whose catalogue of the Egyptian kings has already been noticed as bearing intrinsic marks of the authenticity of his information, and whose competency, as an accomplished astronomer, to discuss the regulation of the calendar, is of still greater notoriety. Geminus, a Greek astronomer of the Augustan age, has very distinctly stated that the later Greeks had been in the habit of mentioning the Egyptian festivals as connected with particular seasons of the year, in spite of the clearest evidence that their mythological year consisted of 365 days only, and that their anniversary festivals must necessarily have passed in succession through every part of the natural year. "It is a common and inveterate error among the Greeks," says Geminus, "to believe that the festival of Isis happens at the winter solstice. This was indeed true a hundred and twenty years ago, but it is now a month earlier; and such a mistake betrays the grossest ignorance of the Egyptian calendar. In former ages this festival was celebrated not only as late as the winter solstice, but, at an earlier period of time, even at the summer solstice; as Eratosthenes expressly states in his *Commentary upon the Octaeterides.*"[1]

The later inhabitants of Lower Egypt, and especially the Greeks of Alexandria, had certainly a stationary as well as a wandering year; but this was no other than the Julian year, which was introduced here some little time after its establishment in other parts of the Roman empire, and which was probably the only year ever employed by the Coptic Christians, although it can scarcely have been adopted at any time by the Pagan Egyptians. The common opinion is, that the Julian calendar was established at Alexandria in the year twenty-five before Christ, the first month Thoth then beginning on the 29th of August, as the Coptic year continued to do ever after. Thus Vansleb found, in the seventeenth century, that Thoth began on the 8th of September new style, which was the 29th of August old style. A passage of Theon, in his *Commentary on Ptolemy*, would rather incline us to fix on the 1st September for the beginning of the Alexandrian year; but the ecclesiastical authority is more direct, and it is confirmed by the present usage of the Abyssinian church. The quadriennial intercalation of a sixth supplementary day took place, according to the Abbé Boyer, at the end of the second year after the Julian bissextile; so that, in the year preceding the bissextile, the first of Thoth happened on the 30th of August. From these authorities we have no difficulty in ascertaining the beginning of the ancient or moveable Egyptian year for any earlier or later period; reckoning both ways, for the sake of simplicity, in Julian years.

B. C. 1500	2d Sept. O. S.	B. C. 400	1st Dec.
1400	8th Aug.	300	6th Nov.
1300	14th July.	200	12th Oct.
1200	19th June.	100	17th Sept.
1100	25th May.	B. of C.	23d August.
1000	30th April.	100	29th July.
900	5th April.	200	4th July.
800	11th March.	300	9th June.
700	16th Feb.	400	15th May.
600	21st Jan.	500	20th April.
500	26th Dec.		

It is of importance, in the discussion of some representations of astronomical objects, to determine at what time of the year the sun entered the respective signs, according to the Egyptian calendar, or, more particularly, what was the sun's place in the starry zodiac at the commencement of the year for different periods of time. Taking, then, 6h. 9m. 8s. for the excess of the sidereal above the Egyptian year, we find that 1424 Julian years were required for a complete revolution of the sun's place on the first Thoth, and 119 for each sign. Now since, about a century before the establishment of the Julian calendar, the sun entered Libra on the 24th of September, and since the Egyptian year began on that day, in 120 before Christ, it follows that Libra had been the first constellation during the whole of the preceding century; for, at this period, the beginning and end of the signs of the ecliptic agreed very nearly with those of the corresponding constellations of the zodiac. The first constellation of the Egyptian year will therefore stand nearly thus:

From 1552 B. C.		484	♑
to 1433	♍	365	♐
1314	♌	247	♏
1196	♋	128	♎
1077	♊	9	♍
958	♉	A. C. 110	♌
840	♈	228	♋
722	♓	347	♊
603	♒		

We may take, for an example of an Egyptian date, that of the Rosetta stone, in the ninth year of Ptolemy Epiphanes, or 196 before Christ, when the Egyptian year must have begun on the 11th of October; consequently the first of the sixth month, Mechir, was the 9th of March, and the 18th of Mechir, which is made synonymous with the 4th of Xanthicus, the 26th of March; so that Xanthicus must constantly have begun on the 22d of March, if the intercalations were properly adjusted; and this agrees sufficiently well with Usher's table of the Macedonian lunar months, which may therefore be supposed to have been generally employed by the Greeks in Egypt.

If we attempt to determine the date of a given monument from astronomical symbols contained in it, we must suppose that they represented the state of the heavens with respect to the Egyptian year at the time in question. Thus, in the zodiacs of the ruins at and near Esneh or Latopolis, the constellation Pisces seems to be the first sign, as it really was, about 800 before Christ, or in the time of Bocchoris and of the Ethiopian dynasty. It is, however, equally possible that Virgo may have been intended for the first sign, and this would answer either to the century immediately preceding the birth of Christ, or to a period fourteen centuries earlier. The zodiac at Denderah appears to begin with Leo; and unless we suppose its antiquity extravagantly great, we must refer it to the time of Tiberius, as Visconti has indeed already remarked. Mr Hamilton has confirmed this opinion by the collateral evidence of inscriptions in honour of the Roman emperors; although, with respect to the difference of time implied by the difference of a sign in the beginning of the zodiacs, he is rather inclined to adopt the sentiments of Lalande, who refers it to the effect of the precession of the equinoxes; imagining, without any kind of authority, that the division of the signs corresponded to the period of the solstices, a period which never constituted a marked feature in the Egyptian calendar.

In the zodiac at Esneh the sign Libra is denoted, as is usual in the Roman representations, by a female holding the balance; whilst the Egyptian constellation, in most other instances, is without the female. Servius, however, informs us that the Romans borrowed this sign from the Egyptians, the Greek astronomers having considered it as a part of the Scorpion; so that there is no reason to question the antiquity of the ceiling, from the occurrence of this constellation in it. The sign Cancer, both here and elsewhere, has eight feet, and it has certainly no connection with the figure of the sacred beetle, which occurs many thousands of times in other places, but never with more than six feet.

The beetles in the zodiac of Denderah have a very different signification, and the whole representation is much more of a mythological than of an astronomical nature. The beetle near the beginning of the zodiac is the well-known symbol of generation, and he is in the act of depositing his globe. On the opposite side, at the end of the zodiac, is the head of Isis, with her name, as newly born; both the long female figures are appropriate representations of the mother; and the zodiac between them expresses the "revolving year" which elapsed between the two periods. This explanation is completely confirmed by a similar representation of two female figures on the ceiling of the first tomb of the kings at Biban-el-Molouk; one with the beetle, and the other with the name of the personage just born. Between them, instead of the zodiac, are two tablets, divided into 270 squares, or rectangles, corresponding to the number of days in nine Egyptian months, with ten circles placed at equal distances, probably intended to represent full moons, and relating to the ten incomplete lunations to which these days must belong. The number 270 is too remarkable to be supposed to have been introduced by mere accident; and when the argument is considered as a confirmation of other evidence, in itself sufficiently convincing, the whole must be allowed to be fully conclusive.

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[1] Geminus *in Petavii Uranologia*. Par. 1630, f. p. 33.

There is indeed little chance of our discovering any astronomical records of importance among the profusion of hieroglyphical literature which is still in existence. Herodotus tells us that the Greeks derived their acquaintance with astronomy from the Babylonians, though they were supposed to have learned the elements of geometry from the Egyptians; and it is well known that Ptolemy the astronomer, who lived at Alexandria, and who, as well as Eratosthenes before him, must have had easy access to all the knowledge of the Egyptian priests, refers to no Egyptian observations, but employs the Babylonian records of eclipses which had happened a few centuries before his time; records which, as Pliny informs us, were preserved on a particular kind of bricks, the same, perhaps, which have been brought to Europe in our own times, as undeciphered specimens of the nail, or arrow-headed character. But a certain degree of geometrical knowledge can scarcely be denied to a people who had made very considerable progress in sculpture and architecture, at a time when all Europe was immersed in the profoundest barbarism, and who must necessarily have had frequent occasion for the employment of agrarian measurements. The Egyptians must also have been good practical chemists; so far, at least, as was required for the preparation of brilliant, diversified, and durable pigments; and even their devotion to alchemy, which derives its name from having been the *secret* or *dark* study of Egypt, must have led them to make some little progress in experimental philosophy, although neither their manufacturers nor their magicians could have any right to boast of solid acquirements in genuine science.

The months of the fixed or Alexandrian year were these:—

1. Thoth,	began 29th August, O. S.
2. Paophi,	28th September.
3. Hathôr, Athôr, or Athyr,	28th October.
4. Choiak,	27th November.
5. Tobi,	27th December.
6. Mechir,	26th January.
7. Phamenoth,	25th February.
8. Pharmuthi,	27th March.
9. Pashon,	26th April.
10. Paoni,	26th May.
11. Epiphi,	25th June.
12. Mesori,	25th July.

The years are commonly dated from the era of the martyrs of Diocletian, beginning in the autumn of 284.[1]

SECTION VIII.

REMARKS ON VARIOUS PUBLICATIONS RELATING TO EGYPT.

General observations.—French national work.—Hamilton's Egyptiaca.—Travels of Ali Bey, or Senor Badia.—Legh's Narrative.—Captain Light's Travels.—Mr Walpole's Collection of Memoirs relating to European and Asiatic Turkey.—Journal of Dr Hume.—Colonel Leake's Map of Egypt.—Quarterly Review.—Captain Caviglia; his labours and researches.—Mr Belzoni; his discoveries in the catacombs at Biban-el-Molouk, and in the Pyramid of Cephrenes.—Mr Salt and Mr Bankes.—Sheikh Ibrahim (Burckhardt); his travels and researches in Nubia.—Mr Cailliaud.—Discovery of Berenice.—The Egyptian Society.—Its collection of hieroglyphics.—Trilingual or trigrammatic stone of Rosetta.—First attempts made to decipher its triple inscription.—Reference to the article HIEROGLYPHICS.

By reason of the very early progress which the inhabitants of Egypt had made in the arts of civilized life, the antiquities and literature of that country have always been considered as objects of the highest interest and curiosity, though involved in inextricable obscurity; but we have acquired, in the course of the last thirty years, and are still continuing to acquire, such additional information respecting them as promises, if completely confirmed by future researches, to establish the whole of our knowledge respecting this marvellous country on a new and a sure foundation.

The labours of the French Institute at Cairo have been communicated to the public in a work of unexampled splendour and magnificence, the *Déscription de l'Egypte*, which was some time ago completed at the cost of the government. Many of the monuments brought by the British army to England have also been accurately and elegantly engraved in this country; and a variety of travellers of different nations have published accounts of their numerous observations and discoveries made in Egypt and the neighbouring countries.

The first in order of these that it will be necessary to notice is Mr William Hamilton's volume, entitled *Remarks on several parts of Turkey*, Part i. *Ægyptiaca.* London, 1809, 4to. It appears that the power of the French in Egypt having terminated in September 1801, the temporary possession of the country was at first divided between the Turks, the Mamlukes, the Arabs, and the English, a circumstance which afforded some convenience to a European traveller, although it had no tendency to enlarge the sphere of his observations. In the beginning of October, Captain Leake and Lieutenant Hayes were appointed by General Hutchinson to make a general survey of Egypt, and of the country beyond it, if it should be found practicable to penetrate farther south. Mr Hamilton, who had resided at the British head-quarters for the purpose of corresponding with Lord Elgin upon the events of the war, was now at liberty to join these gentlemen in their expedition; and the various information which, with their assistance, he collected, respecting the remains of the ancient Egyptian magnificence, bears ample testimony to the good taste, as well as to the industry and accuracy of the whole party. On account, however, of the disturbed state of the country, and of a multitude of other difficulties, both moral and physical, they were unable to proceed farther south than a few hours' journey beyond Syené, to a village called Debôd, opposite to which they observed the ruins of Barembre, the Parembole of the ancients, among which they found a Greek dedication of a temple to Isis by Ptolemy Philometor and his queen. They also collected a variety of inscriptions from other parts of Egypt, to which they added drawings and descriptions of the remains of the buildings to which they belonged; and, at Alexandria in particular, Mr Hamilton was enabled, in company with some other gentlemen, by examining the inscription on Pompey's pillar in different positions of the sun, to ascertain the name of Diocletian as that of the emperor to whom it was dedicated, and also to detect some traces of the name of Pompeius, who has been shown by M. Quatremère to have been a prefect of Egypt under that emperor. It is to be regretted, however, that the Coptic inscriptions, which are sometimes found mixed with the Greek, have not been more generally copied by travellers.

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[1] For much valuable information, laboriously collected and clearly digested, respecting the peculiarities of the form of year used by the ancient Egyptians, more especially as regards the influence which these peculiarities are supposed to have exercised on their modes of calculating and recording the dates of their civil history; and also for some very original and ingenious speculations concerning the primitive form and probable origin of the Egyptian calendar, astrological as well as civil, together with an examination of the period and circumstances of the first introduction of the zodiac into Greece; the reader may consult *A Dissertation on the Calendar and Zodiac of Ancient Egypt*, by W. Mure, Esq.; a work which, from the learning and research embodied in it, no less than from the novelty of some of the speculative views it unfolds, will amply repay the most attentive perusal.

Señor Badia, a Spaniard, who is supposed to have been sent into the East on the business of the French government, published two volumes of his *Travels*, under the name of *Ali Bey*. They embody some documents relating to the recent history and present state of Egypt, but contain very little information respecting its antiquities.

Mr Legh and Mr Smelt visited Egypt in 1812. They extended their tour as far as Ibrim, and observed in their way many remains of ancient buildings, some of which were in perfect preservation; but they were unable to attain the second Cataract, which was said to be three days' journey farther south.

Besides some other interesting antiquities which he collected, Mr Legh obtained in the island of Elephantiné a few Thebaic manuscripts, written with a chalybeate ink on skins of leather, which he afterwards deposited in the British Museum. They appear to be principally conveyances of estates, dated at Cyrshe or Gyrshe, a place fifty or sixty miles beyond Assouan or Syené; and, though unimportant in themselves, they tend to illustrate the history of the kingdom of Nubia in the middle ages. This kingdom seems to have been almost forgotten by some late travellers and geographers, although it was formerly remarkable for having been, according to an old tradition, one of the first that embraced Christianity, even in the time of the Queen Candace, one of whose servants was baptized by St Philip,[1] and who appears to have been one of the immediate successors of the Candace mentioned by Strabo as having attacked the province of Egypt, and having been conquered by Petronius in the time of Augustus. The kingdom of Nubia extended as far north as Syené, which continued to be the boundary of the Mussulman power in the tenth century, and probably much later. To the south it originally comprehended Ethiopia, its capital Meroë being placed in latitude 17°, on an island in the Nile, or rather on a peninsula formed by its principal branches. Candace had also a palace at Napata, which Pliny makes about five hundred Roman miles beyond Syené, and three hundred and sixty short of Meroë. In the seventh century, the Nubians seem nominally to have been made tributary to the Arabs; but they remained in fact almost wholly independent of them in their government, and their religion was entirely subjected to the spiritual direction of the patriarchs of Alexandria. Early in the tenth century the Nubians attacked Syené, not as rebels, but as legitimate enemies. They were, however, repulsed soon afterwards. A little later we find that George, king of Nubia, was a mediator between the king of Abyssinia and the patriarch, whom he persuaded to send bishops from Alexandria into Ethiopia. In the eleventh century, Solomon, king of Nubia, abdicated in favour of his nephew George, and retired to a monastery, within three days' journey of Syené; whence he was brought by the Saracens to Cairo, and there treated with great attention as a sort of state prisoner. It is also said that a king Cyriac once raised a hundred thousand men to assist the Christians against the Mussulmen; but the magnitude of the number renders the whole story more than doubtful. We learn from Hartmann's notes on Edrisi, that Abulfeda in the fourteenth century, and Bakoui in the fifteenth, spoke of the Nubians as still Christians; and it seems highly probable that they continued to exercise their religion till about the time of Sultan Selim in the beginning of the sixteenth century, if not still later; for Vansleb, who was at Siout in 1673, tells us that the churches were then still entire, though they were shut up, Christianity having become completely extinct for want of pastors. He gives us the names of seventeen bishoprics, which had constituted three provinces: the first province he calls Maracu, and attributes to it the bishoprics of Korta, Ibrim, Bucoras, Dunkala or Dungala, Sai, Termus, and Scienhur; the second province seems to hold a middle place; and in the third he mentions Soper as the capital of the kingdom, without noticing Nuabah, which is the name given to the metropolis by the Arabic authors. D'Herbelot, who died in 1695, speaks of the patriarch still resident at Dongola, and appointed by the patriarch of Alexandria. At any rate, there can be little doubt that the "King John" mentioned in the manuscripts of Gyrshe as a Christian must have been a king of Nubia, and rather a predecessor of the Mek of Dongola than a Greek emperor, whose authority was probably never acknowledged in this country, and least of all when Egypt was in the possession of the Arabians.[2] The remains of the churches mentioned by Vansleb were observed in many parts of Nubia, by Captain Light of the Royal Artillery, covered generally with paintings of scriptural subjects, and not uncommonly appearing to have been originally built for pagan temples. At Dakké Captain Light found the name of Hermes inscribed as that of the deity to whom the temple situated there must have been dedicated; and it will be interesting to inquire if any hieroglyphics can still be found on this remarkable edifice, which will bear a similar interpretation.[3] More recently Captain Light published a separate volume of his *Travels*, London, 1818, 4to.

Mr Walpole's collection contains also some older papers by Mr Davison, who was British consul at Algiers, and accompanied Mr Wortley Montague to Egypt in 1763. Mr Davison, as already stated, discovered in the Great Pyramid a room before unknown, immediately over the chamber which contains the sarcophagus; and he descended the three successive wells to the depth of a hundred and fifty-five feet. He also described the catacombs of Alexandria, which seem to have been principally employed by the Greek inhabitants of that city. The same volume contains a very interesting account of the customs and manners of modern Egypt, from the journal of Dr Hume.

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[1] Acts, viii.

[2] Strabo, book xvii.; Pliny, book vi. chap. xxix.; *Hist. Byzant.* vol. xxi.; *Ancient Universal History*, fol. vol. vii.; *Modern Universal History*, vol. i.; Vansleb. *Hist. de l'Egl. d'Alexandrie*, Par. 1677, p. 29; D'Herbelot, *Bibl. Orient.*; *Narrative of a Journey in Egypt, and the Country beyond the Cataracts*, by Thomas Legh, M. P. 4to, Lond. 1816; *Sepulchral Inscriptions from Nubia*, Archæologia, xix. p. 169.

[3] *Memoirs relating to European and Asiatic Turkey*, edited by R. Walpole, M. A. 4to, Lond. 1817, p. 402. 465.

A considerable addition has been made to our knowledge of the geography of Egypt by the publication of Lieutenant Colonel Leake's accurate and elegant map of that country, comprehending also a sketch of Nubia, as far as the southern Cataract, which appears to be the limit of the existing remains of antiquity. Besides the results of his own personal survey, Colonel Leake has employed the observations of the French astronomers for the determination of the situation of the different places; and, with respect to the remoter parts, he had the advantage of consulting the manuscript papers of the lamented Mr Burckhardt, who unhappily fell a victim to a dysentery at Cairo in October 1817, after having obtained, by a long residence in the country under the name of Sheikh Ibrahim, an intimate acquaintance with every thing that could have tended to facilitate the further prosecution of his projected expedition into parts of the continent still more remote. Besides the ruins of Greek churches scattered throughout this country, the principal points of Nubia, which are remarked as exhibiting remains of still greater antiquity, are the Parembole of the Itinerary of Antoninus near Debôd, and Tzitzi, now Klitzie, both of which had been visited by Colonel Leake and Mr Hamilton; Kardassy or Gartaas; Taphis and Contra Taphis, now Tafa; Kalabshé, the ancient Talmis; Merowan, the ancient Tutzis, near Gyrshe; Pselcis, now Dakké and Corte, still Korti; Maharraka, supposed to be the Hierosycaminon of the Itinerary, and which may very possibly have been the Maracu mentioned by Vansleb as an archbishopric; Seboua; Hasseya; Derr; Ibrim, the Premnis of the ancients; Ybsambul, perhaps the Aboccis, with its two temples, still better known by the labours of the active and ingenious Belzoni; Beyllany, or rather Fereyg; Serra, probably Phthuris; Sukkoy, perhaps Cambusis; Samne, not improbably the Acina of Nero's spies; Aamara, possibly Stadysis; and Soleb, not far short of the southernmost Cataract, where the author is disposed to place the Napata of the ancients, in latitude about $19\frac{1}{2}$°. This situation would agree very well with the distances of Napata from Syené and from Meroë; but it is impossible to admit that this Cataract can be so far south as even 20°, consistently with the testimony of other geographers respecting the latitudes of Mosho and Sukkot; and indeed the course of the river is laid down more nearly north and south than the description of Burckhardt requires.[1]

The *Quarterly Review*, in various numbers, afforded a highly interesting and gratifying detail of the operations and discoveries which had been conducted in Egypt by several of our spirited and enterprising countrymen. Amongst these Mr Bankes proceeded the farthest south in the steps of Mr Burckhardt, and made collections and drawings of a great number of striking remains of antiquity;[2] and he sent home to this country a variety of statues and bas reliefs, as well as large manuscripts on papyrus, in the epistolographic or enchorial character. Mr Salt was also indefatigable in his exertions, and he most fortunately found an assistant of Herculean strength of body, and of proportional energy of mind, in the person of Mr Belzoni. The head called a young Memnon, now in the British museum, which weighs eight or ten tons, and which is one of the very finest specimens of Egyptian sculpture extant, was a joint present of Mr Salt and Mr Burckhardt; and Mr Belzoni, as already stated, had the merit of having conducted the very difficult operation of bringing it down to the Nile. Mr Hamilton conjectured that it might have belonged to the statue described by Philostratus as a Memnon of great beauty;[3] but the remaining fragment of the hieroglyphical inscription agrees better with the name of another sovereign, apparently of the same family, who is represented in several other magnificent monuments at Thebes and elsewhere.

Captain Caviglia, the master of a mercantile vessel in the Mediterranean, exerted himself with singular activity and perseverance in examining the interior of the great pyramid of Cheops. After having retraced the forgotten steps of Mr Davison, he succeeded in pursuing the principal oblique passage two hundred feet farther downwards than it was before practicable, and in discovering at this point a communication with the well, which descends from the floor of the upper chamber. This communication affording him a freer circulation of air, he was enabled to proceed twenty-eight feet farther in the passage, when he found that it opened into a spacious chamber, sixty-six feet by twenty-seven, but of unequal height, immediately under the centre of the pyramid, which Mr Salt supposes to have been the place of the *theca*, or sarcophagus, mentioned by Strabo as situated at the end of the oblique passage, though at present no sarcophagus is to be found in it. The floor is elevated thirty feet above the level of the Nile, so that the water could never have flowed into this part of the pyramid, to surround the tomb of Cheops, as Herodotus imagined. Some passages leading out of this chamber appear to terminate abruptly, without opening into any others. The dimensions of the upper chamber, which still contains a sarcophagus, are only thirty-five and a half feet by seventeen and a quarter, and eighteen and three fourths high.

Captain Caviglia having proceeded to examine a number of detached mausoleums, more or less dilapidated, in the neighbourhood of the pyramids, found their embellishments chiefly in the style of the Theban catacombs; and, what is not a little remarkable, they sometimes contained images too large to have been brought in through the doors or windows. Some of the stones with sculptures were placed upside down; and it was conjectured that these might possibly have been portions of the original casing of the pyramids, which is said to have been sculptured, but which is now fallen down. His next undertaking was the very arduous task of digging away the sand in front of the great Sphinx; a share of the expenses of this labour, which amounted to eight or nine hundred pounds, being contributed by Mr Salt and some other gentlemen. The body of the monster is principally formed out of the solid rock, and the paws are of masonry, extending forwards fifty feet from the body; between them were found several sculptured tablets, so arranged as to constitute a small temple or chapel; and farther forwards a square altar with horns, which seems to have been employed for burnt offerings.

Mr Belzoni, after many fruitless efforts, succeeded, as already mentioned, in discovering the entrance into the second pyramid of Cephrenes, in which Herodotus had asserted that there were no chambers. An Arabic inscription testifies that the pyramid had once been opened in the presence of the "Sultan Ali Mahomet the First, Ugloch," who may possibly have been the Ottoman emperor, Mahomet the First, in the beginning of the fifteenth century.[1] Among the Theban catacombs Mr Belzoni discovered six new tombs; the most remarkable of which, with all its galleries, three hundred and nine feet in length, he called the tomb of Apis, from having found the mummy of a bullock in one of its chambers. In another apartment was the magnificent sarcophagus of white alabaster already mentioned; and the whole excavation, sculptured and painted in the most finished style of art, was found in the most perfect preservation. In Nubia the spirit and perseverance with which the little band of excavators pursued the attempt to penetrate into the temple of Ybsambul were not less worthy of admiration. Mr Belzoni and his servant, accompanied only by Mr Beechey, were abandoned on some futile pretence by the Arab workmen whom they had employed, and were unable to procure for many weeks any other food than dhurra or millet. They had resolution enough, however, to proceed with their enterprise as manual labourers, and they were at last amply rewarded for their perseverance. In front of the temple there were four colossal statues, sixty feet high, one of which had been thrown down; but it was only after digging for three weeks, through a hundred and fifty feet of sand, that our adventurers succeeded in entering the temple, consisting of fourteen chambers and a great hall, cut out of the solid rock, and ornamented with sculptures superior in point of execution to the greater part of those which are found in Egypt; besides eight colossal statues thirty feet high, which are placed in the hall. Mr Belzoni also found at Thebes a colossal head and arms, supposed to have belonged to a Horus; and his lady discovered, during his absence in Nubia, a fine statue of white marble, supporting a ram's head on its knees.

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[1] *Map of Egypt*, two sheets, Lond. 1818.

[2] *Quarterly Review*, No. 31.

[3] *Ibid.* No. 36.

Though Burckhardt's untimely end interrupted his farther progress in Africa, yet with respect to Nubia his observations were complete, and he had himself prepared his journals for publication, in a form which does equal credit to his diligence and judgment in observation, and to his candour and good taste in the simple and elegant narration of that which he had observed.

It appears that the Nile, between the first and second Cataracts, runs chiefly through a country of sandstone, and is navigable throughout this extent; but at the Cataract of Wady Halfa, a little above Ybsambul, the sandstone terminates, and the district of granite and other primitive rocks begins, extending a hundred miles farther upwards; and in this space the course of the river is interrupted by frequent shallows and small falls. The roaring of the fall at Wady Halfa may be heard at the distance of a mile or two; but the part of the river that falls is only about twenty yards over. There are, however, three falls in succession, and the neighbouring scenery is very romantic. Immediately beyond this country is Kolbe, the principal place in the district of Sukkot, for there is no town of that name; then the island Say, probably the Sai of Vansleb; and four hundred and fifty miles above Assouan, according to Mr Burckhardt's reckoning, is Tinareh, in the district of Mahass, the farthest point to which he penetrated, within fifteen or twenty miles of the remotest Cataract, and a day and a half's journey only from Mosho by the shortest road. The country through which he passed was supposed to contain a population not exceeding a hundred thousand, and governed by three Kashefs, who are brothers, and tributary to Egypt, but inclined to favour the Mamlukes, who were established in the neighbourhood of Dongola. At Mahass a series of more than twenty little kingdoms begins, which extend to Sennaar. At Mosho begins the kingdom of Dongola; and near the same place is the island of Argo, a whole day's journey in length, with a brick castle in it. There are many other islands in the course of the river through Dongola, which extends for five days' journey. The country is celebrated for a very fine breed of horses, like the Arabian, but much stronger, and fed, as Bruce observed of the horses in the same neighbourhood, on straw only. The city of Merawe, singularly resembling the ancient Meroë in name, is the metropolis of the Sheygya Arabs, beyond Dongola, and is remarkable for schools of high reputation, which are particularly celebrated for their penmanship.

The languages spoken in Nubia are the Kensy and the Nouba, the former of which was confined to the northernmost parts of the country. These languages somewhat resemble each other, but they differ essentially from the Arabic, although the people are supposed to be the descendants of Bedouin Arabs, who spread from the East in the middle ages, with the exception of a few of the original inhabitants, who remain about Tafa and Serra, having become Mahommedans. But however this may be, it is certain that the languages exhibit no traces whatever of any dialect of the old Egyptian; and this circumstance affords a very strong argument in confirmation of the author's assertion, that the Christians had in general been expelled from Nubia before the time of Sultan Selim; the three garrisons of Bosnian soldiers, whom this prince established in Assouan, Ibrim, and Say, having been sent by the express invitation of one of the rival factions of Arabs, who occupied the country, and remaining still distinct from the rest of the population, and being governed by their own Agas. We can only reconcile these facts with the testimonies in favour of the existence of Christianity in Nubia down to about the same time, by supposing that its extinction must have been gradual, and that the Thebaic language, and the ancient religion of the country, dwindled away by degrees, not for want of pastors only, but from the hostility of the Arabian intruders.

A concise but clear and satisfactory description of the various temples noticed in Colonel Leake's map, is inserted in the relation of Mr Burckhardt, who conjectures that the order of their antiquity is nearly this: 1. Ybsambul; 2. Gyrshe; 3. Derr; 4. Samné; 5. Ballyané; 6. Hasseya; 7. Seboua; 8. Aamara and Kalabshé; 9. Dakké and Maharraka; 10. Kardassy; 11. Merowau; 12. Debôd; 13. Korty; and, 14. Tafa. The small temple at Ybsambul has a head bearing a temple for the capital of its columns, like those at Denderah, but with a lock of hair hanging down on each side. The statues before the great temple, which is supposed to have been dedicated to Osiris, are of remarkably fine forms. In a small temple at Kalabshé there are some good historical sculptures of a victory obtained over the southern countries beyond Meroë. But the sculptures at Dakké Mr Burckhardt thinks superior to any others of the Egyptian school, and such as might have been considered as fit ornaments for a Grecian building. In a small temple at Samné there is still an image with the attributes of Osiris, and there are figures of a Paamyles on the walls.

Mr Burckhardt has given several Greek inscriptions, many of which had been copied by Captain Light a little differently. One of these begins with the words "This is the homage of *Caius* Cassius Celer;" not *Vulsilius*, as it had been read from Captain Light's manuscript. At Maharraka, the writer of one inscription has very benevolently included the reader in his petition for a blessing from "Isis, the goddess with ten thousand names, and from the sun Serapis." At Kardassy, an inscription dated under the Philips, the successors of the Emperor Gordian, records the munificence of Psentuaxis, who gave to the temple "twenty pieces of gold in his first priesthood, and thirty in his second." In fact, there is scarcely any trace of the old Egyptian language to be found in any existing monument, employed upon any other occasion than for the most unimportant memorials of the most insignificant personages.

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[1] *Quarterly Review*, No. 36, 37, 38.

Several years ago, an article appeared in one of the French journals, announcing the discovery of a ruined city situated a few leagues from the Red Sea, by a young French traveller, M. Cailliaud, nearly in the latitude of Assouan, and called by the Arabs Sekelle. It has still many temples, palaces, and private houses standing, so that it may in some respects be compared to Pompeii. The architecture is Grecian, with some Egyptian ornaments; and several inscriptions prove that it was built by the Ptolemies, one of the temples having evidently been dedicated to Berenice. The situation agrees sufficiently well with that of the ancient city Berenice; but the city may easily have been at some little distance from a harbour bearing the same name; and no other town of any magnitude seems to have existed in the neighbourhood. It was through Berenice, according to Pliny, that the principal trade of the Romans with India was conducted, by means of caravans which reached the Nile at Coptos, not far from the point at which the present shorter route by Cosseir meets the river.

Whilst so much had been done abroad for the recovery of the lost treasures of Egypt, it appears that no less labour had been silently employed in pursuit of the investigation at home; and, partly with a view to perpetuate the continuance of these efforts, an association was formed in London, of which the first and immediate object was merely to insure the preservation, and to facilitate the study, of all that remains of Egyptian literature, by making a collection of drawings of all the hieroglyphical inscriptions in existence, and printing them lithographically, in a form most convenient for reference and examination, under the title of *Hieroglyphics, collected by the Egyptian Society*. The plates do credit to the manipulation of Mr Ackermann's press, as well as to the extreme neatness and accuracy of the draughtsman who was employed on them. They can scarcely be said to have been published, as they were only distributed amongst a limited number of subscribers; but as they were presented to several public libraries in different parts of Europe, they may be consulted by the general reader without difficulty.

In the midst of all the zeal and activity displayed by our countrymen who had travelled or who were resident in Egypt, it is much to be regretted that their attention had not been turned to an object paramount to all the rest in its importance for the substantial advancement of our acquaintance with the ancient history and literature of the country; that is, the recovery of the lost fragments or of some of the duplicates of the trilingual, or rather trigrammatic stone of Rosetta; a monument which has enabled us to obtain a general idea of the nature and subject of any given hieroglyphical inscription, by pursuing the investigations carried to an unexpected extent by the discoverer Dr Young, whose interpretation was communicated to the Antiquarian Society by Mr Rouse Boughton, together with copies of some fragments of manuscripts which this gentleman had brought from Egypt.[1] M. de Sacy, and more especially Mr Akerblad, had made some progress in identifying the sense of the several parts of the second or enchorial inscription of the stone; but they had scarcely at all considered the sacred characters; and it was left for British industry to convert to permanent profit a monument which had before been a useless though a glorious trophy of British valour.

It must be recollected that every analysis of an unknown object of this nature must unavoidably proceed more or less by the imperfect argumentation sometimes very properly called a circle, but which, in such instances, may be more aptly compared to a spiral, or to an algebraical approximation; since, by assuming certain incorrect suppositions, not too remote from the truth, we may render them, by means of a continual repetition of the calculation, more and more accurate, until at length the error is rendered wholly inconsiderable; and in this manner we often satisfy the conditions of a problem which it would be impracticable to solve by a more direct method. A process thus tedious and laborious, however, loses the greater part of its interest when the solution is obtained; and it is no longer necessary to explain in detail every step through which it has passed. The deciphering of the Rosetta stone is fortunately in a great measure independent of any hypothesis of this kind extraneous to itself; and the Greek text affords at once the first approximation for beginning the process. But, in order to extend the inquiry to other objects, a variety of authorities must be compared and appreciated. We must select from the Greek authors an abstract of the religious superstitions and of the civil ordinances of the Egyptians; and it will be necessary, in making this selection, to have some regard to the results which have been obtained from an examination of the principal hieroglyphical monuments still extant, in order that we may avoid the confusion which would be the necessary consequence of adopting indiscriminately the whole mass of contradictory matter, which various mythological authors have collected or invented upon the subject; and considering how absurdly and monstrously complicated the Egyptian superstitions really were, it becomes absolutely essential to separate that which is most fully established, or most generally admitted, from the accidental or local varieties which may have been exaggerated by different authors into established usages of the whole nation, and still more from those which have been the fanciful productions of their own inventive faculties. Unfortunately, by far the greater number of the existing monuments of Egypt are of a mythological nature; so that their Pantheon, or rather Pantherion, acquires an interest altogether foreign to its real character, on account of the utility of a general knowledge of the subject in developing the nature of the language employed. The accounts which have been preserved of the customs and civil ordinances of the country are still more discordant than those which relate to their deities, but they may yet in some instances be illustrated from monuments which remain in existence. Respecting the early history and chronology of Egypt, we can do little more than appreciate the various degrees of plausibility of the different fables that have been related, and the comparative credulity of the authors who have appeared to believe in them; for hitherto no hieroglyphical records have been discovered, which can afford us much assistance in this department of the investigation; though it is by no means impossible that a continued series of the sovereigns of Egypt, from the earliest times, may have been chronicled in more than one of the innumerable multitude of inscriptions hitherto uncopied and unexamined. See the article HIEROGLYPHICS.

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[1] *Archæologia*, vol. xviii. p. 61. *Museum Criticum*, No. vi. and vii.

EGYPTIANS, or Gypsies. See Gypsies.

EHINGEN, a bailiwick of the kingdom of Wirtemberg, in the circle of the Danube. It extends over 143 square miles, comprehending two cities, two towns, and sixty-two smaller places, with 21,157 inhabitants. The capital is the city of the same name, situated on the Danube. It contains 500 houses, and 2840 inhabitants, who spin cotton yarn by means of machinery, and prepare the dyes for Turkey red. Long. 9. 51. 34. E. Lat. 48. 29. 36. N.

EHNINGEN, a city of the kingdom of Wirtemberg, in the circle of the Black Forest, where the greatest markets are held of any in the kingdom. It contains 4434 inhabitants, who make ribbons, lace, handkerchiefs, and other goods.

EHUD, the son of Gera, a Benjamite, a left-handed man, who delivered Israel from the oppression of Eglon, king of Moab, under whom they served for eighteen years. This will be found recorded in the third chapter of Judges.

EIA, or Ey, in our old writers, is used to indicate an island. Hence the names of places ending in *ey* denote that they are islands. Thus, Ramsey, the isle of rams; Shepey, the isle of sheep; and so of others.

Eia is also sometimes used for water; and hence the names of places near waters or lakes sometimes terminate in *ey*.

EIBENSTOCK, a city of the kingdom of Saxony, in the circle of Erzgeberg, and bailiwick of Krottendorf. It stands on the river Mulde, in a mining district, 1896 feet above the level of the sea, and contains 3440 inhabitants, employed chiefly in mining and preparing the metals; but the females make a large quantity of thread lace.

EICETÆ, called also Heicetæ and Hicetæ, were heretics of the seventh century, who made profession of the monastic life. From the passage in Exodus where Moses and the children of Israel are said to have sung a song in praise of the Lord, after they had safely passed the Red Sea, the Eicetæ concluded that, in order to praise God aright, the introduction of singing and dancing was necessary; and as Mary the prophetess, sister of Moses and Aaron, beat a drum on the same occasion, an example which was followed by all the other women to express their joy, the Eicetæ, in order the better to imitate them, enticed females to make profession of the monastic life, and assist in their mirth.

EICHSTEDT, a bailiwick of the circle of the Regen, in the kingdom of Bavaria. It was formerly under the dominion of the Duke of Leuchtenberg, but has been mediatised. It extends over 470 square miles, and comprehends four cities, nine market-towns, a hundred and eleven villages, and seventy hamlets, with 45,256 inhabitants. It is a well-watered and well-cultivated district. The mountains contain iron, slates, and marble. It was given by the late king to his son-in-law Eugene Beauharnois, and was said to have yielded L.25,000 yearly. The capital is a city of the same name, which stands in a narrow valley on the river Altmühl. It is surrounded with walls, and has a castle the residence of the prince, a cathedral, a gymnasium, an orphan house, six churches, 900 houses, and 5596 inhabitants, some of whom are employed in manufacturing fine thin cloths and some other articles. Long. 11. 6. 5. E. Lat. 48. 53. 30. N.

EIDER Duck. See Ornithology.

Eider *Down*, the down of the eider duck. The eider duck plucks off the down from its breast for the purpose of making its nest, which it continues to renew as often as deprived of it, until its breast becomes quite bare.

In commerce this down is sold in balls about the size of a man's fist, and weighing from three to four pounds. It is so remarkably fine and elastic, that if one of these balls be opened and cautiously held over a fire to expand, it will fill a quilt about five feet square. Supplies of it are received chiefly from Norway, Iceland, and the Faroe Islands, where the birds abound. There are two kinds of it, sea-weed down and grass down. The former is the heaviest, but not so easily cleaned as the other.

EILAU-PRUSSIAN, or Eylau-Preussischen, a town of the province of East Prussia, and government of Königsberg. It contains a hundred and ninety-eight houses, and 1634 inhabitants. It is remarkable for the great battle fought there on the 7th and 8th February 1807, between the French and the united Russian and Prussian armies.

EILENBURG, a city of the Prussian province of Saxony, in the circle of Deletzsch. It is situated on an island formed by the Mulda, is surrounded with walls, and contains 573 houses, and, with the military, 4545 inhabitants. There are establishments for the printing of calico, and for other manufactures.

EIMBECK, or Einbeck, a city of the province of Grubenhagen, in the kingdom of Hanover, at the foot of the Hartz Mountains. It is walled, and contains 784 houses, with 4995 inhabitants employed in various trades.

EINDHOVEN, a city of the province of North Brabant, in the Netherlands. It stands at the junction of the rivers Gender and Dommel, and contains 390 houses, and 2810 inhabitants. Long. 5. 23. 20. E. Lat. 51. 25. 26. N. It is the capital of a circle of the same name, divided into seven cantons, which contain 85,066 inhabitants.

EINSHEIM, a bailiwick in the circle of the Neckar, in the duchy of Baden, in Germany, comprehending one city, sixteen villages, and five hamlets, with 14,370 inhabitants; the capital of which, of the same name, stands on the river Elsenz, and has 186 houses, with 2358 inhabitants.

EISENACH, a principality, forming a considerable part of the grand duchy of Saxe-Weimar, in Germany. It extends over 456 square miles, comprehending seven cities, six market towns, 228 villages, 12,920 houses, and 65,549 inhabitants. It is a scattered principality, many portions of which are surrounded by the territory of other sovereigns. The city of Eisenach, the capital of the principality, is situated on the river Nesse, at the foot of a range of lofty hills, from the summit of which a fine view is obtained over a great part of Saxony. It contains 1490 houses and 8258 inhabitants. It is a place of active industry in a great variety of manufactures, particularly those of cotton and woollen. Near to it is the castle of Wartburg, situated on a lofty rock, and celebrated as the place of confinement of Martin Luther. Being on the high road between Frankfort and Leipsic, it has a great transit trade. It is in longitude 10. 13. 51. east, and latitude 50. 57. 7. north. Eisenach is also the capital of a bailiwick of its own name, which comprehends one city, one market-town, nineteen villages, and twelve hamlets, with 17,325 inhabitants.

EISENBURG, a city of the principality of Altenburg, in the grand duchy of Saxe-Gotha, in Germany. It is situated on a remarkable elevation, is surrounded with walls, and contains a ducal palace, three churches, 546 houses, and 4243 inhabitants, who make cotton goods, ribbons, furniture, porcelain, leather, and other articles. It is the capital of a bailiwick of the same name, with 13,000 inhabitants.

EISLEBEN, a city of the province of Prussian Saxony, the capital of the circle of Mansfeld. It is divided into the old and the new city, is surrounded with walls, and has several establishments for education, four churches, 957 houses, and 7100 inhabitants. It is celebrated as the birth-place of Martin Luther, the house where he was born being now used as a charity school. It is a place of considerable trade and manufacturing industry. Long. 11. 26. 5. E. Lat. 51. 53. 5. N.

EJECTMENT, in *English Law*, a writ or action which lies in favour of the lessee for years, on his being ejected or put out of his land before the expiration of his term, either by the lessor or a stranger. It may also be brought by the lessor against the lessee, for rent in arrears, or holding over his term, and the like.

EKATERINOGRAD, a town and fortress of Asiatic Russia, in the government of Caucasus, on the river Mulka or Balk, which a little lower falls into the Terek. It is the strongest place on the Caucasian line of posts, having been founded in the year 1776; and it remained the capital of the province of Caucasus, until it was constituted a government in 1785. It is twenty-four miles north-west of Mozdok.

EKRON, a city and government of the Philistines. It fell by lot to the tribe of Judah, in the first division made by Joshua, but it was afterwards given to the tribe of Dan. It was situated very near the Mediterranean, between Ashdod and Jamnia. Ekron was a powerful city, and it does not appear from history that the Jews were ever peaceable possessors of it. The idol Beelzebub was principally adored at Ekron.

ELÆOTHESIUM, in *Antiquity*, the anointing room, or place where those who were to wrestle or had bathed anointed themselves. See GYMNASIUM.

ELAM, in *Ancient Geography*, a country frequently mentioned in Scripture, and situated to the south-east of Shinar. In the time of Daniel (viii. 2) Susiana seems to have been part of that country; and before the captivity it does not appear that the Jews recognised Persia by any other name. Elymæ and Elymais are frequently mentioned by the ancients. Ptolemy, although he makes Elymais a province of Media, yet places the Elymæ in Susiana, and near to the sea; but Stephanus supposes it to have been part of Assyria, and Pliny and Josephus more properly part of Persia, whose inhabitants, we are informed by the latter, were descendants of the Elamites. The best commentators agree that the Elamites were sprung from Elam the son of Shem. It is likewise allowed that the most ancient amongst the inspired writers constantly allude to Persia when they speak of Elam and the kingdom of Elam.

ELAPHEBOLIA, in Grecian antiquity, a festival observed in honour of Diana the huntress. In the celebration of this mystery a cake was made in the form of a deer (ελαφος), and offered to the goddess. It owed its institution to a notable circumstance. When the Phocians had been severely beaten by the Thessalians, they resolved, by the persuasion of one Deiphantus, to raise a pile of combustible materials, and to burn their wives, children, and effects, rather than submit to the enemy. This flaming resolution was unanimously approved of by the women, who decreed Deiphantus a crown for his magnanimity. But when every thing was prepared, and just before they had fired the pile, they engaged their enemies, whom they totally routed, and thus obtained a complete victory. In commemoration of this unexpected success, the festival was instituted, and observed with the greatest solemnity.

ELAPHEBOLIUM, in Grecian antiquity, the ninth month of the Athenian year, answering to the latter part of February and the beginning of March. It consisted of thirty days, and took its name from the festival Elaphebolia, observed in this month in honour of Diana the huntress, as mentioned above.

ELASTIC, in *Natural Philosophy*, an appellation given to all bodies endowed with the property of elasticity.

ELASTICITY, or ELASTIC FORCE, that property which bodies possess of restoring themselves to their former figure, after any force which has disturbed it is withdrawn. Elasticity is generally accounted for by the great law of attraction. Thus, when a hard body is struck or bent, so that the component parts are moved a little from each other, but not so far as to overcome the power of the attractive force by which they cohere, they necessarily, on the cessation of that external force, return to their former state. All hard bodies are elastic, as steel, glass, and ivory, and many soft ones, as caoutchouc, silk thread, &c. The reniform bodies are all perfectly elastic. Liquids are also perfectly elastic, but to a small extent.

ELATEA, the largest and most important city of Phocis, situated on the declivity of a hill above the fertile plains of the river Cephissus. Behind it to the north rose a mountain ridge, which, issuing from Doris, stretched away to the south-east, and at its extremity was called by the name of Cnemis. Here dwelt the Locri Epicnemidii. An enemy who wished to penetrate from Thermopylæ by the most direct road into Greece required first to secure the mountain passes round Elatea, and to get possession of the city itself. Then the whole of Phocis and Bœotia lay open before him. Hence the alarm and consternation produced at Athens on the news reaching it of Elatea having fallen into the hands of Philip. (Demosth. *Orat. de Cor.* p. 284; Strab. ix. 424; Diodor. xvi. 84.) It was burnt to the ground by the Persians, and destroyed at the conclusion of the sacred war by order of the Amphictyonic council. Being afterwards rebuilt, it made a successful stand against the arms of Cassander, and was at last taken by the Romans from Philip, son of Demetrius. Its ruins are found on a site still called *Elephta*.

ELATERIUM, Ελατηριον, in *Pharmacy*, a violently purgative medicine, prepared from the wild cucumber.

ELATH, or ELOTH, a port of Idumæa, situated upon the Red Sea, which David in his conquest of Edom took, and established there an extensive trade. His son, we are informed, built ships in Elath, whence they were dispatched to Ophir for gold. It continued in the possession of the Israelites till the time of Joram, when the Edomites recovered it; but it was wrested from them by Azariah, who left it to his son. It was afterwards taken from Ahaz by the Syrians, who held it a long time; and it passed at length into the hands of the all-subduing Romans.

ELBA, an island of the Mediterranean, separated by a narrow channel from the western coast of Italy. It is situated in long. 10. 9. 24. E. and lat. 42. 49. 6. N., and is about seventy English miles in circuit; but the coast is very winding and irregular.

Elba is supposed to have been first peopled by a colony of Etruscans; but it was afterwards occupied by a body of the Greeks who founded Marseilles. It subsequently fell under the dominion of Carthage, and was taken by the Romans during the first Punic war. In the second, Elba supplied iron for naval and military purposes, and was considered as one of the states which had saved the republic. In the contest between Sylla and Marius, the adherents of the latter fled thither for refuge, and Elba became thus involved in prescription and devastation, from the effects of which it never recovered under the Roman dominion. In modern times it became attached to the commercial republic of Pisa, under the auspices of which it rose to a comparatively flourishing state. On the annexation of Pisa to Milan, Elba, with Pianosa, Monte Cristo, Piombino, and other territories, was formed into a little principality, which continued for about two centuries in the hands of Gherardo d'Apiano and his successors; though it was repeatedly occupied as a military station by Charles V. and his ally, the grand duke of Tuscany. Being thus involved in the wars of that monarch with the Porte and the Barbary states, Elba became exposed to the incursions of the Turkish corsairs. It was laid waste with fire and sword, once by Barbarossa, and twice by Dragut, and it has never fully recovered from these ravages. Under Philip III. it fell into the possession of Spain, and that prince ordered the construction of Porto Longo, which proved a barrier against the incursions of the corsairs. Several transferences afterwards took place, the result of which was, that after 1735 the king of Naples had possession of Porto Longo, and the grand duke of Tuscany of Porto Ferrajo. Elba continued in this state till the French revolution, when it first became part of the kingdom of Etruria, and was then annexed to France. It afterwards attracted a remarkable degree of attention by becoming the temporary residence of Napoleon Bonaparte. Upon his second downfall, Elba was ceded to the grand duke of Tuscany.

The island of Elba is entirely filled with mountains, which are formed into three distinct clusters, separated by a valley, which widens as it approaches the sea. The highest are those situated on the western part of the island, the pinnacle of which, called Monte Capanna, rises upwards of 3000 feet above the level of the sea. The greater part of these hills present an arid, rugged, and often ruinous aspect; but a few are embellished with myrtles, laurels, wild olives, and other verdant shrubs. The western part is almost entirely composed of granite, which forms also the basis of the soil in this quarter of the island. Rock crystal abounds, and is often found in large masses, but somewhat injured in its transparency, and, when combined with alum and slate, it produces numerous varieties of calcedony, particularly that called *cachalong*. The eastern mountains are composed of serpentine and schistus, and abound with aluminous mixtures; but they are chiefly distinguished by the iron which they contain.

Except husbandry, which is wholly that of the spade or the hoe, the chief employment of the inhabitants consists in mining, and iron is the chief article of exchange.

The population in 1778 was estimated at 8000, but it has since risen to 12,000 souls. The Elbese are a race differing in many respects from that which inhabits the continent of Italy. They are well made and robust, and often attain a great age without experiencing ailment or infirmity. They are brave, active, hardy, laborious, and at the same time kind-hearted and hospitable. They are, however, very irritable, and impatient of contradiction. They are almost universally ignorant and credulous, yet have a certain liveliness of imagination, which renders them fond of extravagant and romantic tales. The females are not in general handsome, but to this there are some exceptions; they are generally virtuous, however, and make good wives and mothers.

The principal town is Porto Ferrajo, which contains a population of 3000 souls. The houses are small and inconvenient. Porto Longo is a well-fortified town, with an agreeable and picturesque neighbourhood, and contains 1500 inhabitants. Rio is poor, and is only supported by the great iron mine which is situated in its neighbourhood; its population amounts to about 1800 souls. Other villages and districts are Capo Liveri, Campo, and Marciano.

(*Voyage to the Island of Elba*, by Arsenne Thiebaut de Berneaud; translated by W. Jordan, 8vo, 1814. *Tour through the Island of Elba*, by Sir Richard Colt Hoare, Bart. 4to, 1814.)

ELBE (the *Albis* of the ancients), a large river of Europe, in Germany, which rises in the *Riesen Gebirge*, or Giant's Mountains, between Silesia and Bohemia, and is known at its source by the Sclavonic name of the *Labbe*. Its principal sources are the White Fountain, at the base of the *Schnee-Kuppe*, and the eleven fountains of the Elbe in the Navarian meadow. To the number of streams which descend into Bohemia from the neighbouring mountains it owes its early increase. After its junction with the river Eger, it becomes navigable, and, entering Saxony, passes successively Dresden, Meissen, Torgau, and Wittenberg. In its course, which is northerly, it receives two other rivers, the Muldau and the Saale; and running through the territory of Magdeburg and the duchies of Mecklenburg and Launburg, it discharges itself at last into the German Ocean, about seventy miles below Hamburg, after a course of 500 miles. The Elbe has always been an important river in a military point of view. With respect to commerce, it gives to Hamburg its command of the navigation far into the interior, although the voyage is difficult, on account of the numerous sand-banks, and the occasional violence of the wind. It communicates with the Havel by the canal of Plauen, in the territory of Magdeburg; and at Hamburg it is connected in like manner with the Trave at Lubeck; it is also joined to the Weser by a canal running between Vegesak and Stade. Besides the natural difficulties of navigating this noble stream, the circumstance of its traversing so many different kingdoms and petty states has given rise to another, namely, the endless tolls imposed by the princes of the various sovereignties through which it passes. The congress of Vienna intended to rectify this evil; but, notwithstanding the regulations introduced, the navigation of the German rivers cannot yet be called free.

ELBERFELD, a city of the Prussian province Clewe-Juliers, of the government of Dusseldorf, and the capital of a circle of the same name. It stands on the river Wipper, which falls into the Rhine a few miles from the city. It is a place the most celebrated for its activity and progress of any in the Prussian dominions. In 1817 the houses were 2400, and the inhabitants 15,681, and in 1830 the latter had increased to 25,000. It has more than 1000 looms at work in silk goods, many mills for spinning cotton, besides machines for weaving cottons, and most of the other inventions for facilitating manufacturing operations which are known in England. The value of the goods annually produced at and near to the city is said to amount to L.1,500,000 sterling. It is the chief seat of the Rhenish company, who export the various goods of Germany to the West Indies and all parts of North and South America.

ELBEUF, a city of the department of the Lower Seine, in France, on the left bank of that river, containing 919 houses, and 6351 inhabitants, among whom are many manufacturers of the finest cloth, and of flannels, carpets, and hosiery. Long. 0. 53. E. Lat. 49. 20. N.

ELBING, a city in the province of West Prussia, and government of Dantzic, and the capital of a circle of the same name. It is situated on the river Eblach, which divides the suburb of Grubenhagen, and the part where the corn magazines are built, from the town. About five miles below the city that river joins the Nogat, which is navigable for large vessels. Elbing contains six churches, five hospitals, and several other public buildings, with 2029 houses and 18,570 inhabitants. It is, next to Dantzic, the greatest corn market of Europe, and a stock of wheat is generally kept there amounting to from forty to eighty thousand quarters. A great portion of the productions of Poland is exported from this city. These, besides corn, consist of potash, pearl ash, linen, wood, tallow, and wax; and that country receives a part of its supply of manufactured and coloured goods, of wine, of iron, of salt, and other articles, through the same channel. The city possesses some manufactories, such as refineries for sugar, soap-boiling, snuff-mills, breweries, and tanneries; and many ships are built and equipped. Long. 19. 16. 5. E. Lat. 54. 7. 54. N.

ELBOW, the outer angle made by the flexure or bend of the arm. That eminence whereon the arm rests, called by us *elbow*, is by the Latins called *cubitus*, and by the Greeks αγκων, and by others ολεκρανον.

Elbow is also used by architects, masons, and others, for an obtuse angle of a wall, building, or road, which diverts it from its right line.

ELCESAITES, in *Ecclesiastical History*, were ancient heretics, who made their appearance in the reign of the Emperor Trajan, and took their name from their leader Elcesai. The Elcesaites observed a mean between the Jews, Christians, and Pagans. They worshipped but one God, observed the Jewish sabbath, and practised circumcision and the other ceremonies of the law. They rejected the Pentateuch and the prophets; nor had they any more respect for the writings of the apostles, particularly those of St Paul.

ELCHE, a town of Spain, in the province of Valencia. It is situated on a small river that runs into the Guadarma. It is celebrated for the beauty of its palm woods, and for the exquisite marbles raised in the quarries in its vicinity. It is situated in latitude 38. 29. and contains 2600 houses and 17,405 inhabitants, three monasteries, an hospital, poor-house, one Latin and three other schools. Manufactories of esparto, tanning, and soap-making, are carried on at this place.

ELDERS, or Seniors, in Jewish history, were persons the most considerable for age, experience, and wisdom. Of this sort were the seventy men whom Moses associated to himself in the government of his people; such as were those who afterwards held the first rank in the synagogue as presidents.

In the first assemblies of the primitive Christians, those who held the principal place were called *elders*. The word *presbyter*, so often used in the New Testament, is of the same signification; and hence the first council of Christians were called *presbyteria*, or *councils of elders*.

Elders is also a denomination still retained in the Presbyterian discipline. The elders are officers, who, in conjunction with the pastors or ministers, and deacons, compose the consistories or kirk-sessions, meeting to consider, inspect, and regulate matters of religion and discipline. They are chosen from among the people, and are received publicly with some degree of ceremony. In Scotland, the number for each parish or congregation is indefinite, varying according to circumstances.

ELEA, or Elis, in *Ancient Geography*, a district of Peloponnesus, situated between Achaia and Messenia, and stretching from Arcadia to the west or Ionian Sea. It is so called from Elis, a cognominal town.

ELEATIC Philosophy, amongst the ancients, a name given to that of the Stoics, because it was taught at Ελεα, in Latin *Velia*, a town of the Lucani.

The founder of this philosophy, or of the Eleatic sect, is supposed to have been Xenophanes, who lived about the fifty-sixth Olympiad, or between five and six hundred years before Christ. This sect was divided into two parties, which may be denominated *metaphysical* and *physical*, the one rejecting and the other approving the appeal to fact and experiment. Of the former persuasion were Xenophanes, Parmenides, Melissus, and Zeno of Elea. They are supposed to have maintained principles not very unlike those of Spinoza: they held the eternity and immutability of the world; that whatever existed was only one being; that there was neither generation nor corruption; that this one being was immoveable and immutable, and was the true God; and that whatever changes seemed to happen in the universe were to be looked upon as mere appearances and illusions of sense. However, it is supposed by some that Xenophanes and his followers, speaking metaphysically, understood by the universe, or the one being, not the material world, but the great originating principle of all things, or the true God, whom they expressly affirm to be incorporeal. Thus Simplicius represents them as merely metaphysical writers, who distinguished between things natural and supernatural, and who supposed the former to be compounded of different principles. Accordingly, Xenophanes maintained that the earth consisted of air and fire; that all things were produced from the earth; that the sun and stars sprung from clouds; and that there were four elements. Parmenides also distinguished between the doctrine concerning metaphysical objects, called *truth*, and that concerning physical or corporeal things, called *opinion*. With respect to the former, there was one immoveable principle, but in the latter, two that were moveable, namely, fire and earth, or heat and cold; and in these particulars Zeno agreed with him. The other branch of the Eleatic sect were the atomic philosophers, who formed their system from observing the phenomena of nature; of these the most considerable were Leucippus, Democritus, and Protagoras.

ELECT or *Chosen* (from *eligo*, I choose), in the Scriptures, is applied to the primitive Christians; in which sense the elect are those chosen and admitted to the favour and blessing of Christianity.

Elect, in some systems of theology, is a term appropriated to the saints, or the predestinated; in which sense the elect are those persons who are said to be predestinated to glory as the end, and to sanctification as the means.

Elect is likewise applied to archbishops, bishops, and other officers, who are chosen, but not consecrated, or actually invested with their office or jurisdiction.

The emperor is said to be elect before he is inaugurated and crowned; and a lord mayor is elect before his predecessor's mayoralty is expired, or the sword is put in his hands.

ELECTION, the choice that is made of any person or thing by which he or it is preferred to any other. There seems this difference, however, between choice and election, that election has usually a regard to a company or community which makes the choice; whereas choice is seldom used but when a single person makes it.

Election, in British polity, is the people's choice of their representatives in parliament. (See Parliament.)

Election is also the state of a person who is left to his own free will, to take or do just what he pleases.

Election, in *Theology*, signifies the choice which God, of his good pleasure, makes of angels or men, as the objects of mercy and grace.

The election of the Jews was the choice God made of that people to be more immediately attached to his worship and service, and for the Messiah to be born of them. And thus particular nations were elected to the participation of the outward blessings of Christianity.

Election also, in the language of some divines, signifies a predestination to grace and glory, and sometimes to glory only. And it has been enjoined as an article of faith, that predestination to grace is gratuitous; *gratia, quia gratis data*. But the divines are much divided as to the point, whether election to glory be gratuitous, or whether it supposes obedience and good works; that is, whether it be before or after the provision of our obedience.

ELECTIVE, something that is done, or passes, by election.

Elective *Attraction*. See Chemistry.

ELECTOR, a person who has a right to elect or choose another to an office, honour, and the like.

ELECTORATE, a term used indiscriminately to signify the dignity of, or the territories belonging to, any of the electors of Germany; such as Baden, Saxony, &c. See Germany.

ELECTRICITY.

In duc- n.

Electricity, from the Greek word ηλεκτρον,[1] *electron*, *amber*, is the name given to a modern science which treats of the phenomena and effects produced by the friction of amber, and other bodies which possess analogous properties.

The science of Electricity, in its most general acceptation, may be divided into four different branches, viz.

I. *Ordinary Electricity*, or that which is developed by friction.

II. *Magneto-Electricity*, or that which is developed by magnets.

III. *Thermo-Electricity*, or that which is developed by heat; and

IV. *Voltaic Electricity*, or that which is produced by chemical action.

Under these four articles we shall be able, not only to give a perspicuous and condensed view of those splendid discoveries which have illustrated the present age, but to render our account of them much more complete than if we had treated the subject under the titles of *Electro-magnetism* and *Galvanism*, which occur so early in our alphabetical arrangement.

In giving a succinct and popular view of the science of *Electricity* in the ordinary acceptation of the word, the subject naturally divides itself into two parts: 1*st*, On the phenomena and laws of electricity; and, 2*dly*, on the instruments and apparatus used in electrical experiments. Before we proceed, however, to these topics, we shall give a brief history of the origin and progress of the science.

HISTORY OF ELECTRICITY.

Tes, B. 600.

The name of the philosopher who first observed that amber when rubbed possesses the property of attracting and repelling light bodies has not been handed down to our times. Thales of Miletus is said to have described this remarkable property, and both Theophrastus (B. C. 321) and Pliny (A. D. 70) mention the power of amber to attract *straws* and *dry leaves*. The same authors speak of the *lapis lyncurius*, which is supposed to be a mineral called *tourmaline*, as possessing the same property.

A hal ricity.

The electricity of the torpedo was also known to the ancients. Pliny informs us, that when touched by a spear it paralyses the muscles and arrests the feet, however swift; and Aristotle adds that it possesses the power of benumbing men, as well as the fishes which serve for its prey. The influence of electricity on the human body, and the electricity of the human body itself, were also known in ancient times. Anthero, a freedman of Tiberius, was cured of the gout by the shocks of the torpedo; and Wolimer, the king of the Goths, was able to emit sparks from his own body.

A 415.

Eustathius, who records this fact, also states that a certain philosopher, while dressing and undressing, emitted occasionally sudden crackling sparks, while at other times flames blazed from him without burning his clothes.

Such are the scanty gleanings of electrical knowledge which we derive from the ancient philosophy; and though several writers of the middle ages have made occasional references to these facts, and even attempted to speculate upon them, yet they added nothing to the science, and left an open field for the researches of modern philosophers.

History.

Gilbert, A. D. 1600.

Our countryman Dr Gilbert of Colchester may therefore be considered as the founder of the science of electricity, as he appears to have been the first philosopher who carefully repeated the observations of the ancients, and applied to them the principles of philosophical investigation. In order to determine if other bodies possessed the same property as amber, he balanced a light metallic needle on a pivot, and observed whether or not it was affected by causing the excited or rubbed body to approach to it. In this way he discovered that the following bodies possess the property of attracting light substances: Amber, gugates or jet, diamond, sapphire, carbuncle, rock crystal, opal, amethyst, vincentina or Bristol stone, beryl, crystal, paste for false gems, glass of antimony, flags, belemnites, sulphur, gum-mastic, sealing-wax of lac, hard resin, arsenic, sal gem, mica, and alum.

These various bodies attracted, with different degrees of force, not only straws and light films, but likewise metals, stones, earths, wood, leaves, thick smoke, and all solid and fluid bodies. Among the substances which are not excited by friction, Gilbert enumerated emerald, agate, carnelian, pearls, jasper, chalcedony, alabaster, porphyry, coral, marble, Lydian stone, flints, hæmatites, mugris (*emery* or *corundum*), bones, ivory, hard woods, such as cedar, ebony, juniper, and cypress, metals and natural magnets.

Having thus determined the bodies which were capable, as well as those which were incapable, of electrical excitation, Dr Gilbert was desirous of ascertaining the circumstances which were most favourable to the production of electricity. When the wind blew from the north and east, and when the air was dry, the body was excited in about ten minutes after the friction commenced; but when the wind was in the south, and the air moist, the attractive power of the body was greatly diminished, and in some cases it could not be excited at all.

Boyle, A. D. 1675.

The celebrated Mr Boyle added many new facts to the science of electricity, and he has given a full account of them in his *Experiments on the Origin of Electricity*. By means of a suspended needle, he discovered that amber retained its attractive virtue after the friction which excited it had ceased; and though smoothness of surface had been regarded as advantageous for excitation, yet he found a diamond which in its rough state exceeded all the polished ones and all the electrics which he had tried, having been able to move a needle three minutes after he had ceased to rub it. He found also that heat and *tersion* (or the cleaning or wiping of any body) increased its susceptibility of excitation; and that if the attracted body were fixed, and the attracting body moveable, their mutual approach would still take place. To Dr Gilbert's list of electrics Mr Boyle added the resinous cake which remained after evaporating one fourth part of good oil of turpentine; the dry mass which remains after distilling a mixture of petroleum and strong spirit of nitre, glass of antimony, glass of lead, caput mortuum of amber, white sapphire, white amethyst, diaphanous ore of lead, carnelian, and a green stone supposed to be a sapphire.

Otto Guericke, born 1602, died 1686.

To these discoveries of Mr Boyle, his illustrious contemporary Otto Guericke added the highly important one of *electric light*. Having cast a globe of sulphur in a glass sphere, the glass was broken, and the sulphur ball mounted upon a revolving axis, and excited by the friction of the hand. By this means he discovered that light and sound accompanied strong electrical excitation, and he compares the light to that which is exhibited by breaking lump sugar in the dark. With this powerful apparatus Guericke verified on a greater scale the results obtained by his predecessors, and obtained several new ones of very considerable importance. He found that a light body, when once attracted by an excited electric, was repelled by it, and was incapable of a second attraction until it had been touched by some other body; and that light bodies suspended within the sphere of influence of an excited electric, possessed the same properties as if they had been excited.

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[1] According to Salmasius, the word *karabe*, the Arabian word for *amber*, signifies the power of attracting straws. May not ηλεκτρον (ηλεκτριανος λιθος) come from ελκω, to *draw* or *attract*, and θριξ-τριχος, a *hair* or *filament*, or θριον, a leaf?

Newton, born 1642, died 1727.

To our illustrious countryman Sir Isaac Newton the science of electricity owes some important observations. He seems to have been the first person who constructed an electrical machine of glass. "A globe of glass," says he, "about eight or ten inches in diameter, being put into a frame where it may be swiftly turned round its axis, will in turning shine when it rubs against the palm of one's hand applied to it; and if at the same time a piece of white paper or a white cloth, or the end of one's finger, be held at the distance of about a quarter of an inch or half an inch from that part of the glass when it is most in motion, the electric vapour which is excited by the friction of the glass against the hand will, by dashing against the white paper, cloth, or finger, be put into such an agitation as to emit light, and make the white paper, cloth, or finger, appear lurid like a glow-worm, and in rushing out of the glass will sometimes push against the finger so as to be felt. And the same things have been found by rubbing a long and large cylinder of glass and amber with a paper held in one's hand, and continuing the friction till the glass grew warm."[1] We owe also to Sir Isaac a beautiful experiment on the excitation of electricity on the side of a disc of glass opposite to the side which was rubbed. Having fixed a round disc of glass at the distance of one third of an inch from one end of a brass hoop or ring, and one eighth of an inch from another, he placed small pieces of thin paper within the brass ring and upon a table, so that the lower surface of the glass was one eighth of an inch distant from the table. He then rubbed the upper surface of the glass, and he observed the pieces of paper "leap from one part of the glass to the other, and twirl about in the air." Upon sliding his finger upon the upper side of the glass, he also observed that the pieces of paper, as they hung under the glass, inclined this way or that according as he moved his finger. The Royal Society had ordered this experiment to be tried at their meeting of the 16th December 1675; and, in order to ensure its success, had obtained the above account of it from Sir Isaac. The experiment however failed, and the secretary requested the loan of Sir Isaac's apparatus, and inquired whether or not he had secured the papers from being moved by the air which might have somewhere stolen in. In Sir Isaac's reply, dated 21st December, he recommended them to rub the glass "with stuff whose threads may rake its surface, and if that will not do, to rub it with the finger ends to and fro, and knock them as often upon the glass." By means of these directions, the society succeeded with the experiment on the 13th January 1676, when they used "a scrubbing brush of short hog's bristles, and the heft of a knife made with whalebone."[2]

Hawksbee, A. D. 1705.

Mr Francis Hawksbee, one of the most active and ingenious experimental philosophers of his age, added many new facts to the science. In 1705 he communicated to the Royal Society several curious experiments on what he calls "the mercurial phosphorus." He showed that light could be produced by passing common air through mercury placed in a well-exhausted receiver. The air rushing through the mercury, blew it up against the sides of the glass that held it, "appearing all around like a body of fire, consisting of abundance of glowing globules." The phenomenon continued till the receiver was half full of air. When the mercury was made to descend in vacuo from the top to the bottom of a receiver about twenty-one inches high, it fell in minute particles, "like a shower of fire, in a very surprising manner." In repeating this experiment with about three pounds of mercury, and making it break into a shower by dashing it against the crown of another glass vessel, *flashes resembling lightning*, of a very pale colour, and very distinguishable from the rest of the produced light, were dashed from the crown of the glass, sometimes horizontally, and at other times upwards and downwards. Mr Hawksbee likewise showed that considerable light may be produced from mercury, by giving it motion before the receiver was quite exhausted; and that even in the open air "abundance of particles of light are discoverable by shaking quicksilver in a glass."

In a subsequent series of experiments on the attraction of bodies in vacuo, he showed that light was generated by the swift attrition of amber on woollen; that a purple light was produced by the attrition of glass on woollen; and that a considerable light was developed by the attrition of glass on glass in vacuo, and in common air, or under water. During the attrition of glass on woollen, Hawksbee "observed the light to break from the agitated glass *in as strange a form as lightning*," particularly when he used some list of cloth that had been drenched in spirit of wine. In all these experiments Hawksbee was not aware that the light which he observed was that of electricity.

Like Sir Isaac Newton, Hawksbee used a glass globe capable of revolving in a wooden frame, and by its assistance he made a great number of experiments, which are not sufficiently important to be given in detail. The following experiment, however, is too interesting to be omitted. Having coated more than one half of the inside of a glass globe with sealing wax, which in some places was an eighth of an inch thick, and therefore absolutely opaque, he exhausted it and put it in motion. When his hand was applied to excite it, the form of his hand was distinctly seen in the concave surface of the wax, as if it had become transparent. The same result was obtained when pitch or common brimstone was substituted in place of sealing-wax.

We have already seen that Hawksbee observed the resemblance between the electric spark and lightning. Dr Wall went a step farther, and compared the crackling and the flash of excited amber to thunder and lightning. The crackling he found to be fully as loud as that of charcoal on fire when the finger was held at a little distance from the amber after it had been drawn gently and slightly through a piece of woollen cloth.

Mr St phen G r, 1720– 36

One of the most ardent experimentalists of the present time was Mr Stephen Gray, a fellow of the Royal Society. In his first paper, published in 1720, he showed that electricity could be excited by the friction of feathers, hair, silk, linen, woollen, paper, leather, wood, parchment, and gold-beaters' skin. Several of these bodies exhibited light in the dark, especially after they had been warmed; but all of them attracted light bodies, and sometimes at the distance of eight or ten inches.

The communication of electricity to bodies not capable

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[1] *Optics*, query 8th.

[2] Brewster's *Life of Sir Isaac Newton*, p. 307, 308.

Dr Wall, A. D. 1708.

of excitation was the next discovery of Mr Gray. An ivory ball, and various other substances of a metallic, animal, and vegetable nature, were made to attract light bodies by connecting them with strings, wires, or pieces of wood, with one extremity of an excited glass tube; and by suspending pack-threads of different lengths with silken threads, he was able to transmit the electrical influence in any direction to distances of 50, 147, 293, and finally 765 and 886 feet.

In order to determine if the electric attraction is proportioned to the quantity of matter in bodies, Mr Gray and Mr White made two cubes of oak about six inches square, the one solid and the other hollow. When suspended by hair lines, and similarly electrified by an excited glass tube, both the cubes attracted and repelled leaf brass at the same time and to the same height. Hence Mr Gray concluded *that it was the surface of the cubes only which attracted.*

The conducting powers of fluids and of the human body were next ascertained by Mr Gray. Having blown a soap bubble with an electrified tobacco pipe, he found that the lower part of the bubble attracted small pieces of Dutch metal; and when a boy eight or nine years old, and weighing 47 lbs., was suspended upon hair lines, he found that every part of his body exercised a strong electrical action upon light bodies, and hence he concluded "that animals receive a greater quantity of electrical effluvia." When an excited tube was held above water or quicksilver placed in little ivory dishes, the fluid was attracted upwards into little conical mounds, accompanied with a snapping noise and a discharge of light from their summit. In sunshine small particles of water rose from the top of the fluid cone, and sometimes a fine stream of water like a fountain, from which there arose a fine steam or vapour. Hot water was attracted much more powerfully, and at a much greater distance, and the steam was more distinctly visible. Mercury did not rise so high as the water; but the snapping noise was louder, and continued much longer, than when water was employed.

Mr Gray now set himself to discover "whether there might not be a way found to make the property of electrical attraction more permanent in bodies." Having procured iron ladles of several sizes, he melted the substances given in the following table. They were then set by in the ladle to cool and harden, and afterwards being replaced on the fire so as to allow what was next the bottom and sides of the ladle to melt, the ladle was inverted, and the substance taken out. These bodies at first would not attract light substances till their temperature was nearly that of a hen's egg; but when cold they attracted ten times farther than at first. In order to preserve these bodies in a state of attraction, he wrapped them up in flannel or white paper or black worsted stockings, and then put them into a large fir box till they were used. The following is Mr Gray's list of the electrics thus formed:—

Names.	Weight Avoird.		Time when made.
	oz.	oz.	
Fine black rosin	2	0	Jan. 31.
Stone pitch, and black rosin	2	2	Jan. 31.
Fine rosin and bees' wax	2	1	Feb. 1.
Stone pitch	1	7	Feb. 1.
Stone sulphur	3	6	Feb. 4.
Shell lack	10	0	Feb. 10.
Fine black rosin	10	4	Feb. 10.
Bees' wax and rosin	9	0	Feb. 12.
Rosin 4, gum lac 1 part	10	0	Feb. 12.
Sulphur	18	0	Feb. 15.
Stone pitch	10	12	Feb. 16.
Black rosin	23	0	Feb. 23.
White rosin	7	12	Feb. 25.
Gum-lac	11	14	Feb. 26.
Gum-lac and black rosin	9	12	Feb. 26.
Gum-lac 4, rosin 1 part	17	8	Feb. 28.
Gum-lac, fine black rosin	28	4	March 2.
Cylinder of blue sulphur	19	4	March 20.
Large cone of ditto	30	0	March 29.
Cake of sulphur	11	4	April 29.

Mr Gray continued for thirty days to observe every one of these bodies, and at the end of that time he found that they attracted as vigorously as at the first or second day, and some of them continued to preserve their attraction for more than four months.

M. Dufay, A. D. 1733.

While Mr Gray was pursuing his career of discovery in England, M. Dufay, of the Academy of Sciences, and superintendent of the Royal Botanic Gardens, was actively employed in the same researches. He found that all bodies, whether solid or fluid, could be electrified by an excited tube, by setting them on a glass stand slightly warmed, or only dried; and that those bodies which are in themselves least electrical, received the greatest degree of electricity from the approach of the glass tube. He found that electricity was transmitted more easily along packthread when it was wetted, and that it might be supported upon glass tubes in place of silk lines; and in this way he conveyed it along a string 1256 feet long.

M. Dufay repeated Mr Gray's experiments on the human body, by suspending a child on silken strings; but having suspended himself in a similar manner, he discovered that an electrical spark, accompanied with a crackling noise, took place when any other person touched him, and he has described the prickling sensation like the burning from a spark of fire, which is at the same time felt either through the clothes or on the skin. He found that the same effects took place in other living animals; but that if the carcass of an animal was suspended, there were no snippings or sparks, but merely a still uniform light observed in the dark.

Vitreous and resinous electricity.

The great discovery of M. Dufay, however, was that of two different kinds of electricity, to which he gave the name of *vitreous* and *resinous*, and the importance of which he did not fail to recognise. He has given the name of *vitreous* electricity to that which is produced by exciting *glass*, rock crystal, precious stones, hair of animals, wool, and many other bodies; and the name of *resinous* to that which is produced by exciting resinous bodies, such as amber, copal, gum-lac, silk, paper, thread, and a number of other substances. The characteristic of those two electricities was, that a body with *vitreous electricity* attracted all bodies with *resinous electricity*, and repelled all bodies with *vitreous electricity;* while a body with *resinous electricity* attracted all bodies with *vitreous electricity*, and repelled all bodies with *resinous electricity.* Two electrified silk threads, for example, repel each other, and also two electrified woollen threads; but an electrified silk thread will attract an electrified woollen thread. Hence it is easy to determine whether any body possesses vitreous or resinous electricity. If it *attracts* an electrified silk thread, its electricity will be vitreous; if it *repels* it, it will be resinous. This important discovery seems to have been made about the same time by Mr White, by a series of independent observations.

Mr Gray repeated and varied the experiments of M. Dufay, and made many new ones, which our limited space will not permit us to detail. Like Hawksbee and Dr Wall, he recognised the similarity between the phenomena of electricity and those of thunder and lightning; and he expresses a hope "that there may be found out a way to collect a greater quantity of electric fire, and consequently to increase the force of that power, which, by several of these experiments, *si licet magnis componere parva*, seems to be *of the same nature with thunder and lightning*."

Labours of continental philosophers.

The discoveries which we have now recounted began to rouse the activity of the German and Dutch philosophers. To the electrical machine used by Newton and Hawksbee, Professor Boze of Wittemberg added the *prime* conductor, which at first consisted of an iron or tin tube supported by a man standing upon cakes of rosin; but it was afterwards suspended by silken strings. Professor Winkler of Leipsic substituted the *cushion* in place of the hand for exciting the revolving globe; and Professor Gordon of Erfurt, a Scotch Benedictine monk, first used a glass cylinder, eight inches long and four broad, which he caused to revolve by means of a bow and string. By these means electrical sparks of great size and intensity were produced, and by their aid various combustible substances, both fluid and solid, were inflamed. In 1744 M. Ludolph of Berlin succeeded in firing, by the electrical spark, the ethereal spirit of Frobenius. Winkler did the same by a spark from his finger; and he succeeded in inflaming French brandy and other weaker spirits after they had been heated. Mr Gordon kindled spirits by a jet of electrified water. Dr Miles inflamed phosphorus by the electric spark; and oil, pitch, and sealing-wax, when strongly heated, were set on fire by similar means.

Leyden phial, 1745.

These striking effects were all produced by the electricity obtained immediately from an excited electric; but a great step was now made in the science by the discovery of a method of accumulating and preserving the electric fluid in large quantities. The author of this great invention is not distinctly known; but there is reason to believe that a monk of the name of Kleist, a person of the name of Cuneus, and Professor Muschenbroeck of Leyden, had each the merit of an independent inventor. The invention by which this accumulation was effected was called the *Leyden Jar* or *Phial*, because it was principally in that city where it was either invented or tried. Having observed that excited electrics soon lost their electricity in the open air, and that their loss was accelerated when the atmosphere was charged with moisture or other conducting materials, Muschenbroeck conceived that the electricity of bodies might be retained by surrounding them with bodies which did not conduct it. In putting this idea to the test of experiment, they electrified some water in a glass bottle, and a communication having been made between the water and the prime conductor, while the bottle was held by an assistant, who was trying to disengage the communicating wire, he received a sudden shock in his arms and breast, and thus established the efficacy of the Leyden jar.

Sir William Watson.

Sir William Watson made some important experiments at this period of our history. He succeeded in firing gunpowder by the electric spark; and by mixing the gunpowder with a little camphor he discharged a musket by the same power. He also fired inflammable air by the electric spark; and he kindled both spirits of wine and inflammable air by means of a drop of cold water, and even with ice. In the German experiments the fluid or solid to be inflamed was set on fire by an electrified body; but Sir William Watson placed the fluid in the hands of an electrified person, and set it on fire by causing a person not electrified to touch it with his finger.

Sir William Watson first observed the flash of light which attends the discharge of the Leyden phial, and it is to him that we owe the present improved form of the Leyden phial, in which it is coated both without and within with tinfoil. Dr Bevis indeed had suggested the outside coating, and, at Mr Smeaton's recommendation, he coated a pane of glass on both sides, and within an inch of the edge, with tinfoil; but still the idea of coating the jar doubly belongs to Sir William Watson.

Exper ments the R Societ Londo

A party of the Royal Society, with the president at their head, and Sir William Watson as their chief operator, entered upon a series of magnificent experiments, for the purpose of determining the velocity of the electric fluid, and the distance to which it could be conveyed. The French sçavans had conveyed the influence of the Leyden jar through a circuit of 12,000 feet; and in one case the basin at the Thuilleries, containing about an acre of water, formed part of the circuit; but the English philosophers made a more complete series of experiments, of which the following were the results:

1. That in all their operations, when the wires have been properly conducted, the electrical commotions from the charged phial have been very considerable only when the observers at the extremities of the wire have touched some substance readily conducting electricity with some part of their bodies.

2. That the electrical commotion is always felt most sensibly in those parts of the bodies of the observers which are between the conducting wires and the nearest and the most non-electric substance; or, in other words, so much of their bodies as comes within the electrical circuit.

3. That on these considerations we infer that the electrical power is conducted between these observers by any non-electric substances which happen to be situated between them, and contribute to form the electrical circuit.

4. That the electrical commotion has been perceptible to two or more observers at considerable distances from each other, even as far as two miles.

5. That when the observers have been shocked at the end of two miles of wire, we infer that the electrical circuit is four miles, viz. two miles of wire, and the space of two miles of the non-electric matter between the observers, whether it be water, earth, or both.

6. That the electrical commotion is equally strong, whether it is conducted by water or dry ground.

7. That if the wires between the electrifying machine and the observers are conducted on dry sticks, or other substances non-electric in a slight degree only, the effects of the electrical power are much greater than when the wires in their progress touch the ground, or moist vegetables, or other substances in a great degree non-electric.

8. That by comparing the respective velocities of electricity and sound, that of electricity, in any of the distances yet experienced, is nearly instantaneous.

In the following year these experiments were resumed with the view of ascertaining the absolute velocity of electricity at a certain distance, and it was found, "that through the whole length of a wire 12,276 feet, the velocity of electricity was instantaneous."

One of the most important discoveries of the present period was that of Sir W. Wtsoan, who proved "that the glass tubes and globes had not the electrical power in themselves, but only served as the first movers or determiners of that power." In rubbing a glass tube while standing upon a cake of wax, he was surprised to observe that no spark could be obtained from his body by any other person touching any part of him. But if a person not electrified held his hand near the tube while it was rubbing, the snapping was very sensible. The great discovery of *plus* and *minus* electricity which was afterwards made by Franklin, was distinctly announced by Sir W. Watson. He lays it down as a law, that in electrical operations there is an afflux of electric fluid to the globe and the conductor, and also an efflux of the same matter from them. In the case of two insulated persons, the one in contact with the rubber and the other with the conductor, he observed that either of them would communicate *a much stronger spark to the other than to any bystander. The electricity of the one,* he says, *became more rare than it is naturally, and that of the other more dense,* so that the density of the electricity in the two insulated persons differed more than that between either of them and a bystander.

Our limits will not permit us to give a detailed account of the various ingenious experiments which were about this time made by Le Monnier, Nollet, Winckler, Ellicott, Jallabert, Boze, Menon, Smeaton, and Miles. In 1746 Le Monnier confirmed the result previously obtained by Mr Gray, that electricity is communicated to homogeneous bodies in proportion to their surfaces only. M. Boze discovered that capillary tubes which discharged water by drops afforded a continued stream when electrified. The Abbé Nollet ascertained that electricity increases the natural evaporation of fluids, and that the evaporation is hastened by placing them in non-electric vessels. M. Jallabert confirmed the result previously obtained by Watson, that electricity passes through the substance of a conducting wire, and not along its surface. Smeaton found that the red-hot part of an iron bar could be as strongly electrified as the cold parts on each side of it. Dr Miles kindled common lamp spirits by a stick of black sealing-wax excited by dry flannel. Mr Ellicott conceived that the particles of the electric fluid repel each other, while they attract those of all other bodies. Mr Mowbray discovered that the vegetation of two myrtles was hastened by electrifying them; a result which Nollet confirmed in the case of vegetating seeds. The Abbé Menon found that cats, pigeons, sparrows, and chaffinches, lost weight by being electrified for five or six hours, and that the same result was true of the human body; and hence it was concluded that electricity augments the insensible perspiration of animals.

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Passing over the scientific fables of John Pivati of Venice, we arrive at that auspicious period when Dr Franklin raised electricity to the dignity of a science, and connected it with that tremendous agency which had so often terrified the moral and convulsed the physical world. The thunderbolt had frequently descended from heaven upon its victims; but mortal genius had now learned to bring it down in chains, to disarm its fury, and to convert it into an useful and even a friendly element.

One of the first labours of the American philosopher was to present, in a more distinct form, the theory of plus and minus electricity, which Sir W. Watson had been the first to suggest. He showed that electricity is not created by friction, but merely collected from its state of diffusion through other matter by which it is attracted. He asserted that the glass globe, when rubbed, attracted the electrical fire, and took it from the rubber, the same globe being disposed, when the friction ceases, to give out its electricity to any body which has less. In the case of the charged Leyden jar, the inner coating of tinfoil had received more than its ordinary quantity of electricity, and was therefore electrified *positively* or *plus,* while the outer coating of tinfoil having had its ordinary quantity of electricity diminished, was electrified *negatively* or *minus.* Hence the cause of the shock and spark when the jar is discharged, or when the superabundant plus electricity of the inside is transferred by a conducting body to the defective or minus electricity of the outside. This theory of the Leyden phial Franklin established in the clearest manner, by showing that the outside and the inside coating possessed opposite electricities, and that, in charging it, exactly as much electricity is added on one side as is subtracted from the other. The copious discharge of electricity by points was observed by Franklin in his earliest experiments, and also the power of points to conduct it copiously from an electrified body. Hence he was furnished with a simple method of collecting electricity from other bodies; and he was thus enabled to perform those remarkable experiments which we shall now proceed to explain.

Hawksbee, Wall, and Nollet had successively suggested the similarity between lightning and the electric spark, and between the artificial snap and the natural thunder. Previous to the year 1750 Dr Franklin drew up a statement, in which he showed that all the general phenomena and effects which were produced by electricity had their counterpart in lightning. Like the electric spark, lightning moves in a crooked and irregular direction. Lightning strikes the highest and most pointed bodies, and electricity does the same. They both inflame combustibles, fuse metals, destroy animal life, produce blindness in animals, render common sewing needles magnetic, and reverse the polarity of needles that have been magnetised. Notwithstanding these points of resemblance, direct experiment was still necessary to establish his views. He waited anxiously for the erection of a spire at Philadelphia, by means of which he might bring down the electricity of a thunder-storm; but his patience being exhausted, he conceived the idea of sending up a kite among the clouds themselves. With this view he made a small cross of two light strips of cedar, the arms being sufficiently long to reach to the four corners of a large thin silk handkerchief when extended. The corners of the handkerchief were tied to the extremities of the cross, and when the body of the kite was thus formed, a tail, loop, and string were added to it. The body was made of silk to enable it to bear the violence and wet of a thunder-storm. A very sharp pointed wire was fixed at the top of the upright stick of the cross, so as to rise a foot or more above the wood. A silk ribband was tied to the end of the twine next the hand, and a key suspended at the junction of the twine and silk. In company with his son, Franklin raised the kite like a common one, in the first thunder-storm, which happened in the month of June 1752. To keep the silk ribband dry, he stood within a door, taking care that the twine did not touch the frame of the door; and when the thunder-clouds came over the kite he watched the state of the string. A cloud passed without any electrical indications, and he began to despair of success. He saw, however, the loose filaments of the twine standing out every way, and he found them to be attracted by the approach of his finger. The suspended key gave a spark on the application of his knuckle, and when the string had become wet with the rain, the electricity became abundant; a Leyden jar was charged at the key, and by the electric fire thus obtained spirits were inflamed, and all the other electrical experiments performed which had been formerly made by excited electrics. In subsequent trials with another apparatus, he found that the clouds were sometimes positively and sometimes negatively electrified, and thus demonstrated the perfect identity of lightning and electricity.

Having thus succeeded in drawing the electric fire from the clouds, Franklin immediately conceived the idea of protecting buildings from lightning, by erecting on their highest parts pointed iron wires or conductors communicating with the ground. The electricity of a hovering or a passing cloud would thus be carried off slowly and silently; and if the cloud was highly charged, the electric fire would strike in preference the elevated conductors.

Death of Professor Richman, A. D. 1753.

The attention of European philosophers was now directed to the great discovery of Franklin, and various individuals fearlessly sought to repeat his experiments. Among these Professor Richman of St Petersburg was one of the most enterprising. He had undertaken a series of experiments on the electricity of the atmosphere, and for this purpose he had erected an electrical gnomon, which consisted mainly of a Leyden jar, communicating with an iron rod, which rose four or five feet above the roof of his house, and an electrometer formed of a linen thread with half a grain of lead, the angular ascent of which on the face of a divided quadrant indicated the force of the accumulated electricity. On the 9th August 1752 Professor Richman obtained from the end of the rod electrical flashes which could be heard at several feet of distance; and if any person touched the apparatus, a sharp stroke was felt in the hand and arm. On the 31st May 1753 the electric fire exploded from the apparatus with such a force that it was heard at the distance of three rooms from the apparatus. On the 6th August 1753 the professor had prepared and adjusted his apparatus, and having heard the sound of distant thunder, he left a meeting of the Academy of Sciences, and took with him his engineer, Mr Sokolow, to draw any interesting phenomena that might occur. On their arrival at the professor's house, the plummet of the electrometer was elevated four degrees from the perpendicular; and while the philosopher was describing to his friend the dangerous consequences that might take place if the thread should rise to 45°, a tremendous burst of thunder terrified the imperial city. Richman leant his head over the gnomon to observe the indications of the electrometer, and in this stooping position, with his head a foot from the iron rod, a huge globe of bluish-white fire, about the size of Mr Sokolow's fist, shot from the iron rod to the professor's head, with a report like that of a pistol. The blow was fatal; he fell back upon a chest and instantly expired. Sokolow was stupified and benumbed by a sort of steam or vapour, and the red hot fragments of a metallic wire struck his clothes and covered them with burnt marks. As soon as he recovered from his surprise, Sokolow ran out of the house, acquainting every person with the accident which had taken place. In the mean time Madam Richman, alarmed by the thunder-stroke, hastened to the chamber, and found her husband apparently lifeless, in the attitude of sitting upon the chest, and leaning against the wall. Medical aid was instantly obtained, but though a vein was opened, from which no blood would flow, and though every attempt was made to restore life by violent friction and other means, they were all fruitless. A small quantity of blood dropped from the mouth when the body was turned, and on the forehead there was a red spot, from the pores of which a few drops of blood oozed out. Several red and blue spots, like leather shrunk by burning, were found on the left side, the back, and other parts of the body. The shoe upon the Professor's left foot was burst open, and a blue mark appeared on the foot beneath the aperture. There was no corresponding hole in the stocking, and the coat was uninjured. When the body was opened, twenty-four hours after death, there was no appearance of injury either in the brain or the cranium: a little extravasated blood appeared in the cavities below the lungs, and in the lungs towards the back, which were of a dark brown colour. The heart, glands, and smaller intestines, were all inflamed; but the entrails were uninjured. About seventy rubles of silver which were in the left coat pocket were not altered by the electric fluid. Immediately after the accident the house was filled with a sulphureous vapour. A clock which stood in the corner of the adjoining room was stopped; the ashes from the hearth were scattered about the room; the door-case of the room was rent asunder, and a piece of the door itself actually torn off. The Leyden jar was also broken, and the metallic filings which it contained thrown about the room.

Labou Canto A. D. 1

One of the most active and ingenious labourers in the field of electrical science was our countryman Mr John Canton. Before his time it had been assumed as indisputable that the same kind of electricity was invariably produced by the friction of the same electric; that glass, for example, yielded always *vitreous*, and amber always *resinous* electricity. Having roughened a glass tube by grinding its surface with emery and sheet lead, he found that it possessed vitreous or positive electricity when excited with oiled silk, but *resinous electricity when excited with new flannel.* He found, in short, that vitreous or resinous electricity may be developed at will in the same tube, by altering the surfaces of the tube and the exciting rubber, and according as the one or the other is most affected by their mutual friction. This he illustrated by the very beautiful experiment of removing the polish from one half of the tube. In this case the different electricities were excited with the same rubber at a single stroke, and, what is very curious, *the rubber was found to move much easier over the rough than over the polished half.*

Mr Canton likewise discovered that glass, amber, sealing-wax, and calcareous spar, were all electrified positively when taken out of mercury; and hence he was led to the important practical discovery, that an amalgam of mercury and tin was most efficacious in exciting glass when applied to the surface of the rubber. Mr Canton found also that any body placed within the electric atmosphere of another body acquired the electricity opposite to that of the body in whose atmosphere it was placed; and that the whole air of a room could be electrified either positively or negatively, and made to retain it for a considerable time.

Beccar A. D. 17

Signor Beccaria, a celebrated Italian, kept up the spirit of electrical discovery in Italy; and in his work on natural and artificial electricity, he has given us the results of many important original investigations. He showed that water is a very imperfect conductor of electricity, that its conducting power is proportional to its quantity, and that a small quantity of water opposes a powerful resistance to the electric fluid. He succeeded in making the electric spark visible in water, by discharging shocks through wires that nearly met in tubes filled with water. In this experiment the tubes, though sometimes eight or ten lines thick, were burst in pieces. Beccaria likewise demonstrated that air adjacent to an electrified body gradually acquired the same electricity; that the electricity of the body is diminished by that of the air; and that the air parts with its electricity very slowly. He considered that there was a mutual repulsion between the particles of the electric fluid and those of air, and that in the passage of the former through the latter a temporary vacuum was formed.

Symme experiments, A. D. 17

The science of electricity owes several practical as well as theoretical observations to our countryman Mr Robert Symmer. In pulling off his stockings in the evening, Mr Symmer had often remarked that they not only gave a crackling noise, but even emitted sparks in the dark. The electricity was most powerful when a silk and a worsted stocking had been worn on the same leg, and it was best exhibited by putting the hand between the leg and the stockings, and pulling them off together. The one stocking being then drawn out of the other, they appeared more or less inflated, and exhibited the attractions and repulsions of electrified bodies. Mr Symmer's first trials were accidentally made with *black* silk stockings, but he was surprised to find that *white* ones produced no electricity. Two white silk stockings, or two black ones, when put on the same leg and taken off, gave no electrical indications. When a black and a white stocking were put on the same leg, and at the end of ten minutes taken off, they were so much inflated when pulled asunder, *that each of them showed the entire shape of the leg, and at the distance of a foot and a half they rushed to meet each other.* With worsted stockings, also, nothing but the combination of black and white produced electricity. As it was troublesome to electrify the stockings by putting them on and taking them off the leg, Mr Symmer excited the stockings by drawing them on the hand, which, however, produced a weaker degree of electricity. The electricity was in this case more permanent, and the effects were more powerful, when the stockings were new or newly washed. When an excited white and black stocking are presented to each other, they attract one another, inclining to each other at the distance of three feet, catching hold of each other within two feet, and at a less distance rushing together with surprising violence, becoming as flat as so many folds of silk when they are joined. "But what appears most extraordinary is, that when they are separated, and removed at a sufficient distance from each other, their electricity does not appear to have been in the least impaired by the shock they had in meeting. They are again inflated, again attract and repel, and are as ready to rush together as before. When this experiment is performed with two black stockings in one hand, and two white in the other, it exhibits a very curious spectacle; the repulsion of those of the same colour, and the attraction of those of different colours, throws them into an agitation that is not unentertaining, and makes them catch each at that of its opposite colour, at a greater distance than one would expect. When allowed to come together, they all unite in one mass. When separated, they resume their former appearance, and admit of the repetition of the experiment as often as you please, till their electricity, gradually wasting, stands in need of being recruited."

In the course of these experiments Mr Symmer accidentally threw a stocking out of his hands, and some time afterwards he found it sticking to the paper hangings of the room. They stuck also to the painted pannelling, and often continued for a whole hour suspended upon the hangings.

Mr Symmer's attention was next directed to the force of cohesion between stockings of black and white silk, and he found that from ten ounces to nine pounds weight was necessary to separate the stockings, according to their weight, or according as the rough or smooth surfaces were in contact.

Mr Symmer likewise found that a Leyden jar could be charged by the stockings either positively or negatively, according as the wire from the neck of the jar was presented to the black or white stockings. When the electricity of the white stocking was thrown into the jar, and on that the electricity of the black one, or *vice versa*, the jar will not be electrified at all. With the electricity of two stockings he charged the jar to such a degree that the shock from it reached both his elbows; and by means of the electricity of four silk stockings he kindled spirits of wine in a tea-spoon which he held in his hand, and the shock was at the same time felt from the elbows to the breast. Independent of these curious experiments, Mr Symmer had the merit of having first maintained the theory of two distinct fluids, not independent of each other, as Dufay supposed them to be, but co-existent, and, by counteracting each other, producing all the phenomena of electricity. He conceived that when a body is said to be *positively electrified*, it is not simply that it is possessed of a larger share of electric matter than in a natural state; nor, when it is said to be *negatively electrified*, of a less; but that, in the former case, it is possessed of a larger portion of one of these active powers, and in the latter, of a larger portion of the other; while a body, in its natural state, remains unelectrified, from an equal balance of these two powers within it.

Contemporary with Symmer were Delaval, Wilson, Cigna, Kinnersley, and Wilcke. M. Delaval found that the sides of vessels that were perfect conductors, were non-conductors, and that animal and vegetable bodies lost their conducting power when reduced to ashes. Mr Wilson discovered that when two electrics are rubbed together, the harder of the two is generally electrified positively, and the other negatively, but always with opposite electricities. Cigna made many curious experiments by using silk ribbands in place of the silk stockings of Symmer. Kinnersley, the friend of Franklin, made some important experiments on the elongation and fusion of iron wires, when a strong charge was passed through them in a state of tension; and Wilcke brought to light many new phenomena respecting the spontaneous electricity produced by the melting of electric substances.

Pyro-electricity of minerals.

The pyro-electricity of minerals, or the faculty possessed by some minerals of becoming electric by heat, and of exhibiting negative and positive poles, now began to attract the notice of philosophers. There is reason to believe that the *lyncurium* of the ancients, which, according to Theophrastus, attracted light bodies, was the *tourmaline*, a Ceylon mineral, in which the Dutch had early recognised the same attractive property, whence it got the name of *Aschentrikker*, or attracter of ashes. In 1717 M. Lemery exhibited to the Academy of Sciences a stone from Ceylon which attracted light bodies; and Linnæus, in mentioning the experiments of Lemery, gives the stone the name of *Lapis Electricus*. The Duke de Noya had heard at Naples that Count Pichetti had seen at Constantinople a stone called *tourmaline*, which attracted and repelled light bodies; and in 1758 he purchased some of them in Holland, and, assisted by MM. Daubenton and Adanson, he made a series of experiments with them, which were published separately.

Labours of Æpinus.

This curious subject, however, had engaged the attention of M. Æpinus, a celebrated German philosopher, who published an account of them in 1756. Hitherto nothing had been said respecting the necessity of heat to excite the tourmaline; but it was shown by Æpinus that a temperature between $99\frac{1}{2}$° and 212° of Fahrenheit was requisite for the development of its attractive powers. Mr Benjamin Wilson, Priestley, and Canton, continued the investigation; but it was reserved for the Abbé Haüy to throw much light on this curious branch of the science. He found that the electricity of the tourmaline decreased rapidly from the summits or poles towards the middle of the crystal, where it was imperceptible; and he discovered that if a tourmaline is broken into any number of fragments, when excited, each fragment has two opposite poles. Haüy discovered the same property in the Siberian and Brazilian topaz, borate of magnesia, mesotype, prehnite, sphene, and calamine. He also found that the polarity which minerals receive from heat has a relation to the secondary forms of their crystals, the tourmaline, for example, having its resinous pole at the summit of the crystal which has three faces, and its vitreous pole at the summit which has six faces. In the other pyro-electrical crystals above mentioned, Haüy has detected the same deviation from the rules of symmetry in their secondary crystals which occurs in tourmaline. Mr Brard discovered that pyro-electricity was a property of the axinite; and more recently Sir David Brewster has detected it, as we shall afterwards see, in a variety of other minerals.

In repeating and extending the experiments of Haüy, Sir David Brewster discovered that various artificial salts were pyro-electrical; and he mentions the tartrate of potash and soda, and the tartaric acid, as exhibiting this property in a very strong degree. He likewise made many experiments with the tourmaline when cut into thin slices, and reduced to the finest powder, in which state each atom preserved its pyro-electricity; and he has shown that *scolezite* and *mesolite*, even when deprived of their water of crystallization, and reduced to powder, preserve their property of becoming electrical by heat. When this white powder is heated and stirred about by any substance whatever, it collects in masses like new fallen snow, and adheres to the body with which it is stirred.

Experiments of Æpinus.

In addition to his experiments on the tourmaline, Æpinus made several on the electricity of melted sulphur; and, in conjunction with Wilcke, he investigated the subject of electric atmospheres, and discovered a beautiful method of charging a plate of air by suspending large wooden boards coated with tin, and having their surfaces near each other, and parallel. Æpinus, however, has been principally distinguished by his ingenious theory of electricity, which he has explained and illustrated in a separate work which appeared at St Petersburg in 1759. This theory is founded on the following principles. 1. The particles of the electric fluid repel each other with a force decreasing as the distance increases. 2. The particles of the electric fluid attract the particles of all bodies, and are attracted by them, with a force obeying the same law. 3. The electric fluid exists in the pores of bodies; and while it moves without any obstruction in non-electrics, such as metals, water, &c., it moves with extreme difficulty in electrics, such as glass, rosin, &c. 4. Electrical phenomena are produced, either by the transference of the fluid from a body containing more to another containing less of it, or from its attraction and repulsion when no transference takes place.

Electricity of fishes.

The electricity of fishes, like that of minerals, now began to excite very general attention. The ancients, as we have seen, were acquainted with the benumbing power of the torpedo, but it was not till 1676 that modern naturalists attended to this remarkable property. The Arabians had long before given this fish the name of *raad* or lightning; but Redi was the first who communicated the fact that the shock was conveyed to the fisherman by means of the line and rod which connected him with the fish. Lorenzini published engravings of its electrical organs; Reaumur described the electrical properties of the fish; Kæmpfer compared the effects which it produced to lightning; but Bancroft was the first person who distinctly suspected that the effects of the torpedo were electrical. In 1773 Mr Walsh and Dr Ingenhouz proved, by many curious experiments, that the shock of the torpedo was an electrical one; and Dr Hunter examined and described the anatomical structure of its electrical organs. Humboldt, Gay Lussac, and M. Geoffroy, pursued the subject with success; and Mr Cavendish constructed an artificial torpedo, by which he was able to produce artificially the actions of the living animal. The subject has been more recently investigated by Dr Todd, Sir Humphry Davy, and Dr John Davy.

The power of giving electric shocks has been discovered also in the *Gymnotus Electricus*, the *Silurus Electricus*, the *Trichiurus Indicus*, and the *Tetraodon Electricus*. The most interesting and the best known of these singular fishes is the *Gymnotus* or Surinam eel. Its electrical organs have been minutely described by Hunter and Geoffroy; Dr Williamson, Dr Gordon, and Mr Walsh have published interesting details of its electrical powers; and Humboldt has more recently given the most romantic account of the combats which are carried on in South America between the gymnoti and the wild horses in the vicinity of Calabozo.

Mr Ca
dish, b
1731, d
1810.

Among the modern cultivators of electricity, our countryman, the late Mr Cavendish, is entitled to a distinguished place. Before he had any knowledge of the theory of Æpinus, he had composed and communicated to the Royal Society a theory of electrical phenomena nearly the same as that of the German philosopher. As Mr Cavendish, however, had carried the theory much farther, and considered it under a more accurate point of view, he did not hesitate to give his paper to the world.

Mr Cavendish made some accurate experiments on the relative conducting power of different substances. He found that the electric fluid experiences as much resistance in passing through a column of water one inch long, as it does in passing through an iron wire of the same diameter 400,000,000 inches long, and hence he concludes that rain or distilled water conducts 400,000,000 times more than iron wire. He found that the water, or a solution of one part of salt in one of water, conducts a hundred times better than fresh water; and that a saturated solution of sea-salt conducts seven hundred and twenty times better than fresh water. Mr Cavendish likewise determined by nice experiments that the quantity of electricity in coated glass of a certain area increased with the thinness of the glass; and that in different coated plates the quantity was as the area of the coated surface directly, and as the thickness of the glass inversely.

Chemic
electric

Although electricity had been employed as a chemical agent in the oxidation and fusion of metals, yet it is to Mr Cavendish that we owe the first of those brilliant enquiries which have done so much for the advancement of modern chemistry. By means of the electric spark he succeeded in decomposing atmospheric air. By using different proportions of oxygen and hydrogen, and examining the product which they formed after explosion with the electric spark, he obtained a proportion when the product was pure water. He was equally successful in the more difficult experiment of exploding oxygen and nitrogen; but when he combined seven measures of oxygen with three measures of nitrogen, he obtained from their explosion *nitric acid*. As several foreigners had failed in repeating this interesting experiment, Mr Cavendish, aided by Mr Gilpin, exhibited it publicly before the leading members of the Royal Society on the 6th of December 1787.

The decomposition of water by the electric spark was first effected by MM. Paets, Troostwyk, and Deiman; and improved methods of doing it were discovered and used by Dr Pearson, Mr Cuthbertson, and Dr Wollaston.

Galvan
and Vo
taic ele
tricity.

As a chemical agent, however, electricity was now destined to transfer its supremacy to another science. The great discovery made by Galvani in 1790, that the contact of metals produced muscular contraction in frogs, and the invention of the Voltaic pile, in 1800, by M. Volta of Como, have led to the establishment of a new science, called *Galvanism* or *Voltaic Electricity*, which, though now proved to be identical with common electricity, requires to be treated in a separate article. The chemical effects of the Voltaic pile far transcended those of ordinary electricity, and enabled Sir Humphry Davy to decompose the earths

History.

and the alkalies, and thus to create a new epoch in the history of chemistry.

Coulomb, born 1736, died 1806.

Contemporary with Mr Cavendish was M. Coulomb, one of the most eminent experimental philosophers of the last century. Anxious to determine the law of electrical action, he invented for this purpose an instrument called a *torsion balance*, which has since his time been universally used in all delicate researches, and which is particularly applicable to the measurement of electrical and magnetical actions. Æpinus and Cavendish had considered the action of the electrical fluid as diminishing with the distance; but M. Coulomb proved, by a series of elaborate experiments, that it varied like gravity in the inverse ratio of the square of the distance. Our countryman Dr Robison had previously determined, without, however, having published his experiments, that in the mutual repulsion of two similarly electrified spheres, the law was slightly in excess of the inverse duplicate ratio of the distance, while in the attraction of oppositely electrified spheres the deviation from that ratio was in defect; and hence he justly concluded that the law of electrical action was similar to that of gravity.

Adopting the hypothesis of two fluids, Coulomb investigated experimentally and theoretically the distribution of electricity on the surface of bodies. He determined the law of its distribution between two conducting bodies in contact; he measured the density of the electricity in different points of two globes in contact; he ascertained the distribution of electricity among several globes (whether equal or unequal) placed in contact in a straight line; he measured the distribution of electricity on the surface of a cylinder, and its distribution between a globe and cylinder of different lengths but of the same diameter. His experiments on the dissipation of electricity possess also a high value. He found that the momentary dissipation was proportional to the degree of electricity at the time; and that when the electricity was moderate, its dissipation was not altered in bodies of different kinds or shapes. The temperature and pressure of the atmosphere did not produce any sensible change; but the dissipation was nearly proportional to the cube of the quantity of moisture in the air. In examining the dissipation which takes place along imperfectly insulating substances, he found that a thread of gum-lac was the most perfect of all insulators; that it insulated ten times better than a dry silk thread; and that a silk thread covered with fine sealing-wax insulated as powerfully as gum-lac when it had four times its length. He found also that the dissipation of electricity along insulators was chiefly owing to adhering moisture, but in some measure also to a slight conducting power.

Experiments of Laplace, Lavoisier, and Volta, [illegible]

Towards the end of the last century a series of experiments was made by MM. Laplace, Lavoisier, and Volta, from which it appeared that electricity is developed when solid or fluid bodies pass into the gaseous state. The bodies which were to be evaporated or dissolved were placed upon an insulating stand, and made to communicate by a chain or wire with a Cavallo's electrometer, or with Volta's condenser, when it was suspected that the electricity increased gradually. When sulphuric acid diluted with three parts of water was poured upon iron filings, inflammable air was disengaged with a brisk effervescence; and at the end of a few minutes the condenser was so highly charged as to yield a strong spark of negative electricity. Similar results were obtained when charcoal was burnt on a chafing dish, or when fixed air or nitrous gas was generated from powdered chalk by means of the sulphuric and nitrous acids.

Volta.

M. Volta, who happened to be at Paris when these experiments were made, and who took an active part in them, had subsequently observed that the electricity produced by evaporation was always negative. He found that burning charcoal gives out negative electricity; and in other kinds of combustion he obtained distinct electrical indications.

Saussure.

In this state of the subject M. Saussure undertook a series of elaborate experiments on the electricity of evaporation and combustion. In his first trials he found that the electricity was sometimes positive and sometimes negative when water was evaporated from a heated crucible of iron; but he afterwards found it to be always positive both in an iron and a copper crucible. In a silver and in a porcelain crucible the electricity was negative. The evaporation of alcohol and of ether in a silver crucible also gave *negative* electricity. M. Saussure made many fruitless trials to obtain electricity from combustion, and he likewise failed in his attempts to procure it from evaporation without ebullition.

Many valuable additions were about this time made to electrical apparatus, as well as to the science itself, by Van Marum, Cavallo, Nicholson, Cuthbertson, Brooke, Bennet, Read, Morgan, and Henley; but our limits will not permit us to do any thing more than thus notice their labours.

Application of analysis to electricity.

The application of analysis to electrical phenomena may be dated from the commencement of the present century. Coulomb had considered only the distribution of electricity on the surface of spheres; but Laplace undertook to investigate its distribution on the surface of ellipsoids of revolution, and he showed that the thickness of the coating of fluid at the pole was to its thickness at the equator as the equatorial is to the polar diameter, or, what is the same thing, that the repulsive force of the fluid, or its tension at the pole, is to that at the equator as the polar is to the equatorial axis.

M. Biot.

M. Biot has extended this investigation to all spheroids differing little from a sphere, whatever may be the irregularity of their figure. He likewise determined analytically that the losses of electricity form a geometrical progression when the two surfaces of a jar or plate of coated glass are discharged by successive contacts; and he found that the same law regulates the discharge when a series of jars or plates are placed in communication with each other.

M. Poisson.

It is to M. Poisson, however, that we are mainly indebted for having brought the phenomena of electricity under the dominion of analysis, and placed it on the same level as the more exact sciences. By assuming the hypothesis of two fluids, he has deduced theorems for determining the distribution of the electric fluid on the surface of two conducting spheres when they are either placed in contact or at any given distance; and the truth of these theorems has been established by experiments performed by Coulomb long before the theorems themselves had been investigated.

Oersted's discovery of electro-magnetism, 1820.

The cultivation of the new science of Voltaic electricity had now withdrawn the attention of experimental philosophers from that of ordinary electricity. The splendour of its phenomena, as well as its association with chemical discovery, contributed to give it popularity and importance; but the discoveries of Galvani and Volta were destined, in their turn, to pass into the shade, and the intellectual enterprise of the natural philosophers of Europe was directed to new branches of electrical and magnetical science. Guided by theoretical anticipations, Professor H. C. Oersted of Copenhagen, in 1820, laid the foundations of the science of *Electro-magnetism*. He found that the electrical current of a galvanic trough, when made to pass through a platina wire, acted upon a compass needle placed below the wire; and upon repeating the experiment, he discovered the fundamental law, that *the magnetical effect of the Voltaic current had a circular motion round the current*, or round the *conductor*, or the wire through which the current passed. M. Ampere of Paris soon afterwards made the important discovery, that two wires conducting electrical currents, when suspended so as to be capable of motion, *attracted* each other when the currents moved in the *same direction*, and *repelled* each other when they moved in *opposite* directions; or, to express the fact more simply, *two points of electrical currents repel each other by their similar sides, and attract each other by their opposite sides;* so that, as Professor Oersted remarks, *an electric current contains a revolving action, exhibiting every appearance of polarity.*

Discoveries of Ampere.

Discoveries of Arago, Davy, and Seebeck.

In 1820 M. Arago, Sir H. Davy, and Dr Seebeck of Berlin, without being acquainted with each other's labours, discovered the power of the electric current to impart magnetism to iron and steel needles; but the most singular discovery on this branch of the subject was made by M. Savary, who found that small steel needles placed at different but very short distances from a wire conducting an electrical current, are magnetised in different directions. Needles in contact with the wire are magnetised in the usual or *positive* direction; while needles at the distance of 1·1 millimeter, or $\frac{1}{24}$th of an inch, are magnetised in an opposite direction, which he calls *negative.* At the distance of two inches from the wire there was a neutral line in which the needles were not magnetised at all. When the distance of the unmagnetised needle was increased from three to eight millimeters it again became positively magnetic, the maximum effect taking place at the distance of $5\frac{1}{2}$ millimeters. Between the distance of 8·6 and 21·4 millimeters the magnetism was a second time negative, the effect increasing from 8·6 to 14·6, and again reaching the vertical or zero point at 21·4. Beyond the distance of twenty-three millimeters the magnetism was again positive. With different conducting wires M. Savary found, that within certain limits the maximum intensity is produced at a greater distance from the wire, and the number of alternations of positive and negative direction is also greater in proportion, as the wire is shorter in proportion to the length of the helix. When needles are placed parallel to the axis of a helix of narrow windings, they all receive the same kind of magnetism; but when the electrical charge is increased from one jar to a battery of twenty-two superficial feet, six alternations, viz. three positive and three negative, are obtained. When Voltaic electricity is substituted for ordinary electricity, the alternations are destroyed by a continued current, but appear when the current is established only for an instant.

Discoveries of M. Savary.

Discoveries of Professor Erman.

These curious experiments were followed by those of Professor Erman of Berlin, who found that when an electrical discharge passes through the centre of a circular disc of steel, and in a line perpendicular to its surface, no apparent magnetism is developed; but when a slit is made in the plate, or a sector cut out of it, the side of the disc opposite to the slit, or the sectoral opening, exhibits the opposite magnetism. MM. Gay Lussac and Welther obtained the same result with a steel ring.

Discoveries of Dr Seebeck, 1822.

The discovery of thermo-electricity by Dr Seebeck in 1822 gave a new impulse to this branch of science. In studying the influence of heat in Galvanic arrangements, he was led to believe that magnetism might be developed in two metals forming a circuit when the equilibrium of heat in them was disturbed. He accordingly joined a semicircular piece of bismuth with a similar piece of copper, so as to form a circle by their union; and when one of the junctions was heated an electrical current was produced, which could show its existence only by the magnetic needle, and which exhibited all the magnetical properties of an electrical current.

Dr Fa day's c coveri

In the same year in which Dr Seebeck made this remarkable discovery, the rotation of a magnetical needle round an electrical current, and of a body transmitting an electrical current round a magnet, were exhibited in a series of beautiful and highly ingenious experiments by Dr Faraday, whose subsequent discoveries place him at the head of the cultivators of this most interesting science.

Exper ments Arago others

These experiments were followed by those of Arago, Barlow, Seebeck, Herschel, and Babbage, in which a revolving plate of copper gives a rotatory motion to a magnetic needle conveniently suspended; but notwithstanding the ingenuity and talent with which this subject was treated by these eminent individuals, it is to Dr Faraday that we owe a complete analysis and explanation of this curious phenomenon.

Disco of ma to-ele city b Farad

This explanation was founded on the great discovery of the evolution of electricity from magnetism, by which Dr Faraday laid the foundation of the new science of magneto-electricity. By means of a series of simple and beautiful experiments with the celebrated magnets of Dr Godwin Knight, and with the powerful magnet of Professor Daniel, Dr Faraday obtained the most unequivocal and striking electrical effects, though the intensity of the electricity was very feeble, and its quantity small. He obtained a distinct though feeble spark; he succeeded in convulsing the limbs of a frog by means of a magnet; and he perceived also the sensation on the tongue and the flash before the eyes, but he could not effect chemical decomposition by magnetism. Besides obtaining these important results, Dr Faraday has clearly established the laws according to which a magnet developes magnetic currents. He applies these laws to the explanation of the reciprocal action of revolving magnets and metals, and he adduces unquestionable proofs of the production of electricity by terrestrial magnetism.

These important results have been more recently extended by Dr Faraday and others. M. Pixii observed attractions and repulsions in the electricity evolved by magneto-electric induction; and by an ingenious and powerful apparatus he obtained a great degree of divergence in the gold leaves of an electrometer. At the meeting of the British Association at Oxford in June 1832, Dr Faraday, by means of Mr Snow Harris's electrometer, subsequently described, succeeded in heating a wire by magneto-electric induction. By means of the magneto-electric apparatus of M. Pixii already referred to, he and M. Hachette decomposed water, and obtained the oxygen and hydrogen in separate tubes.

Ident the va electr ties e blishe Dr Fa day.

In the progress of his electrical researches, Dr Faraday found it necessary for their further prosecution to establish either the identity or the distinction of the electricities excited by different means; and in a paper of great value, he has established beyond a doubt the identity of common electricity, Voltaic electricity, magneto-electricity, thermo-electricity, and animal electricity. The phenomena exhibited in these five kinds of electricity do not differ in kind, but merely in degree; *and in this respect they vary in proportion to the variable circumstances of quantity and intensity, which can at pleasure be made to change in almost any one of the kinds of electricity, as much as it does between one kind and another.* Dr Faraday has given the following interesting table of the experimental effects common to the electricities derived from different sources.[1]

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[1] The cross indicates that the effect at the top of this table is produced by the electricity mentioned in the column at the side.

	Physiological Effects.	Magnetic Deflection.	Magnets made.	Spark.	Heating Power.	True Chemical Action.	Attraction and Repulsion.	Discharge by Hot Air.
1. Electricity..................	×	×	×	×	×	×	×	×
2. Voltaic Electricity.........	×	×	×	×	×	×	×	×
3. Magneto-Electricity.......	×	×	×	×	×	×	×	
4. Thermo-Electricity	×	×	?	×	?			
5. Animal Electricity.........	×	×	×	?		×		

ion easure linary oltaic ricity.

Dr Faraday was anxious to determine the relation by measure of ordinary and Voltaic electricity; and after various excellent experiments, he obtained as an approximation, and judging from magnetical force only, "that two wires, one of platina and one of zinc, each one eighteenth of an inch in diameter, placed five sixteenths of an inch apart, and immersed to the depth of five eighteenths of an inch in acid consisting of one drop of oil of vitriol, and four ounces distilled water at a temperature about 60°, and connected at the other extremities by a copper wire eighteen feet long and one eighteenth of an inch thick (being the wire of the galvanometer coils), yield as much electricity in eight beats of my watch, or in $\frac{8}{150}$ths of a minute (or 3·2 seconds), as the electrical battery (of fifteen jars) charged by thirty turns of the large machine in excellent order. The same result was found to be true in the case of chemical force."

Fara- s new of elec- l con- ion.

In the course of his investigations relative to electro-chemical composition, Dr Faraday was led to observe the effects due to a very general law of electric conduction which had not formerly been recognised. He found that solid bodies assume the power of conducting electricity during liquefaction, and lose this conducting power during congelation. The Voltaic electricity produced by a battery of fifteen troughs, or a hundred and fifty pairs of four-inch plates powerfully charged, was incapable of passing through a thin film of ice three sixteenths of an inch thick; but when the ice was melted, the electricity passed in such quantities as to deflect the magnetic needle 70°. This insulation, however, exhibited by ice is not effective with electricity of exalted intensity. In making this experiment with other solid bodies, Dr Faraday chose those which, being solid, at common temperatures were fusible, and of such a composition as, for other reasons connected with electro-chemical action, led to the conclusion that they would be able to replace water. When the electric current passed through the solid body employed, there was no chemical decomposition; but when the body was liquefied or fused, the decomposition took place. The bodies which Dr Faraday found to be subject to this law will be found in our section on Electrical Conduction. The degree of conducting power conferred upon bodies by liquidity is generally very great. In water it is the feeblest of all; and in the various oxides, chlorides, salts, &c. it is given in a much higher degree, some a hundred times greater, than in the case of pure water.

cove- of M. tier.

Before we close this brief history of electrical discoveries, we must notice the very remarkable one communicated to the Academy of Sciences at Paris, on the 27th May 1833, by M. Peltier, who has announced that, without changing the producing cause, he can transform *quantity* of electricity into *intensity*, and *intensity* into *quantity*, and neutralise two similar currents, proceeding always from the same cause, by making them interfere in opposite directions.

Labours of Mr Snow Harris.

Among the able and active cultivators of electrical science, we must not omit the name of Mr Snow Harris of Plymouth. His beautiful instrument for measuring the heat evolved in electrical action,—his lightning conductors for ships,—his measuring electrometer,—his application of it in determining in a new way the law of electrical attraction, whether it takes place between simply electrified conductors, or between accumulated electricities,—his experiments on the action of spheres and planes, and bodies of other forms,—on the laws of electrical accumulations, and on the controlling power of bodies,—entitle him to a high place in the lists of electrical discovery.

PART I.

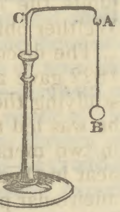
PHENOMENA AND LAWS OF ELECTRICITY.

Elementary Phenomena and Definitions.

Elementary phenomena and definitions.

1. If a smooth glass tube, or the glass of a watch, or a piece of sealing-wax, or amber, be rubbed upon the sleeve of a cloth coat, or, what is still better, if it be rubbed with a piece of dry flannel or woollen cloth, it will be found to have acquired from this friction a new physical property. This property will be exhibited by holding the body which has been newly rubbed above small shreds of paper, gold leaf, or any thin light bodies placed upon the table. These bodies will be instantly *attracted* to it, some of them adhering to its surface, others falling back to the table, and others being thrown off from the body as if they were repelled from it.

The property which has thus been communicated by friction is called *electricity*, the body which acquires the property is called the *electric*, the attraction which it exercises over light bodies is called *electric attraction;* and when the attractive power is produced by friction, the body *rubbed*, or the *electric*, is said to be *excited* by friction, and the body by which it is excited is called the *rubber*.



2. In order to study these phenomena with more precision, let a small ball B, the size of a pea, made of cork, or the dry pith of elder, or, what is better still, of the finely porous pith of the sola tree from India, be suspended from a stand ACD by a dry silk thread AB. Having rubbed a large glass tube with a piece of dry silk, present it to the ball B, and the ball will be instantly attracted to the tube, and will adhere to it. After they have continued in contact for a second or two, withdraw the glass tube, taking care not to touch the ball with the finger. If the excited glass tube is now a second time brought near the ball, the ball will recede from it, or will be *repelled* by the tube. If, after touching the ball

with the finger, so as to deprive it of its electricity, the above experiment is accurately repeated with a stick of *sealing-wax* in place of glass, the very same phenomena will be exhibited; the ball will, in the first instance, be *attracted*, and on the second application of the sealing-wax it will be *repelled*. Hence we draw two conclusions, *first*, that both *glass* and *sealing-wax* attract the ball B before they have communicated to it any of their own electricity; and, *second*, that both these electrics repel the ball after each of them has communicated to it some of their own electricity.

3. Let us now examine what takes place when the excited sealing-wax is presented to the ball, after the ball has received electricity from the excited glass, and *vice versa*. For this purpose excite the glass tube, present it to the ball B, and after it has been a few seconds in contact, withdraw it. The ball has now received electricity from the glass tube. Let the sealing-wax be now excited and presented to the ball, the ball, in place of being *repelled*, will be *attracted* by the wax. Reverse this experiment, by first presenting the excited wax to the ball, and then the excited glass, and it will be in like manner found that the glass *repels* the ball. Hence it follows that

Excited glass *repels* a ball electrified by excited glass.
Excited wax *repels* a ball electrified by excited wax.
Excited glass *attracts* a ball electrified by excited wax.
Excited wax *attracts* a ball electrified by excited glass.

From which we conclude that there are two opposite electricities, namely, that produced by excited glass, to which the name of *vitreous* or *positive* electricity has been given, and that produced by excited wax, to which the name of *resinous* or *negative* electricity has been given.

4. If, when the pith ball B is electrified, either with excited glass or wax, we touch it with a rod of glass, its property of being subsequently attracted or repelled by the excited glass or wax will suffer no change; but if we touch it with a rod of metal it will lose the electricity which it had received, and will be attracted both by the excited glass or wax, as it was when they were first applied to it. Hence the rod of glass and the rod of metal possess different properties, the former being incapable, and the latter capable, of carrying off the electricity of the pith ball. The metal is therefore said to be a *conductor*, and the glass a *non-conductor*, of electricity.

In the few elementary experiments which we have now described, the electricity has been produced by *friction*; but the pith ball could have been electrified by a great variety of other methods, which will be explained in a subsequent part of this article. In all these cases the effects are precisely the same, whatever be the source from which the electricity is obtained; but as friction is the simplest means of generating electricity, and as machines and apparatus have been invented, by means of which it can be thus produced in great abundance, and accumulated in great quantities, we shall proceed to describe the phenomena and laws of electricity as produced by friction.

CHAP. I.—ON THE PHENOMENA OF ELECTRICITY PRODUCED BY FRICTION.

SECT. I.—*Description of the Electrical Machine for generating Electricity.*

Although the friction produced by the strength of the human arm is sufficient to produce abundance of electricity for ordinary experiments, yet the aid of mechanism has been found essential for carrying on electrical investigations, and producing powerful electrical effects. The various forms which have been given to the electrical machine will be described in the second part of this article, under the head of Electrical Apparatus, so that we shall chiefly confine our attention at present to a description of the plate-glass machine.

Plate-g
machi
Pl. CC
Fig. 1.

This machine, in its common form, is represented in Plate CCIX. fig. 1, where AB is a circular disc of plate glass from eighteen inches to two or more feet in diameter, and from two to three eighths of an inch thick. This disc is fixed perpendicular to a horizontal axis, supported by two uprights E, F, of a mahogany frame, and is capable of being turned round with any ordinary degree of velocity, by means of the handle or winch W. The rubbers by which this disc of glass is rubbed or excited are placed at the upper and lower end of the disc, as seen in the section, fig. 2. The two upper rubbers above A, viz. G, H, are suspended from the top of the frame, and are fixed by screws to two flat pieces of wood *m*, *m*, which can be pressed together or slackened by turning the screw *s* so that the rubbers G, H may be made to press with the requisite degree of force against the disc AB which revolves between them. The lower rubbers M, N below B, are supported upon the stand, and are similarly put together. The rubbers are generally flat cushions of silk or soft leather stuffed with hair.

Rubbe

Prime
ductor

The prime conductor CD is a semicircle of hollow brass, supported on the upright E by means of the solid glass cylinder R. The two extremities of this conductor, one of which is seen below A, and the other above B, carry each a row of brass points, and the transverse piece of brass tube in which the points are inserted terminates in a varnished wooden ball.

Silk fl

From the upper rubbers an oil silk flap, embracing both surfaces of the plate, extends to a little above the row of points on the conductor; and from the lower rubbers a similar flap extends to a little below the other row of points. One of these flaps is seen in the figure, but the other is hid by the upright E.

Amalg

As it has been found that electricity is developed more copiously when the rubbers are covered with an amalgam of one part of tin and two of mercury, various compositions have been tried by philosophers. The following amalgam, recommended by Singer, is equal in efficacy to any that has yet been proposed. Melt two ounces of zinc and one of tin, and pour into the crucible six ounces of mercury. Shake the whole together till it is cold, in an iron or thick wooden box; and when it has been reduced to a fine powder in a mortar, mix it with as much lard as will form it into a paste. The amalgam thus formed must then be thinly spread on the surface of each cushion; and when the disc of glass has been well cleaned from dust, and from black specks or lines, by means of a little spirits of wine, the mixture is ready for use.

When a very powerful excitation is required, it is usual to cover a piece of smooth leather, four or five inches broad, with the amalgam, and apply it with the hand to the revolving disc; and it has been found very useful to apply previously a rag with a little tallow, so as just to give a slight dimness to the glass.

Rona
cylinc
machi
Fig. 3

Although the plate glass machine is generally regarded as the best, yet, from its greater cheapness and facility of construction, the cylinder machine is most commonly used. We shall therefore describe at present one of those machines as improved by Mr F. Ronalds. This machine is represented in fig. 3, where A is a cylinder of blue glass about a quarter of an inch thick, supported by the two mahogany uprights B, B, fixed to the box or case C, which forms the base of the machine. DD is a copper pipe which supports the semicylinder E, which is also hollow, and into which the pipe D opens. This semicylinder carries on its flat side the cushion or rubber, the surface of which is made concave to suit the convexity of the cylinder AA. A small spirit-lamp F, the burner of which consists only of a single cotton thread, is placed, as shown in the figure, immediately beneath the mouth of the copper pipe DD. The prime conductor G, which stands parallel to the cylinder, is a cylindrical tube of thin copper, rounded at both ends, and carrying at its middle a row of metallic points, which nearly touch the surface of the glass cylinder. The conductor G is supported by a hollow glass support H, opening into the hollow conductor G. Its lower end at H is fixed to the wooden case C by means of three screws, one of which is seen at *a* passing through a circular piece of hard boxwood, the inside of which, as well as that of the perforation in the case C, is lined with leather. The lower end of the glass tube H terminates, like that of D, within the case C, and a spirit-lamp is in like manner placed beneath it.

By these ingenious contrivances the rubber and the conductor[1] are kept warm and dry, and in damp weather, or in a close room, where the air is rendered moist by the breath of the audience, the machine will be found always effective and in working order. Mr Ronalds is of opinion that the excitation of the cylinder is promoted by the excitation of the amalgam by means of the heat. If similar means are not taken to heat the interior of the glass cylinder, the development of electricity may be promoted by holding a hot piece of cloth or flannel beneath the cylinder while it is in operation.

Sect. II.—*On the Phenomena of Electrical Attraction and Repulsion.*

If the electrical machine, when thus prepared, is put in motion, the two rows of points will collect the electricity which is generated by friction, and the brass conductor CD, fig. 1, will be filled with the electricity thus produced. By means of this electricity the following experiments may be readily performed.

Exp. 1. If we suspend a pith ball by a slender wire, and bring the ball near the conductor, it will be instantly attracted by, and adhere to, the conductor, as long as there is any electricity left. In this case the electricity imparted to the ball by the conductor is carried off by the conducting wire to the hand, and through the body to the earth.

If the pith ball is suspended by a dry silk thread, and held near the conductor, it will at first be attracted to it as formerly; but after it has received as much as it can take, it will then be repelled by the conductor, from the repulsive action of the two similar electricities, and it will not again approach the conductor, till either its own electricity or that of the conductor has been carried off by the contact of some conducting body. In either of these cases the pith ball will be again attracted by the conductor.

Exp. 2. Suspend a little brass ball by a silk thread, and bring the ball near the conductor, so as to receive electricity from it, and be repelled, as in experiment 1. Then with the other hand bring another brass ball near to the first, but on the side of it opposite to the conductor. The first ball will now be attracted to the conductor in consequence of having given out its electricity to the second ball; but having received a new charge of electricity, it will be repelled from the conductor and attracted to the hand or fixed ball. In this way it will oscillate like a pendulum between the conductor and the fixed ball. If in place of the fixed ball we substitute a bell, the ball will oscillate as before, and cause the bell to ring by its successive strokes.

Electrical bells.

Exp. 3. The beautiful experiment of the *electrical bells* is exhibited in fig. 4, where AB is a solid glass rod surmounted by a brass ball A, and supported upon a wooden stand. Two arms of brass crossing at right angles are also supported by the glass rod, and, by means of wires or chains hanging from their extremities, are suspended four bells *b*, *b*, *b*, *b*. From the middle part of each of these cross arms is suspended a brass ball by silk threads, so that each ball when put in motion and made to oscillate in a plane passing through its own cross arm, may strike alternately the middle bell b' and the one adjacent to it. If the brass ball is now placed close beneath the brass knob of the prime conductor, or made to communicate with it, the electricity of the conductor will be transmitted through the brass arms to the balls, and the balls giving out their electricity to the bells, will strike them alternately, and cause them to ring, the electricity passing off through the central bell b' into the earth.

The experiment may be made more simply by suspending three bells, one from the middle, and one from each extremity of a brass rod, which is hung by its middle part from an electrified conductor. Two brass balls are hung by a silk thread between the central bell and the outer ones. The outer bells are supported by a wire or chain, and the central one by a silk thread. This central bell, however, must communicate with the ground by a chain. When the machine is put in motion, the electricity passes to the outer bells, and the insulated balls, being attracted and repelled, strike the outer bells and the inner one, by which last the electricity passes into the earth.

A still simpler form of the experiment consists in placing two small bells on separate glass stands, at a quarter of an inch distance, one of the bells communicating with the prime conductor, and the other with the ground. A brass ball is then suspended between them by a silk thread, and when the machine is wrought, the electricity will pass to the earth through the bells and the ball, the latter oscillating between them, and ringing them, as long as the current of electricity is kept up.

Exp. 4. Take a dozen of threads about a foot long, and having tied them together at both ends, hang them, by a loop attached to the upper knot, to the prime conductor. When the machine is wrought, the threads will separate from each other, swell out at the middle, and assume a form approaching to that of a sphere. If the threads are merely joined at each end, so that their extremities point to two poles, which may easily be done, they would swell out, and form, as it were, the meridians of a hollow globe. This pretty experiment we owe to Mr Wheler.

Exp. 5. Having fastened a piece of sealing-wax to a wire, and inserted the wire in the hole at the end of the prime conductor, soften the sealing-wax by the flame of a candle, and work the machine;—fine fibres of wax like those of wool will be thrown off, and may be received on paper. By gently heating the paper, the result of the experiment may be fixed. These fibres are thrown off by the repulsion of the electrified particles of wax, which becomes a conductor when melted. The same experiment might no doubt be made with melted sugar, rosin, and other substances.

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[1] It would be easy to improve this construction, by introducing the heated air of other two spirit-lamps into each end of the cylinder.

Fig. 5.

Exp. 6. The experiment of the dancing figures is one of the finest illustrations of electrical attraction and repulsion. Take two circular discs of wood or pasteboard, E, F, like those shown in fig. 5. Cover them with tinfoil, and having suspended the uppermost from the prime conductor (or from the end D of a metallic rod CD insulated by the glass stand AB, and whose other extremity C communicates by a chain with the prime conductor), place the other upon a stand G, so that, by means of the screw nut *n*, it can be raised or depressed. Place upon the lower disc small painted figures cut out of paper, and as soon as the machine is wrought the figures will spring upon their feet, and execute the most extraordinary movements, sometimes dancing on their heads, sometimes hanging by the upper plate, and sometimes flying into each other's arms. If these figures are cut out of the pith of the sola tree, and if the arms and legs are made separate, and attached by threads to the body, the effect surpasses all description. The circular discs will answer equally well if made of metal.

Exp. 7. Suspend from the prime conductor a small metallic cup nearly full of water, and having placed in it the shorter end of a syphon made with a capillary glass tube, of such a bore that the water will with difficulty drop from it. When the water is electrified by working the machine, it will be discharged in a continuous stream from the larger arm of the syphon; and if the electricity is powerful, the current of water will divide itself into several branches. In like manner, if a condensed air fountain is electrified, the jet will subdivide itself into minute parts, and suffer great expansion; but the moment the machine stops it resumes its original form. In like manner, if a sponge filled with water discharges the fluid only by drops, it will, when electrified, let fall an abundant shower, which in the dark will be luminous.

Exp. 8. In a metallic cup place a piece of lighted camphor, and when the cup communicates with the electrified conductor, the camphor will throw off numerous ramifications, shooting forth its branches like a vegetable in growth.

An immense number of similar experiments may be made by placing pith balls under inverted tumblers, and thin balls of glass within metallic rings; and when the tumblers and the rings are electrified, the most varied movements are produced; and the effect is greatly heightened by the accompanying luminosity, which displays itself in the dark.

The theory of the phenomena which we have now described will be given in a subsequent section.

SECT. III.—*On the Phenomena of Positive and Negative Electricity.*

Positive and negative electricity.

We have already seen that there are two opposition electricities, which have received the name of *positive* or *vitreous*, and *negative* or *resinous* electricity, the former being generated by excited *glass*, and the latter by excited *wax*.

In order to examine the properties of these two kinds of electricity, take four stands like that shown in page 575, consisting of a vertical rod of glass fixed in a wooden base. From the top of each stand suspend a single pith ball by a slender wire, and place the four stands, which we shall call P, P′ and N, N′ at some distance from each other on a table. Electrify the pith balls on P, P′ by excited glass, so as to make them *positively* electrical; and the pith balls on N, N′ with excited wax, so as to make them *negatively* electrical. The following phenomena will then be observed. If the balls P, P′ or N, N′ are brought near each other, they will *repel* one another, but if P or P′ is brought near to N or N′, the balls will attract each other. Hence it follows,

Propert of posit and neg tive ele tricity.

That two SIMILARLY *electrified bodies P, P′ or N, N′* REPEL *each other, while two* DISSIMILARLY *electrified bodies P, N or P′, N′* ATTRACT *each other.*

If, in place of electrifying the balls with the glass and the sealing-wax, we had electrified them with the rubber with which they had been excited, we should have found that the rubber which excited the glass gave out *resinous* electricity, and the rubber which excited the wax *vitreous* electricity. Hence we learn,

That in electrical excitation positive and negative electricity are simultaneously produced.

Pl. CC Fig. 6.

In all electrical machines, therefore, where the plate or cylinder is made of glass, the conductor which takes the electricity from the glass will be charged with *positive* electricity; and as the rubber is negatively electrified, we may obtain negative electricity from it in the same abundance, by placing a conductor behind the rubber, and insulating them both by a glass stand. In the cylinder machine this is easily done, as shown in fig. 6, which represents a machine driven by a wheel and pulley, where E is the negative conductor placed at the back of the rubber R, and S the glass stand by which they are both supported and insulated.

Van M rum's m chine, Pl. CC Fig. 1–

Dr Ha machin fig. 7.

In the plate-glass machine it is more difficult to unite a conductor to the rubbers. In Van Marum's beautiful electrical machine, shown in fig. 1–5 of Plate CCX. and which will be more minutely described afterwards, the *positive* and *negative* electricity can be obtained only in succession; but Dr Hare, of the university of Pennsylvania, has removed this difficulty by the very ingenious contrivance shown in fig. 7, of making the plate revolve horizontally, and thus allowing the positive and negative conductors B, F to stand like arches in two vertical planes at right angles to each other.

The circumstances of surface and structure under which bodies yield the two opposite electricities by friction are still very imperfectly understood. Mr Canton found that the same body gave out opposite electricities when rubbed with different substances. *Polished glass*, for example, was always *positively* electrified when excited with flannel or silk; but always *negatively* electrified when excited by the back of a cat. But, what was still more strange, he found that *rough glass* acquired *negative* electricity when excited by flannel, and *positive* electricity when excited by dry oiled silk. Rough quartz has been found to exhibit the same difference.

A still more extraordinary and instructive anomaly was observed by Haüy in exciting a mineral called *kyanite*. Some of the crystals he found to acquire positive electricity by friction, while others acquired negative electricity. Saussure had announced that they were negatively electrified by friction; and when Haüy obtained an opposite result in his first experiment, he was led to examine the subject more carefully, and to make his trials both with the natural faces and with those produced by cleavage. "I have," he remarks, "in my collection a crystal whose opposite faces have presented me with these opposite effects (*electricities*), and I can assign no other cause for this singular result than a certain alteration in the contexture of one of the surfaces." Hence Haüy has given the name of *disthene*, or *two powers*, to this mineral. The remarkable property which Haüy discovered in the individual crystal above referred to, may have arisen from some composite structure which he did not recognise.

As the property of giving positive or negative electricity by friction has been used as a mineralogical character, we shall lay before our readers a general view of the experiments which have been made on the subject, which we have collected from a great variety of sources.

Names of the Excited Substances.	Nature of the Electricity produced.	Substances used for Excitation.
Smooth glass	Positive	Every substance yet tried but the back of a cat and mercury.
	Negative	Back of a cat, and sometimes caoutchouc. (Nich. *Journ.* xxviii. p. 11.)
Rough glass	Positive	Dry oiled silk, metals, wax, and resinous matters.
	Negative	Woollen cloth, human hand, back of a cat, wood, paper, quills.
Quartz, smooth	Positive	Flannel, &c.
Quartz, rough	Negative	Flannel, &c.
Topaz, smooth	Positive	Flannel, &c.
Topaz, rough	Negative	Flannel, &c.
Back of a living cat	Positive	Every substance yet used.
Hare skin	Positive	Human hand, silk, leather, metals, paper, baked wood, and loadstone.
	Negative	Other finer furs.
White silk	Positive	Black silk, black cloth, metals.
	Negative	Human hand, weasel's skin, paper, hair.
Black silk	Positive	Sealing-wax.
	Negative	Hare's, weasel's, and ferret's skin, white silk, human hand, brass, silver, iron, loadstone.
Woollen cloth	Positive	Zinc, silver, bismuth, copper, lead, oligist iron.
	Negative	Platina, gold, tin, antimony, grey copper, grey cobalt, tellurium, &c.
Sealing-wax	Positive	Rough glass, white wax, sulphur, and all metals except iron, steel, plumbago, lead, and bismuth.
	Negative	Hare's, weasel's, and ferret's skin, human hand, leather, smooth glass, flannel, wood, paper, iron, steel, plumbago, lead, and bismuth.
Baked wood	Positive	Silk, paper, rough glass, wax, lead, sulphur, and the metals.
	Negative	Flannel, hare's skin, smooth glass, quills.
Sulphur	Positive	All metals but lead.
	Negative	Lead and all other substances.
Resinous bodies	Positive	All resinous substances.
	Negative	All bodies but resinous ones.

The most accurate and numerous observations on the development of electricity by friction were made by the Abbé Haüy in reference to the discovery of new characters of minerals. He rubbed the minerals on a woollen cloth, and when it was necessary to insulate them he fixed them by wax to the end of a stick of gum-lac or Spanish wax. In this way he divided the mineral kingdom into four classes of bodies in reference to the electrical character of the minerals.

Class I.—*Containing minerals which possess the insulating property,*[1] *and acquire vitreous electricity by friction.*

Boracite.
Topaz.
Axinite.
Tourmaline.
Mesotype.
Prehnite.
Oxide of zinc.
Sphene.
Carbonate of lime.
Carbonate of magnesia.
Arragonite.
Apatite.
Fluate of lime.
Gypsum.
Anhydrite.
Sulphate of barytes.
Sulphate of strontian.
Carbonate of barytes.
Carbonate of strontian.
Sulphate of magnesia.
Siliceous borate of lime.
Nitrate of potash.
Sulphate of potash.
Muriate of soda.
Glauberite.
Hyalin quartz.
Zircon.
Corundum.
Cymophane.
Spinelle.
Emerald.
Euclase.
Cordierite.
Garnet.
Essonite.
Idocrase.
Feldspar.
Apophyllites.
Actinote.
Tremolite.
Diopside.
Epidote.
Stilbite.
Analcime.
Nepheline.
Kyanite.
Mica.
Macle.
Talc transp.
Diamond.
Carbonate of lead.
Sulphate of lead.
Tungstate of lead.
Carbonate of zinc.
Oxide of tin.

Class II.—*Containing minerals which possess the insulating property (excepting anthracite), and acquire resinous electricity by friction.*

Sulphur.
Bitumen.
Retinasphaltum.
Amber.
Mellite.
Anthracite.

Class III.—*Containing conducting substances which acquire, when they are insulated and rubbed, the one order vitreous electricity, and the other resinous electricity.*

Order 1. *Substances which acquire vitreous electricity.*

Pure silver.
Native silver.
Silver coin.
Pure lead.
Pure copper.
Native copper.
Copper coin.
Pure zinc.
Brass.
Native bismuth.
Native amalgam.

Order 2. *Substances which acquire resinous electricity.*

Pure platina.
Native platina.
Palladium.
Pure gold.
Native gold.
Gold coin.

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[1] That is, they do not require to be insulated or placed upon a substance which does not conduct or carry off electricity, in order to exhibit their electricity.

- Pure nickel.
- Native iron.
- Hammered iron.
- Pure tin.
- Amalgam of tin and mercury.
- Native arsenic.
- Pure antimony.
- Native antimony.
- Tellurium of naygag.
- Antimonial silver.
- Arsenical nickel.
- Arsenical iron.
- Oxidulated iron.
- Metalloidal oxide of manganese.
- Sulphuret of silver.
- Sulphuret of lead.
- Copper pyrites.
- Grey copper.
- Sulphuret of copper.
- Graphite.
- Common sulphuret of iron.
- White sulphuret of iron.
- Magnetic sulphuret of iron.
- Sulphuret of tin.
- Sulphuret of bismuth.
- Sulphuret of manganese.
- Sulphuret of antimony.
- Sulphuret of molybdena.
- Chromate of iron.
- Oxide of iron.
- Jenite.
- Black oxide of cobalt.
- Oxidulated uranium.
- Wolfram.
- Tantalite.
- Yttro-tantalite.
- Black oxide of cerium.

Class IV.—*Containing substances which acquire resinous electricity by friction. The insulating property is limited to the very transparent varieties.*

- Ruby silver.
- Sulphuret of mercury.
- Red copper ore.
- Oligist iron ore.
- Sulphuret of arsenic.
- Titanite.
- Anatase.
- Muriate of mercury.
- Chromate of lead.
- Phosphate of lead.
- Molybdate of lead.
- Green carbonate of copper.[1]
- Blue carbonate of copper.
- Arseniate of copper.
- Dioptase.
- Phosphate of copper.
- Hydrate of copper.
- Sulphate of copper.
- Phosphate of iron.
- Arseniate of iron.
- Sulphate of iron.
- Sulphuret of zinc.
- Red cobalt.
- Green oxide of uranium.
- White oxide of antimony.
- Red oxide of cerium.

As the causes which determine the production of positive or negative electricity by friction are wholly unknown, and require to be carefully investigated, we must warn the philosopher against the implicit adoption of all the preceding determinations. Different results have in many cases been obtained by different observers, and even by the same observer while using the same materials; and we could have greatly enlarged the first of the preceding tables had we inserted the opposite results of different philosophers. There are two points, however, which require to be attended to in such inquiries: 1*st*, There is a tendency to the production of negative electricity in the substance which has the least extent of surface; and, 2*dly*, there is a tendency to the production of an opposite electricity when the surface of the body is even minutely scratched.

Sect. IV.—*On Electrical Conduction.*

Electrical conduction.

It is obvious, from all the phenomena described in the preceding sections, that electricity is communicated from one body to another. The excited glass or wax communicate, as we have seen, their electricity to a pith ball; and the electricity of the machine is conveyed first to the prime conductor, and from that to the bells or other apparatus which have been already described. If we touch an electrified pith ball, or any other electrified body, with a rod of metal of any kind, the electricity of the pith ball will be instantly carried off; but if we touch it with glass or wax it will not be carried off. Hence metals are said to be *conductors*, and glass and wax *non-conductors*, of electricity.

Bodies vary greatly in the degree in which they conduct electricity; and many of them owe their conducting power to the water which they contain. The conducting power of any substance depends on the state of the atmosphere at the time with regard to humidity, and on the intensity of the electricity employed. The following tables of conductors and non-conductors have been collected from different authors. The bodies are placed in the order of their conducting or non-conducting power; but it is probable that this order would be greatly changed if the bodies were all submitted to a new and uniform examination.

List of Conductors.

- All metals.
- Silver.
- Copper.
- Lead.
- Gold.
- Brass.
- Zinc.
- Tin.
- Platina.
- Palladium.
- Iron heated.
- Iron cold.
- Charcoal well burned.
- Plumbago.
- Concentrated acids.
- Powdered charcoal.
- Diluted acids.
- Saline solutions.
- Metallic ores.
- Animal fluids.
- Hot water.
- Sea water.
- Spring water.
- River water.
- Ice above — 13° Fahr.
- Snow.
- Living vegetables.
- Living animals.
- Flame.
- Smoke.
- Steam.
- Soluble salts.
- Rarefied air.
- Vapour of alcohol.
- Vapour of ether.
- Moist earths.
- Anthracite.
- All the substances and minerals in the third class of Haüy's list, as given in Sect. II.
- Powdered glass.
- Flowers of sulphur.
- Resins rendered fluid by heat.
- Glass heated to redness.

List of Non-conductors.

- Shell-lac.
- Amber.
- Resins.
- Sulphur.
- Wax.
- Jet.
- Glass.
- Vitrifications.
- Mica,
- Diamond,
- Transparent gems,
- And all the minerals in Class I. of Haüy's list.
- Raw silk.
- Bleached silk.
- Dyed silk.
- Wool.
- Hair.
- Feathers.
- Dry paper.
- Parchment.
- Leather.
- Air and all dry gases.
- Baked wood.
- Dry vegetable bodies.
- Porcelain,
- Dry marble, and
- Siliceous and argillaceous stones in Class I. of Haüy's list.
- Camphor.
- Caoutchouc.
- Lycopodium.
- Dry chalk.
- Lime.
- Phosphorus.
- Ice below — 13° Fahr.
- Ashes of animal bodies.
- Ashes of vegetable bodies.
- Oils, the heaviest being the best conductors.
- Dry metallic oxides.

Insulato

The most perfect *non-conductors* of electricity are also called *insulators*, from their power of insulating an electrified body, or preventing any of its electricity from escaping along its support. It is to Coulomb that we owe the useful discovery that *shell-lac* is the most perfect of all insulators; and hence it is of great value in electrical inquiries. Coulomb found that the electricity of a pith ball five or six lines in diameter could be completely insulated by a cylinder of sealing-wax or gum-lac about half a line in diameter and eighteen or twenty lines long; that a very fine silk thread, penetrated and covered with melted wax so as to form a cylinder one fourth of a line in diameter, had the same insulating power when its length was five or six inches; and that an equal degree of insulation could not be obtained by a fine thread of glass five or six inches long, or by a hair or a fibre of silk, unless the electricity insulated was very weak, or the air very dry. Coulomb found also that the density of electricity insulated by a fibre of gum-lac was ten times as great as that which could be insulated by a silk fibre of the same length and diameter; and he established the following general law, *that the densities of electricity insulated by different lengths of fine cylindrical fibres, such as those of gum-lac, hair, silk, &c. vary as the square root of the lengths of the fibre.*

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[1] This salt has often the insulating property, and acquires vitreous electricity by friction.

In examining whether or not positive and negative electricity were conveyed with equal facility by conducting bodies, M. Erman found that there were some bodies which completely obstructed the passage of one kind of electricity, while they afforded a ready passage to the other. As this result, however, was obtained by weak galvanic electricity, the question is still open to examination in reference to ordinary electricity.

Although some bodies are said to be perfect non-conductors, yet this is not strictly true. A strong electrical charge can be made to pass through a thin film of the worst conductor. Dr Ritchie found that electricity permeated thin balls of blown glass; and though in one case he found that a small invisible aperture had been made in the glass, yet in other experiments he could not by any known method detect the smallest perforation.

It has been long known that imperfect conductors have their conducting power increased by heat; gases, charcoal, glass, ice, and resins when melted, are proofs of this. Dr Ritchie,[1] on the authority of some accurate experiments, is of opinion, that if the body be naturally a pretty good conductor, the ratio of its conducting power will not be so much increased by heat as in the case of a less perfect conductor. Marianini found this to be true with fluid conductors, and Dr Ritchie thinks that it is universally true.

It appears from some recent experiments made by Professor Delarive of Geneva, that the degree of conductibility of bodies for electricity *depends on the quantity of electricity which traverses them.* Hence it follows, that, of two conducting bodies, that which is the most perfect for an electric current of a given intensity, may be the worst conductor for either a stronger or a weaker current. The conducting powers of bodies, therefore, ought to be re-examined in reference to electric currents of different intensities; and when such experiments are made with accuracy, we may expect that they will lead to great improvements in our electrical apparatus.

Much light has been recently thrown on the conducting power of bodies by the researches of Dr Faraday, of which we have already given a general account in our history of electricity. He found that a great number of solid bodies which were incapable of conducting electricity of low tension, acquired by liquefaction or fusion the power of conducting it in a very high degree. The following is a list of the bodies which possessed this property:

Water.

Oxides. Potassa, protoxide of lead, glass of antimony, protoxide of antimony, oxide of bismuth.

Chlorides of potassium, sodium, barium, strontium, magnesium, manganese, zinc, copper (proto-), lead, tin (proto-), antimony, silver.

Iodides of potassium, zinc, and lead; protiodide of tin, periodide of mercury, fluoride of potassium, cyanide of potassium, sulpho-cyanide of potassium.

Salts. Chlorate of potassa; nitrates of potassa, soda, baryta, strontia, lead, copper, and silver; sulphates of soda and lead; proto-sulphate of mercury; phosphates of potassa, soda, lead, copper, phosphoric glass, or acid phosphate of lime; carbonates of potassa and soda, mingled and separate; borax, borate of lead, perborate of tin; chromate of potassa, bichromate of potassa; chromate of lead; acetate of potassa.

Sulphurets. Sulphuret of antimony, sulphuret of potassium made by reducing sulphate of potassa by hydrogen, ordinary sulphate of potassa.

Silicated potassa; chameleon mineral.

In those substances which soften before they liquefy, Dr Faraday found it highly interesting to watch the increase of conducting power as they approached to perfect fluidity. When borate of lead, for example, is heated by the lamp upon glass, it becomes as soft as treacle, without gaining the power of conduction; and it was only when brought to a fair red heat by the blowpipe that it conducted. When it was quite liquid, it conducted with extreme facility.

The following bodies were found by Dr Faraday to acquire no conducting power when they assumed the liquid state.

Sulphur.
Phosphorus.
Iodide of sulphur.
Periodide of tin.
Orpiment.
Realgar.
Glacial acetic acid.
Mixed margaric and oleic acids.
Artificial camphor.
Caffeine.
Sugar.
Adipocire.
Stearine of cocoa-nut oil.
Spermaceti.
Camphor.
Naphthaline.
Resin.
Gum sandarach
Shell-lac.
Perchloride of tin.
Chloride of arsenic.
Hydrated do.

Boracic acid and green bottle glass raised to the highest heat by an oxyhydrogen flame acquired no conducting power. Flint glass conducted a little when so heated.

When a solid becomes fluid it loses almost wholly its power of conducting heat, and gains in a high degree that of conducting electricity, and *vice versa;* and hence Dr Faraday concludes that there is a natural dependence between the two classes of facts.

Dr Faraday concludes his very interesting researches on this subject with the following summary of conditions of conduction in bodies, which, though they apply chiefly to Voltaic electricity, are yet true within certain limits for ordinary electricity.

Conditions of electrical conduction.

1. All bodies conduct electricity in the same manner from metals to lac and gases, but in different degrees.

2. Conducting power is in some bodies powerfully increased by heat, and in others diminished, yet without our perceiving any accompanying essential electrical difference, either in the bodies or in the changes occasioned by the electricity conducted.

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[1] *Philosophical Transactions*, 1828, p. 376.

3. A number of bodies insulating electricity of low intensity when solid, conduct it very freely when fluid, and are then decomposed by it.

4. There are many fluid bodies which do not sensibly conduct electricity of this low intensity; there are some which conduct it and are not decomposed, nor is fluidity essential to decomposition.

5. There is but one body yet discovered (periodide of mercury) which, insulating a Voltaic current when solid, and conducting it when fluid, is not decomposed in the latter case.

6. There is no strict electrical distinction of conductors which can as yet be drawn between bodies supposed to be elementary and those known to be compounds.

The experiments of Dr Faraday with ice, in which it appeared that electricity of exalted intensity passed through it, while it completely stopped Voltaic electricity, confirms the observations of M. Delarive on the relation between the conducting power and the quantity of electricity which traverses the conductor; and the phenomena seem to indicate that the electric fluid or matter may consist, like solar light, of different parts possessing different powers of conductibility and other properties, which may facilitate or obstruct their passage through solid, fluid, or gaseous bodies. An electric current, composed of different currents, may have some of its component currents entirely stopped by some bodies, while other currents are transmitted with the greatest facility, in the same way as certain rays both of light and heat are entirely absorbed by coloured bodies, while other rays are copiously transmitted. Non-conductors, like black bodies, stop every electrical current. Perfect conductors, like colourless transparent bodies, may transmit every electrical current, or absorb a small portion of all of them in an equal degree; while there may be imperfect conductors, which, like coloured bodies, stop some currents and transmit others. If this should prove correct, two bodies which, when used separately, conduct electricity, would be insulators when joined so as to transmit the electricity in succession, in the same manner as two transparent coloured bodies which separately transmit light copiously, are opaque when combined, the light which each transmits being absorbed by the other.

Distance to which electricity has been conducted.

We have already seen that electricity was conveyed through a distance of four miles. On the ground that these experiments were made imperfectly, and that an electric charge will prefer a short passage through air to a passage of twenty or thirty feet through thin wire, Mr Singers has expressed his conviction that the results of the experiments referred to are incorrect. We are unable, we confess, to appreciate the reasons on which this opinion is founded; but, even if they have any force, the original fact has been more than confirmed by Mr F. Ronalds, who erected at Hammersmith an electrical telegraph, on which the inflections of the wire composed *one continuous length of more than* EIGHT *miles.* "When a Canton's pith ball electrometer was connected with each extremity of this wire, and it was charged by a Leyden jar, both electrometers appeared to diverge suddenly at the same moment; and when the wire was discharged by being touched with the hand, both electrometers appeared to collapse as suddenly. When any person took a shock through the whole length of wire, and the shock was compelled to pass also through two insulated inflammable air pistols, one connected with each extremity of the wire, *the shock and the explosion seemed to occur quite simultaneously.* But when the shock was compelled to pass through the gas pistols, and any one closed his eyes, it was *impossible* to distinguish more than one explosion, although both pistols were discharged. When people did not look at the pistols, and when I sometimes charged only one highly, and sometimes both lowly, they could never guess, except by mere chance, whether one or both were fired. *Thus, then, three of the senses, namely, sight, feeling, and hearing, seemed to receive absolute conviction of the instantaneous transmission of electrical signs through my pistols, my* EIGHT *miles of wire, and my own proper person.*"[1]

SECT. V.—*On the Electric Spark.*

Electr. spark.

Since the discovery of electric light by Otto Guericke and Dr Wall, the subject has attracted the particular attention of philosophers. In exciting a glass tube, or in working an electrical machine in the dark, sparks and streams of light are distinctly visible; but the phenomenon is best seen when the knuckle or a brass ball is brought near to an electrified conductor. A bright light, called the *electric* spark, passes from the conductor to the knuckle or ball, and exhibits a great variety of phenomena, varying with the nature and intensity of the electricity, and with the form, magnitude, distance, and nature of the bodies between which it passes.

Form the sp

Pl. CC

Fig. 6, 8.

Exp. 1. Having screwed into the prime conductor a brass ball about two inches in diameter, and projecting about three inches, electrify the conductor positively, and hold another ball near the first. Long ramified zigzag sparks will pass between the two balls, as shown in fig. 6, where *pos.* is the *positively* electrified ball, and *nat.* the one held in the hand in a natural state of electricity. If the ball on the conductor is very small, the spark will become a faint divided brush of light. If the ball on the conductor is electrified negatively, the spark will be as shown in fig. 7, clear, straight, and more luminous. If one of the balls is *positively*, and the other *negatively* electrified, the forms shown in fig. 6 and 7 will be combined, as in fig. 8. When, in this last experiment, the distance of the balls is not too great, the positive zigzag spark will strike the negative straight spark about one third of the length of the latter from its point, the other two thirds becoming very luminous. Sometimes the positive spark strikes the negative ball at a distance from the negative spark.

Fig. 9

Exp. 2. If two conductors PM, fig. 9, three fourths of an inch in diameter, and having spherical ends, are placed parallel to each other, at the distance of two inches, so as to have their ends pointing in different directions six or eight inches asunder; then, if P is positively electrified, its spark will strike the other conductor M in its natural state, as in fig. 9. If M is electrified negatively, and P connected with the earth, the conductor M will send the negative spark to P, as in fig. 10; and if the conductors have opposite electricities, the positive spark will appear at one end, and the negative at the other, as shown in fig. 11.

Fig. 1

Exp. 3. Upon the brass stem *bc*, fig. 12, having a fine point at *c*, place a brass ball A, about three inches radius, so that the point *c* can be protruded to any distance beyond the ball, or be drawn within it, as shown in the figure. In this last state the point produces no effect, and the zigzag spark appears between the balls.

In proportion, however, as the point is protruded, its transmitting power is increased, and it may be made to have the same effect as any ball, from the smallest size to one three inches radius. When the point projects to a particular distance, it acts as if no ball were present.

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[1] *Description of an Electrical Telegraph, &c.* p. 4. Lond. 1823.

Phome- n nd ws.

Exp. 4. Hold an insulated sheet of paper at a small distance from a *positively* electrified conductor, and a beautiful star with distinct radiations will be thrown upon the paper. If the conductor is *negatively* electrical, a cone of rays, with its base on the paper and its apex on the conductor, will replace the star.

Exp. 5. If the point of a needle is presented to a positively electrified conductor in the dark, the point will be illuminated with a star; but if the conductor is *negative*, the needle will exhibit a pencil or brush of light.

The following experiment illustrates the effect of distance on the spark.

In ence of tance on e sp

Exp. 6. Fix a sharp-pointed wire to the end of the prime conductor, and having electrified it positively, hold an uninsulated ball of metal very near the metallic point; a succession of small and *brilliantly white* sparks will pass between them. The white colour will tend to red as the distance of the ball and the point is increased, and at a certain distance the sharp explosions will cease, and a feeble violet light will diverge from the extremity of the point, covering with its base the nearest half of the sphere.

In ence of m on th park.

The influence of the form of the body upon the spark which it gives is considerable. Professor Hildebrand of Erlang found that an obtuse cone with an angle of 52° gave a much more luminous spark than one with an angle of 36°, and he found that the parabolic rounding of the summit, or slight inequalities of surface, are particularly advantageous in the production of a strong light. The influence of points on the spark has been already described.

In ence of b- st e on th park.

The nature of the body by which the spark is taken exercises also an influence upon its magnitude and its colour. Professor Hildebrand made some interesting experiments on this subject. The pieces of metal had a conical form, and of the same shape and size. When they were fixed in the same manner at the end of an insulated conductor, the sparks which they yielded differed much in extent. The following table exhibits the results of these experiments, the metals at the head giving the greatest sparks.

Regulus of antimony.
Gold.
Silver.
Brass.
Sulphuret of copper.
Tin.
Zinc.
Iron.
Lead.
Steel.
Tempered steel.

When the spark is *white* by taking it with a metallic body, it will under the same circumstances be *violet* if taken with the finger. If the spark is taken with ice or water, or a green plant, its light will be red; and if it is taken with an imperfect conductor, such as wood, the light will be emitted in faint red streams.

I ence o e me- d on t park;

P CX. F 13.

The medium through which the spark is transmitted exercises also a remarkable influence on its colour and form. A spark capable of passing through only half an inch in common air, will pervade six inches of the Torricellian vacuum. The apparatus used by Sir H. Davy for examining the influence of a vacuum, &c. is shown in fig. 13, where ABC is a bent glass tube, A the wire for communicating electricity, D the surface of quicksilver or fused tin for producing a vacuum, D the tube to be exhausted by the stop-cock C, after being filled by means of the same stop-cock when necessary with hydrogen, and EF the moveable tube connected with the air-pump. Sir H. Davy found, that in all cases when the mercurial vacuum was perfect, it was permeable to electricity, and rendered luminous either by the common spark or the charge of a Leyden jar. The intensity of these phenomena varied with the temperature. When the tube ABC was very hot, the electric light appeared on the vapour of the mercurial vacuum of a bright green colour, and of great density. As the temperature diminished it lost its vividness. At 20° below zero of Fahrenheit it was perceptible only in considerable darkness. When the minutest quantity of rare air was introduced into the mercurial vacuum, the colour of the electric light changed from *green* to *sea green*, and by increasing the quantity, to *blue* and *purple*. At a low temperature the vacuum became a much better conductor. A vacuum above fused tin exhibited nearly the same phenomena. At temperatures below zero the light was yellow, and of the palest phosphorescent kind, just visible in great darkness, and not increased by heat. When the vacuum was formed by pure olive oil, and by chloride of antimony, the electric light through the vapour of the chloride was more brilliant than that through the vapour of the oil; and in the last it was more brilliant than in the vapour of mercury at common temperatures. The light was of a *pure white* with the chloride, and of a *red* inclining to *purple* in the oil.

o f tem- P ture.

Phenomena and Laws.

Colours of the spark.

Upon rarefying the air five hundred times in a glass vessel a foot long and eight inches in diameter, Mr Smeaton made the vessel revolve rapidly on a lathe, at the same time exciting it with the palm of his hand. A large quantity of lambent flame appeared under his hand, *variegated with all the colours of the rainbow.* Though the light was steady, every part of it was continually changing colours.

In carbonic acid gas the light of the spark is white and brilliant, and in hydrogen gas it is red and faint. When the sparks are made to pass through balls of wood or ivory they are of a *crimson* colour. They are *yellow* when taken over powdered charcoal, *green* over the surface of silvered leather, and purple from imperfect conductors.

Experiments on electrical light.

The following experiments on the spark and electrical light are both instructive and entertaining.

Exp. 1. Cover a metallic wire with silk, and form it into a close flat spiral of not more than twenty-four revolutions, with the different coils in contact. When a considerable electric charge (of about two square feet of coated surface) is passed through it, a vivid light resembling that of an artificial fire-work will be seen, even in daylight, originating in the centre of the spires. M. Nobili considers this light as electro-magnetic light, on account of its relation to the magnetic state of the spiral, and as similar to the aurora borealis.

Exp. 2. Take a bound book covered with rich gilding, and, holding it in one hand, bring it near the prime conductor. The spark will immediately shoot along the gilding in sparks or streams of green light, and will exhibit the pattern in the dark, and enable the observers to read the gilt title of the book.

Pl. CCX. Fig. 14.

Exp. 3. In the preceding experiment the letters themselves were covered with a metallic film; but if we construct an apparatus like that in fig. 14, on which the word LIGHT is left blank in a continuous line of narrow tinfoil pasted upon glass, and forming seven parallel lines, and apply the ball B to an electrified prime conductor, the word LIGHT will be seen in the dark in luminous letters formed by the electric spark passing from one piece of tinfoil to the opposite one. Figures of all kinds may in a similar manner be delineated electrically.

Luminous spirals. Fig. 15.

Exp. 4. Another beautiful experiment, called the *luminous spiral tubes*, is shown in fig. 15, where a number of round pieces of tinfoil are pasted spirally upon four glass tubes *a*, *b*, *c*, *d*, fixed on a board round a central rod of glass AB, supporting horizontally a wire *mn* with brass balls, and capable of turning round the pivot A. Electrify by sparks the wire at A, and pushing the wire *mn* gently round, the ball at the top of each tube will receive electricity from *a* or *b*, and a brilliant line of light will appear to surround each ball in succession, in consequence of the spark appearing between each of the small circles of tinfoil.

Luminous jar. Fig. 16.

Exp. 5. The *luminous jar* shown in fig. 16 is a still more beautiful experiment. In one which is now before us, fifty-five squares of tinfoil an inch square, and each perforated with a hole four tenths of an inch in diameter, are pasted in five rows on the outside and inside of a glass jar AB, fig. 16, about five inches in diameter and eleven inches high. The diagonals of the square pieces are placed horizontal and vertical, and their points or angles are separated by about one twelfth of an inch. The rows of the tinfoil squares are similarly placed on the inside of the jar, with this difference only, that their horizontal points nearly touch one another at the centres of the circular holes of the outer squares. The brass ball A communicates with the inside squares by a wire, and when it is charged by the prime conductor, a hundred and ten sparks will be seen at once in a horizontal, and a hundred and ten in a vertical direction, when the jar is discharged.

Exp. 6. Take a glass cylinder three inches wide and three feet long, so fitted up that a brass plate may be let down from the top of the cylinder, so as to stand at any distance from another brass plate fixed at the bottom of the cylinder. When the cylinder is exhausted of air in the usual manner, and the upper plate communicates with the prime conductor, and the lower one with the ground, a brilliant sheet of light will pass from the upper to the lower plate. If the distance of the plates is ten inches, and if the charge of a Leyden jar is made to pass from the one to the other, a continuous body of the most brilliant fire will pass between them.

Sect. VI.—*On the Nature and Origin of Electrical Light.*

Nature of electrical light. Wollaston.

Dr Wollaston seems to have been the first person who made any accurate examination of electric light, and the following is all that he has published as the result of his experiments. "When the object viewed is a *blue* line of electric light, I have found the spectrum to be also separated into several images; but the phenomena are somewhat different from the preceding (viz. the spectrum of the blue portion of the flame of a candle). It is, however, needless to describe minutely appearances which vary according to the brilliancy of the light, and which I cannot undertake to explain."[1] M. Biot, in speaking of electric light, remarks, "that if we look through a prism at the sparks which pass between two conductors oppositely electrified, we shall find all the colours which compose common light."[2]

Biot.

Fraunhofer.

M. Fraunhofer examined the electric spark in a more philosophical manner. In order to obtain a continuous line of electrical light, he brought to within half an inch of each other two conductors, and united them by a very fine glass thread. One of the two was connected with an electrical machine, and the other communicated with the ground. In this manner the light appeared to pass continuously along the fibre of glass, which consequently formed a fine and brilliant line of light. When this luminous line was expanded by refraction, Fraunhofer saw that, in relation to the lines of its spectrum, electric light was very different both from the light of the sun and from that of a lamp. In this spectrum he met with several lines partly very clear, and one of which in the green space seemed very brilliant compared with other parts of the spectrum. He saw in the orange another line not quite so bright, which appeared to be of the same colour as that in lamp-light spectra; but in measuring its angle of refraction he found that its light was much more strongly refracted, and nearly as much as the yellow rays of lamp light. In the red rays towards the extremity of the spectrum, he saw a line of very little brightness, and yet its light had the same degree of refrangibility as the clear line of lamp light. In the rest of the spectrum he saw other four lines sufficiently bright.[3] In a subsequent paper read at Munich in 1823, Fraunhofer observes, that by means of the large electrical machine in the cabinet of the Academy of Munich, he obtained a spectrum of electric light, in which he recognised a great number of light lines, and that he had determined the relative places of the lightest lines, and the ratios of their intensities. What these positions and ratios were we have no means of knowing, as we believe that this distinguished philosopher has not given them to the public.

Brews

The nature of electric light has been more recently examined by Sir David Brewster. He had long ago shown that the light of electricity was refracted singly and doubly, and polarised exactly like all other light; but his recent observations were made, like those of Fraunhofer, on the dark and luminous lines which appear in the spectrum formed from it by a prism. Fraunhofer examined the electric light produced in the manner he has described. In this *species* of electric light Sir David Brewster observed the lines described by Fraunhofer, and also its remarkable difference from that of the sun and a lamp in relation to the fixed lines of the spectrum. This difference he found to arise from the fact that certain *colorific* rays which exist in solar light do not exist in electrical light, though, in some parts of the spectrum, other rays of equal refrangibility are visible. The extreme red space, for example, is wanting, and, generally speaking, much of the red and yellow light. Hence the light of the electric spectrum is *green* at a line or point of a given refrangibility, where it is *yellow* in the solar spectrum. These facts confirm in a remarkable manner the discovery that the spectrum consists of three superimposed spectra of blue, yellow, and red light, of equal lengths,[4] and receive from that discovery a complete explanation.

Sir David Brewster examined electric light of various colours, and produced under different circumstances, and he found it to differ in its composition in a very remarkable manner, each variety of electric light varying in the number, intensity, and position of its bright and defective rays. One species of electric light is as different from another as the coloured lights produced in the flame of alcohol in which different saline substances have been dissolved. It would require almost the lifetime of an individual to examine and make drawings of this class of phenomena while the light passes from a violet, through blue, green, yellow, and red, up to white light. The bright lines which occur in the green space have a most singular appearance. They shine, in reference to the rest, with the metallic brilliancy of silver; and each successive spark, obtained under nearly the same circumstances, will often present to us these lines under different intensities and characters. In another part of this work we may be able to communicate the results of these experiments, which are now going on. In the mean time they furnish us with a most important fact relative to the theories which have been maintained concerning the cause or origin of electric light.

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[1] *Phil. Trans.* 1802.

[2] *Traité de Physique*, tom. ii. p. 459.

[3] Fraunhofer, *Bestimmung*, &c. 1814–15, p. 29.

[4] *Edinr. Trans.* vol. xii.

It has been the general opinion of philosophers that the electric spark was the electric fluid itself, or, as Biot expresses it, " a modification of electricity itself, which had the faculty of becoming light at a certain degree of accumulation." This eminent writer, however, considered this opinion as erroneous, and has devoted a whole chapter to prove that electric light has the same origin as the light disengaged from air by mechanical pressure, " *and that it is purely the effect of the compression produced on the air by the explosion of electricity.*" In order to establish this theory, M. Biot has stated, on the authority of several experiments, " that the intensity of electric light depends always on the ratio which exists between the quantity of electricity transmitted and the resistance of the medium; and he has shown, by an experiment with Kinnersley's air thermometer, " that at each spark the air of the cylinder, driven by the repulsive force, presses on the surface of mercury, which rises suddenly in the small tube, and falls back again immediately after the explosion." " This indication," he adds, " proves the separation produced between the particles of the mass of air where the electricity passes; and from what we know of its extreme velocity, it is certain that the particles exposed immediately to its shock ought in the first moment to sustain individually all the effect of the compression. They ought, then, from this cause alone to disengage light as when they are subjected to any other mechanical pressure. *Thus one part at least* of the electric light is *necessarily* due to this cause; and this being the case, there is no experiment which can lead us to conjecture that it is not all due to this cause."[1]

These arguments, whatever may be their weight, carry no conviction to our mind. When we possess two series of accurate experiments, by which it is proved that light produced by mechanical pressure in air and gases, of different bulks, and of different degrees of temperature, rarefaction, and condensation, has the same colour, the same composition, and the same general character, as the light produced by electricity in passing through air and gases under the very same circumstances, we shall regard this theory as deserving of consideration.

M. Biot, anticipating the objection that electrical light is produced in the best vacuum, replies, that a vacuum such as we can produce is filled with vapours and gas, and that the barometric one is filled with mercurial vapour. Still, however, the light produced is not produced by air, and it should be shown that mechanical pressure is capable of eliciting light in such a vacuum; at all events, the light ought to bear some proportion to the degree of rarefaction, whereas Sir H. Davy obtained a bright light in the best vacuum with mercury, and the same light in the best vacuum with melted tin.

Anticipating another objection from the fact that the electric spark, when intense, passes through water, M. Biot gives a double reply, 1*st*, that the water itself is probably compressible, and therefore, we presume, gives out light during its compression; and, 2*dly*, that water always contains in combination a certain quantity of air, which may also contribute to the result. It would be desirable, therefore, to ascertain if water, and water with much air, give out light by mechanical compression.

In explaining the fact that electrical light is *violet* when the electricity is *feeble*, and of a *brilliant whiteness* when it is produced by a violent discharge, M. Biot remarks that " this variation of tints discloses still further the origin of the light; for we observe it in substances which burn according as the combustion is slow or rapid; that is to say, according as the oxygen of the air which this combustion absorbs is more or less rapidly condensed. The light which sulphur disengages when it begins to inflame is as *violet* as that of feeble electricity, but that of sulphur in vigorous combustion is *white*." The views upon which this argument is founded are themselves hypothetical. It is by no means made out that the colour passes from *violet* to *white* as the intensity of combustion increases; and, in the very case of *sulphur* referred to by M. Biot, Sir John Herschel has proved, that when it is inflamed in a white hot crucible, it gives out neither *blue*, *green*, nor *red* rays, but solely *homogeneous yellow light*, of a very definite refrangibility, and which contains almost none of the elements of *white* light.

Sir H. Davy's theory.

A more philosophical view of the probable origin of electrical light has been hinted at by Sir Humphry Davy, in his paper of 1822, already quoted. " The circumstance," says he, " that the intensity of the electrical light in the mercurial vacuum diminishes as it is cooled to a certain point, when the vapour must be of infinitely small density, and is then stationary, seems strongly opposed to the idea that it (electrical light) is owing to any permanent vapour emitted constantly by the mercury. The results with tin must be regarded as more equivocal; because, as this substance cannot be boiled in vacuo, it may be always suspected to have emitted a small quantity of the rare air or gas to which it has been exposed; yet, supposing this circumstance, such gas must be at least as highly expanded as the vapour from cooled mercury, and can hardly be supposed capable of affording the *dense* light which the passage of the charged Leyden phial through the vacuum produces.

" When the intense heat produced by electricity is considered, and the strong attractive powers of differently electrified surfaces, and the rapidity of the changes of state, it does not seem at all improbable that the superficial particles of bodies, which, when detached by the repulsive power of heat, form vapour, may be likewise detached by electrical powers, and that they may produce luminous appearances in a vacuum, free from all other matter, by the annihilation of their opposite electrical state.

" In common cases of electrical action, the quantity of the heat generated by the annihilation of the different states depends upon the nature of the matter on which it acts; and in cases where electrical sparks are taken in fluids, vapour or gas is always generated; and in elastic fluids, the intensity of the light is always greater the denser the medium."[2]

Discoveries of Dr Fusinieri.

About the same time that Sir H. Davy was occupied with these researches, Dr Fusinieri was engaged in those beautiful experiments on electric light which have added so greatly to our knowledge of its nature and origin. The results of these experiments, which seem to have been commenced in 1821, were published in successive years. In 1825 there appeared, in the Journal of Pavia, a most interesting communication, of which the following is a brief abstract, relative to the transport of ponderable matter in the electrical discharges of ordinary machines; and, in 1831, another of equal importance on the transport of ponderable substances by lightning.

Dr Fusinieri has proved that the electric spark which issues from a *brass* conductor, and traverses air, contains brass in the state of fusion, and incandescent molecules of zinc.

When the spark issues from a globe of *silver*, it contains in its passage through air silver in fusion, and incandescent molecules of the same metal.

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[1] *Traité de Physique*, tom. ii. p. 463.

[2] *Phil. Trans.* 1822, p. 72-73.

If the spark which issues from silver traverses a plate of copper, the silver which it contains passes also through the copper in perforating it, and in traversing even a space of several centimeters, if the passage is oblique from the one surface to the other.

In this passage a portion of the transported silver is detained in the aperture which is made in the copper, and another portion follows the current, and penetrates the ball which receives the electric spark.

When the electric spark issues from a ball of *gold*, and passes into air, it contains gold in a state of fusion, and also incandescent molecules of gold.

If the spark from *gold* traverses a plate of *silver*, the gold contained in the spark traverses the plate in piercing it; and in traversing a space of several centimeters in the silver, if the direction of the passage is oblique, a part of the transported gold remains in the silver, and spreads itself over the two surfaces of the plate, and another part accompanies the electric current, and penetrates the ball which receives the spark. The gold spread over the polished surface of the silver appears in the form of a thin circular stratum upon the surface where it enters, and upon the surface where it leaves the plate. The very same result takes place if the spark passes from brass to silver.

These strata or metallic spots are so exceedingly thin, that after a certain time they are volatilized and disappear.

Dr Fusinieri also found that in each passage of the spark there was an opposite and reciprocal transport of the two metals. In a spark from silver to copper, part of the copper is transported to the silver, as well as the silver to the copper; and the same reciprocal transfer takes place in a spark from gold to silver.

Accompanying this reciprocal transport, there are two strong and opposite percussions produced by the transported metal, one at the point where it is detached, the other at the point where it enters the other metal. These two percussions show themselves, by two opposite cavities which contain the same metal, in such a state as to indicate fusion. Here the transported metal exerts two pressures in opposite directions.

In passing from one metal to another, the electric current leaves the first metal in the second, and takes with it a small quantity of the second.

The electric spark which issues from a metal into air contains a group of molecules, the most central of which are in a state of simple fusion, and the exterior ones are in a state of greater or less combustion, from their contact with oxygen, according as the metal is more or less oxidable; and the matter thus contained in the spark is endowed with a force of spontaneous expansion.[1]

From these highly interesting facts Dr Fusinieri draws the following important conclusions respecting the nature and origin of electric light. 1. The electric spark is not formed by a pure fluid, or by any imponderable fluid. 2. The heat and light of the spark proceed from the ignition and combustion of the particles of ponderable matter. 3. The presence of air produces on the spark two distinct effects, the one to hinder its free expansion in space, the other, by supplying oxygen, to promote the combustion of the exterior molecules of the group, while the central molecules are luminous from ignition and fusion alone. 4. In gases without oxygen, the material molecules which compose the spark ought to be simply in a state of incandescence and fusion, without any combustion of the exterior particles of the group, in the same manner as this takes place for the central parts of the spark in common air. 5. In gases deprived of oxygen, as well as in a vacuum, the molecules which compose the spark ought to be incandescent; that is, in a state which fits them to emit light and heat; a phenomenon of the same kind as those inflammations which chemical experiments prove to take place even without the aid of oxygen, in so great a number of other combinations, or even without there being any new combinations, by the sole effect of division of parts.

In a later memoir on the transport of ponderable substances by lightning, published in the *Ann. delle Scienze del Regno Lomb. Veneto* for 1831, Dr Fusinieri has shown, by a series of laborious and beautiful observations, that lightning leaves in houses and on trees traces of ferruginous and sulphureous substances which it contains; and he infers that iron exists in the clouds, having been attracted[2] from the earth, and principally from mountains, where the mines are more abundant, and where storms generally begin to form. Hence, as Dr Fusinieri supposes, we may connect this fact with meteoric stones, and with the magnetic currents which surround the globe. In our chapter on atmospheric electricity, we may probably find space for a further notice of Dr Fusinieri's researches.

That the electric spark *is a flame*, and consists, like all other flames, of incandescent molecules in a state of minute subdivision, will, we think, be now admitted by every philosopher; and it cannot fail to be observed how singularly this result harmonizes with the varied composition of electric light of different kinds and colours, as ascertained by Sir David Brewster by means of prismatic analysis;—and from the comparison which he is making between the composition of electric light consisting of different ponderable substances, and that of flames in which the same ponderable substances exist in a state of incandescence, there is reason to expect that these two widely separated classes of phenomena may be strictly identified.

SECT. VII.—*On the Law of Electrical Attraction and Repulsion, and the Attraction of Spheres and Planes.*

Law electr attrac and r sion.

It is obvious, from the simplest experiments, that the force of electrical attraction and repulsion diminishes with the distance. In the theories of Æpinus and Cavendish nothing more than this simple fact has been assumed. Newton had supposed that the forces of electricity and magnetism decreased with the cube, or some higher power, of the distance. Lord Stanhope inferred, from reasonings not very conclusive, that the law was the same as that of gravity; and Dr Robison, so early as 1769, ascertained, from more than a hundred experiments, that the repulsive force diminished according to a power of the distance whose exponent was 2·06, or very nearly as the square of the distance.

Coul torsic lance

Pl. C Fig.

The accurate determination, however, of the law of electrical attraction and repulsion was left to Coulomb. The apparatus which he employed for this purpose, and which is known by the name of the *torsion balance*, is represented in Plate CCXI. fig. 1, where ABCD is a glass cylinder, which is covered with a plate of glass AB thirteen inches in diameter. This plate is perforated with two holes *e* and *a*, the former being intended to receive a tube of glass *e*G two feet high, carrying on its upper end a torsion micrometer, consisting of a graduated circle MN, p ome- i and ws.

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[1] Dr Fusinieri likewise found that the electric spark obtained between the two poles of the Voltaic pile, terminated either by metals or charcoal, contains also particles of these substances extremely divided, and in a state of combustion.

[2] The iron may be carried off by the lightning which issues from the ground in cases where the clouds are negatively electrified.

an index M, and a pair of pincers, opened and shut by a ring, for holding a slender silver wire GH, whose lower end H is also grasped by a similar pair of pincers made of copper, and about a line in diameter. Through a hole in these copper pincers there passes a horizontal needle *cd*. This needle consists of a silk thread or a straw covered with sealing-wax, but the end of it, at *d*, about eighteen lines long, is a cylinder of gum-lac. It is terminated at *c* by a ball of the pith of elder about two or three lines in diameter, and at *d* by a vertical plane of paper covered with turpentine. A circular band of paper EF, divided into 360°, is pasted round the cylinder on a level with the needle, and at the hole *a* there is introduced a small cylinder *ab*, the lower end of which, made of gum-lac, carries another ball *b* of the pith of elder. The instrument is adjusted when a line passing through the centre of the silver wire GH at P passes also through the centres of the balls *b* and *c*, and points to the zero of the graduated circle EF.

L of the re lsive fo. F 2.

Having fixed a brass pin BC, fig. 2, with a large head B, into a handle of sealing-wax AC, and having electrified the ball B, Coulomb communicated electricity to the balls *b*, *c*. They accordingly repelled each other, and the needle *cd* turned round through a certain arch. By turning, however, the micrometer button in the direction NP, he twisted the wire GH, and caused it to return to its first position, and point to the zero of the scale. When this is done, the force of torsion has been made to balance the repulsive force of the two balls *b*, *c*; so that, by comparing the forces of torsion which balanced the repulsive forces at different distances of the balls, he obtained measures of the repulsive force at these distances. When the distances were 36°, 18°, and 8½°, he found the angle of torsion, or the force of torsion, which is proportional to the angle, to be 36°, 144°, and 575½°; that is, at *half* the distance the force is *four* times greater, and at a *fourth* of the distance the force is nearly *eight* times as great. Hence he concluded that *the repulsive force of two small globes charged either with positive or negative electricity is inversely as the squares of the distances of the centres of the globes.*

I of t attrac- t force.

In applying the same method to determine the law of the attractive force which takes place between two oppositely electrified bodies, M. Coulomb met with a difficulty, arising from the attractive force increasing in a greater ratio than the force of torsion. From this cause it was difficult to prevent the balls from coming into contact, and a delay was created, during which part of the electricity had escaped. By providing against this difficulty, he obtained results which led to the conclusion *that the attractive force of two small globes, one electrified positively and the other negatively, was in the inverse ratio of the squares of the distances of their centres.*

. 3.

In order, however, to confirm this result by an entirely different method, he employed the apparatus shown in fig. 3, where BC is a vertical stand of wood, carrying a horizontal arm of wood AB, divided into inches, upon which there slides another piece of wood ED, to which is suspended, by a fibre of silk *fe*, a horizontal needle of gum-lac *cd*, fifteen lines long, carrying at one end, and perpendicular to the needle, a circle of gilt paper *d*, seven lines in diameter, and at the other end a ball *c* of gum-lac. A globe of copper a foot in diameter, or a globe of paper covered with tinfoil, resting on four insulating cylinders of glass, coated with sealing-wax, is then placed upon a stand, so that it can be raised or depressed, and fixed in any position, so that its horizontal diameter passes through *dc*.

This apparatus is adjusted by placing the globe so that, when the moveable piece E is at *zero* of the scale on BA, the centre of the circle *d* may just touch the globe. When this is done, place the piece E at three inches on the scale, so that the distance of *d* from the globe will be three inches, and then the distance of *d* from the centre of the globe will be nine inches. Let the globe be now electrified by the spark of a Leyden jar; then, if a conductor is made to touch the plate *d*, the globe will communicate to it the opposite electricity upon removing the conductor, and the globe and the plate will attract one another. Cause the needle *cd* to oscillate through an arch of about 20° or 30° from the line where the force of torsion is nothing, and observe the time in which a given number of oscillations, suppose fifteen, is performed. Repeat the very same experiment when the piece E is placed at twelve and eighteen inches on the scale; that is, when the distances of the centres of the attracting bodies are eighteen and twenty-four inches. In doing this, Coulomb obtained the following results:

Distances of centres.	Number of oscillations.	Time in which they were performed.
9	15	20
18	15	40
24	15	60

As the oscillations in the preceding experiments are produced by the attraction of the globe and plate *d*, in the same manner as the oscillations of a pendulum are produced by the force of gravity; then, since the time in which a given number of oscillations is performed is inversely as the square root of the attractive force, and if we assume that the attractive force is inversely as the squares of the distances, or 9, 18, 24, or 3, 6, 8, then it will follow that the time of oscillation is proportional to these distances. These times will consequently be 20″, 41″, and 54″, if the attractive force is inversely as the square of the distance; but by experiment the times were 20″, 40″, and 60″. The difference is therefore almost nothing at 18 inches of distance, but it is nearly $\frac{1}{10}$th at 24 inches. Coulomb has applied a correction to the number 54″, in consequence of the loss of electricity by the two bodies during the four minutes which the experiment occupied. He found by experiment that the action was diminished $\frac{1}{40}$th of the whole per minute, and consequently $\frac{1}{10}$th of the whole in four minutes. Hence, $\sqrt{10} : \sqrt{9} = 60'' : 57''$, a result which now differs only $\frac{1}{20}$th from 60″, the time determined by experiment. Hence it follows, that by both methods of observation, the law of action is the same for attractive as it is for repulsive forces.

We are not aware that these experiments of Coulomb have been repeated and confirmed by other philosophers. Experiments with the torsion balance and contact plane are very difficult and precarious, and it is almost impossible to estimate with accuracy the loss of electricity in the two charged conductors during the performance of the experiment.

Experiments of Mr Snow Harris.

Under these circumstances, Mr Snow Harris of Plymouth has resumed the subject, and, by new methods of observation, and instruments of great accuracy, he has confirmed the law given by Coulomb, both in the case of simply electrified conductors, and in bodies upon which given quantities of electricity have been accumulated. A more particular account of these instruments, and of the method of applying them, will be given in a subsequent part of this article.

The law of the attractive force is easily obtained when the opposed surfaces are parallel planes or rings; but in the case of spherical conductors, and bodies of other forms, the conditions become more complicated. Considering the distribution of the electricity on the spheres to be uniform, and the whole force exerted to be as the number of attracting points directly, and as the squares of the distances between the respective points inversely, Mr Harris has shown that the *forces between two spheres will* *be inversely as the distances between their nearest points multiplied into the distances between their centres.*

Mr Harris's experiments on the attractions of spheres and planes.

In order to submit this result to the test of experiment, he used two spheres whose radius was an inch, and obtained, by means of his electrical balance, the following results:

Distance of Centres of Spheres.	Distance of nearest Points by experiment.	Calculated Distance of the Points in each Sphere in which the Force may be supposed to be collected.	Force in Grains.
2·2	0·2	0·664	12·0
2·5	0·5	1·117	4·25
2·8	0·8	1·496	2·25
3·0	1·0	1·732	1·75

These results confirm the law deduced from theory, and Mr Harris has established its truth more completely by extending it to several new cases, the most important of which, with the deductions, are as follows:

1. Two spheres at the distances in column 1, exert the same force as two circular planes of equal areas at the distances in column 3.

2. The attractive force of two opposed conductors is not influenced by the form or disposition of the unopposed portions. The attractive force, for example, is the same, whether the opposed bodies are merely circular planes, or planes backed by hemispheres or cones. Two hemispheres also attract each other with the same force as the spheres of which they are hemispheres.

3. The force between two opposed bodies is directly as the number of attracting points, the distance being the same. Thus two circular planes of unequal diameter do not attract each other with a greater force than that of two similar areas, each equal to the lesser. In like manner, the attractive force between a ring and a circular area of the same diameter is equal to that exerted between two similar rings each equal to the former.

4. The attractive force between a spherical segment and an opposed plane of the same curvature, is equal to that of two similar segments on each other.

SECT. VIII.—*On the Dissipation of Electricity by the Contact of Air, and by Imperfect Insulation.*

Dissipation of electricity by air.

If we place an electrified body upon a mass of gum-lac, which is the worst of all conductors, or the best insulator of electricity, we shall find that, in a certain time, the whole of its electricity has disappeared. In like manner, if we suspend the same body under the same circumstances by a long fibre, or very small cylinder of gum-lac, we shall also find that in this last case the electricity will wholly disappear in a certain time; but the time in this last case will be much longer than in the first case. If we perform the same experiments in rarefied, moist, or hot air, we shall find that the electricity disappears faster than in condensed, dry, and cold air.

In all these cases the electricity is said to be *dissipated;* and it becomes an interesting as well as a most useful inquiry to determine the separate influence of these different causes in carrying off the electricity of electrified bodies.

The only observations which we possess on this subject we owe to the ingenuity and industry of M. Coulomb.

By means of the torsion balance he determined, in four days, two in May, one in June, and the last in July, the ratio of the electric force lost per minute to the total mean electrical force of the body, the electrical density varying in the five or six experiments which were made in each day. The following were the results:

May 28. Ratio of the Force Lost.	May 29. Ratio of the Force Lost.	June 22. Ratio of the Force Lost.	July 2. Ratio of the Force Lost.
$\frac{1}{40}$	$\frac{1}{56}$	$\frac{1}{13\frac{1}{2}}$	$\frac{1}{14}$
$\frac{1}{38}$	$\frac{1}{61}$	$\frac{1}{11}$	$\frac{1}{19}$
$\frac{1}{42}$	$\frac{1}{54}$	$\frac{1}{13}$	$\frac{1}{30}$
	$\frac{1}{58}$		
$\frac{1}{42}$	$\frac{1}{54}$	$\frac{1}{13\frac{1}{2}}$	$\frac{1}{19}$
Mean, $\frac{1}{40\frac{1}{2}}$	$\frac{1}{56\frac{3}{5}}$	$\frac{1}{12\frac{3}{4}}$	$\frac{1}{20\frac{1}{2}}$

Hence, in reference to the state of the atmosphere on the days of observation, we have

	Mean Ratio of Force Lost per Minute.	Barometer Inches.	Thermometer of Reaumur.	Hygrometer of Saussure.
May 28.	$\frac{1}{40\frac{1}{2}}$	28·3	15½°	75°
May 29.	$\frac{1}{56\frac{3}{5}}$	28·4	15½	69
June 22.	$\frac{1}{12\frac{3}{4}}$	27·11	15¾	87
July 2.	$\frac{1}{20\frac{1}{2}}$	28·2	15¾	80

By examining the results for each day in the first of the preceding tables, it will appear that the ratio of the electric force to the whole force is a constant quantity during the same day, or when the air has the same degree of moisture. Hence it follows,

1st, *That the loss of electricity is proportional, in the same state of the air, to the electrical density;* from which it follows, as Coulomb has shown,

2d, *That the ratio of the force lost in a minute to the total force, is double of the ratio of the loss of intensity of each body to the total density.*

From a great number of experiments made with balls of different magnitudes, and when the quantity of electricity, as well as the electrical density of each ball, were very different, he found,

3d, *That the ratio of the dissipation of the electric force during a minute, to the total force, is uniformly a constant quantity.*

By using a globe a foot in diameter, cylinders of all lengths and magnitudes, circles of paper and of metal, &c. he found,

4th, *That when the air was dry, and the degree of electricity not great, the ratio of the decrease of the electrical density to the density itself is always a constant quantity, whatever be the form or the magnitude of the electrified body.*

By using *pith balls,* and balls of *copper* and *sealing-wax,* he found,

5th, *That the law of dissipation is not influenced by the nature of the body.*

It appears, from the second of the preceding tables, that the dissipation increases with the degree of moisture, as indicated by Saussure's hygrometer; and, by comparing the observations, he concluded,

6th, *That the diminution of the repulsive force, or, what is the same, of the electric density, is proportional to the cube of the weight of the quantity of water dissolved in a given quantity of air.* He found also, 7th, *That the dissipation of electricity increases with the temperature.*

In the course of these valuable researches Coulomb ascertained that there was no dissipation along the fibre which supported the electrified bodies which he employed; and he found also that there were other causes of dissipation, which produced effects of a considerable amount, and which yet remain to be discovered.

sipa- by erfect lation.

Having thus determined the laws of dissipation by the contact of air, Coulomb proceeded to inquire into the causes of dissipation along imperfectly insulating bodies. The experiments which he performed for this purpose were made on the same days with those made on the dissipation by air, so that he was able to determine by calculation the portion which was lost by aërial contact, and the portion lost by imperfect insulation.

When a highly electrified ball was suspended by a silk fibre, the dissipation of its electricity was much more rapid than it should have been by the contact of the air, and therefore a part of it was owing to the imperfect insulating power of the silk thread. But when the intensity of the electricity was diminished to a certain degree, the silk fibre was as good an insulator as the gum-lac. A cylinder of gum-lac eighteen lines long did not cease to insulate perfectly till the degree of electricity was nearly *triple* of that which is insulated by the silk fibre.

Coulomb likewise found, that when a silk thread, or hair, or any fine cylindrical electric, began to insulate perfectly, the electrical density of the body which was insulated was proportional to the square root of the length of the support; that is, if a silk fibre *one* foot long insulates perfectly when the electrical density is D, it will require a fibre *four* feet long to insulate perfectly when the electrical density is 2 D, or double.

M. Coulomb's experiments seem to have been made only with one kind of electricity. M. Biot, however, found that the dissipation was nearly the same, whether the insulated body was electrified negatively or positively.

Sect. IX.—*On the Distribution of Electricity.*

stribu- of tricity.

When any body is electrified by presenting it to the prime conductor, the electricity, though it enter at one part of the body, is obviously distributed over the whole of it, as every part of the body gives distinct indications of its new state. It becomes an interesting inquiry, therefore, to ascertain by what powers the electricity is thus distributed over the body; to determine whether it is distributed throughout the substance of the body, or only on its surface; and to discover the laws of its local distribution, whether it exists on single bodies, on two or more equal or unequal bodies placed in contact, and on bodies of different forms.

These various topics have been treated by Coulomb with that ingenuity and sagacity which distinguish all his labours; and his torsion balance is the principal apparatus which was found necessary.

In order to determine whether electricity was distributed over conductors by a repulsive force between the particles of the electric fluid, or by some affinity or electric attraction for one body in preference to another, he found, by using a pith ball and a ball of copper, that the pith ball received exactly one half of the electricity of the ball of copper, and that the ball of copper had no more affinity or electric attraction for the electric matter than the pith ball. This experiment was varied by using a disc or circle of iron ten lines in diameter, and a paper disc of the same size. In this case also he found that the electricity was equally distributed between the two discs; and he obtained the same result by using various other substances, and performing the experiments with a large torsion balance, with globes of five or six inches diameter.

In all experiments of this kind, the two balls must be allowed to remain a short time in contact, as several seconds elapse before an imperfectly insulating ball is capable of acquiring from the other half of its electricity. When the experiment is made with circular discs, the surface of the one must be placed symmetrically on the surface of the other.

Superficial distribution of electricity.

In order to determine whether the electricity pervaded the whole substance of the conductor, or was distributed on its surface, Coulomb provided an electrometer, consisting of a small circle of tinsel, suspended by a fibre of gum-lac, which, when suspended in a cylinder of glass, is so extremely sensible that a force equal to the *sixty thousandth* part of a grain was sufficient to repel the ball of the needle through an arch of more than ninety degrees.

The conductor whose electrical state he proposed to examine was a solid cylinder of wood four inches in diameter, and pierced with several holes four lines wide and four deep. This cylinder was then supported upon an insulating stand, and electrified by sparks from a Leyden jar. He then took a small circle of gilt paper one and a half line in diameter, and about the eighteenth part of a line in thickness, and he insulated it at the extremity of a cylinder of gum-lac a line in diameter.

Having electrified the tinsel of his electrometer, he brought the circle of gilt paper into contact with the surface of the electrified wooden cylinder, and upon presenting the circle to the electrometer it repelled the tinsel with great force. The same circle was then introduced into one of the holes of the cylinder, so as to come in contact with the bottom of the hole, and rest upon it. When it was taken out, without touching the sides of the hole, and presented to the electrometer, it gave no indications of electricity. In the first case, the small circle carried off electricity from the part of the surface which it touched; but in the second case it carried off none, so that there was no electric matter in the interior of the cylinder, even at the depth of four lines.

Pl. CCXI. Fig. 4.

These curious results, thus established by accurate observation, may be proved by two very pretty experiments, which have been given by Biot. Let S, fig. 4, be a spheroid of conducting matter, suspended by a perfectly insulating fibre A of gum-lac. Form two cups BC, made of gilt paper or tinfoil, or any other conducting material, so as to fit exactly the spheroid when united, and fix to each of them an insulating handle L, L of gum-lac. Electrify the spheroid S, and holding a cup in each hand by the handles L, L, apply them, as in the figure, to the surface of the spheroid. Upon withdrawing the cups, it will be found that they have abstracted from the spheroid S all its electricity, and that so completely, that it will not affect the most delicate electrometer, while the cups will be found to possess the same quantity of electricity which originally existed in the spheroid.

Fig. 5.

The other experiment of M. Biot is shown in fig. 5, where AB is an insulated cylinder, moveable round a horizontal axis, and which may be turned by the winch H, composed of several rods of glass. Around the cylinder there is wrapped a metallic ribband CD, whose extremity D terminates in a semicircle, and is attached to a silk cord F. This apparatus is made to communicate with an electroscope E, composed of two linen threads carrying two pith balls. When the metallic ribband is electrified, the balls and the threads will diverge. Upon unrolling the metallic ribband, by pulling the silk thread F, the pith balls at E collapse, and indicate a diminution of the electrical repulsion; and if the ribband be sufficiently long, compared with the electric charge given to the apparatus, the separation of the balls may become quite insensible; but they will again diverge, and indicate an increase of electrical intensity, if we again roll up the ribband upon the cylinder.

Method of measuring the distribution of electricity.

Having thus ascertained that electricity occupies the surfaces of conductors, the next point to determine is the law of its distribution in bodies of different forms, that is, to ascertain its intensity, or the electrical density, at different points of the surface.

Pl. CCXI. Fig. 6.

The following was the method used by Coulomb for this purpose: In the balance with which he made his first experiments he suspended his needle by a fine silver wire. He then took a cylinder of gum-lac, and having bent it as shown at *ced*, he attached to it a circle of gilt paper *d*, five or six lines in diameter, and the eighteenth part of a line thick. Having electrified the body whose electrical density was to be ascertained, he electrified the disc, carried by the needle by means of an insulated pin as formerly, and then touched the circle *d* with any part of the body where he wished to ascertain the electrical density. This circle was then placed in the balance, and the quantity of its electricity measured. Hence, as the quantity which the circle acquires by its tangential contact with the body is either the same as that of the point which it touches, or proportional to it, it became easy to ascertain the electrical density of different points of conductors, by touching those points with the circle *d*, and subsequently measuring its electricity. During the time, however, which elapses between different observations, a part of the electricity will be dissipated, so that an error is necessarily introduced in comparing the electrical density of any two points *a* and *b*. In order to correct this error, he proceeds thus: Having measured the electricity in *a*, he then, after an interval, suppose of three minutes, measures the electricity in *b*. He then remeasures the electricity in *a* three minutes after he measured the electricity of *b*, and the mean of these two measures for *a* will be the electrical density of *a* at the time when that of *b* was measured.

Distribution of electricity on a globe;

By the method now described Coulomb measured the distribution of electricity on a conducting sphere, and he found that the electrical density was the same on every part of it.

on the surface of a cylinder.

In a similar manner Coulomb found that the electrical density on the middle of the cylinder is to that of its extremity as 1·00 is to 2·30; that the density of the middle was to that of a point two inches from the extremity, as 1·00 to 1·25; and that the density in the middle was to that of a point situated in the hemisphere which terminated the cylinder, and one inch from its extremity, as 1·00 to 1·80. Hence it appears that the electricity is very much condensed upon the two last inches at the extremity of the cylinder, and that it varies very slightly from the middle to within two inches of the extremity.

Relative electrical densities of two globes in contact.

From various experiments, conducted in a way analogous to that already described, Coulomb obtained the following results relative to the manner in which the electrical fluid distributes itself between two globes A, B, of different diameters, after they have been placed in contact, and separated, so that the electricity is distributed uniformly over their surfaces.

Ratio of the Radii of the Globes.			Ratio of the Surfaces of the Globes.			Ratio of Electrical Densities.		
A		B	A		B	A		B
1	to	1	1	to	1	1	to	1
1	...	2	1	...	4	1·08	...	1
1	...	4	1	...	16	1·30	...	1
1	...	8	I	...	64	1·65	...	1
1	...	Infinity.	1	...	Infinity.	2·00	...	1

In order to explain this table, we shall take the case of two globes 6¼ inches and 24 inches, which were actually used by Coulomb. The small globe of 6¼ inches having been electrified, it was touched with the other globe of 24 inches, and when they were separated, so that the electricity of each was uniformly diffused over their surfaces, it was found that the *quantity* of electricity possessed by the large globe was to that possessed by the small one as 11·1 to 1; but as the surfaces of the two globes are as 14·8 to 1, a greater ratio than the other, it follows that the two globes are not charged with electricity in a ratio as great as that of their surfaces; that is, a given area on the small globe contains a greater quantity of electricity, or has a greater electrical density, than the same area in the large globe. The electrical densities in the third column are therefore found by dividing the ratio of their surfaces by the ratio of the quantities of fluid which they contain, and the quotients will be the ratio of the densities given in the third column. Thus, in the present case, 14·8 ÷ 11·1 = 1·3333, the electrical density of the small globe 6¼ inches in diameter, that of the large one of 24 inches being 1.

Two eq globes.

Such is the electrical state of two electrified globes when placed at a distance. It now becomes a curious point to ascertain how the electricity is distributed when one or more equal or unequal globes are in contact. When two equal globes are in contact, the thickness of the stratum of electricity, if it varies in thickness, or the electrical density, if it is equally thick, is nothing at the point of contact, but increases from the point of contact equally in different azimuths to the opposite point of the globes, where it is a maximum. This law of increase varies with the ratio of the diameters of the globe.

Two un equal globes.

In the case of two equal globes, the electrical densities at different distances from the point of contact were as follows:

Distances from the Point of Contact.	Ratio of Electrical Densities.
0°	0
20	0
30	1
60	3·72
90	4·78
180	5·03

When two unequal globes are in contact, the one being *twice* the size of the other, the density of the small globe was almost nothing at 30°. From 60° to 90° it increased in the ratio of 10 to 17, and from 90° to 180° in the ratio of 75 to 100.

When the one globe was *four* times the size of the other, the density of the *small one* was nothing up to 30°, from 30° to 45° it rose to 1, at 90° it was 4, and at 180° it was 5·72. The density of the *large globe* was nothing to the fourth or fifth degree from contact. From this point it increased rapidly, and from 30° to 180° it was almost uniform.

If we separate the two unequal globes, a curious phenomenon takes place. At a certain distance, which is not great, the point of the little globe which was in contact with the larger globe, and which had no electricity, now shows *negative* electricity till they are farther separated. At a certain distance the electricity becomes again nothing, and at a greater distance the same point becomes *positive*.

When the large globe is eleven inches in diameter, and the small one eight, and both positively electrified, the point of the large globe which touched the small one is always positively electrified, whatever be the distance of the two. The similar point of the small globe, however, will be negatively electrified till the distance of the two is *one* inch, at which distance the electricity becomes nothing, and beyond it it becomes positive. If the small globe is only four inches in diameter, the same phenomena take place, but at the distance of two inches and five lines.

veral nal bes.

When *six* equal globes, two inches in diameter, were placed in one line in contact, and electrified, and then examined by the torsion balance, Coulomb found that the electrical density of the *first* was to that of the second as 148 to 100, and that of the *first* to that of the *third* as 156 to 100. When twelve similar globes were similarly placed, the density of the *first* was to that of the *second* as 150 to 100, and that of the *first* to that of the *sixth* as 170 to 100. When twenty-four similar globes were similarly placed, the electric density of the *first* was to that of the *second* as 156 to 100, and to that of the *twelfth* as 175 to 100. At equal distances from the extremities of the row the electric densities were equal, and the density always least in the middle.

The last series of Coulomb's experiments which we shall notice at present, are the highly important ones relative to the distribution of electricity between a globe and cylinder. When the globe was *eight* inches in diameter, and the cylinder thirty inches long, he obtained the following results:—

Diameter of Cylinder.	Mean Electric Density of the Globe to that of the Cylinder.
24 lines	1 to 1·30
12	1 — 2·00
2	1 — 9·00

Hence the electrical densities of different cylinders are in the inverse ratio of the power $\frac{4}{5}$ of their diameter, which approaches very much to unity when the diameter of the globe is very much greater than that of the cylinder.

When the globes are different, and the cylinders remain the same, the electric density of the cylinders will vary as the diameters of the globes, if their diameters are much greater than that of the cylinder. Hence, calling D the mean electric density of the globe, d that of the cylinder, R the radius of the globe, and r that of the cylinder, we have $d = \frac{m\mathrm{DR}}{r^{\frac{4}{5}}}$ or $d = \frac{m\mathrm{DR}}{r}$, when R is much greater than r. Coulomb found the constant co-efficient m to be $\frac{9}{48}$.

Sect. X.—*On the Action of Points, and on Electrical Rotations.*

ction of oints.

The influence of points in silently drawing off electricity from a conductor has already been mentioned, and also their influence in discharging electricity from any conducting body in which they are fixed. Both these effects are distinctly seen if a person insulates himself by standing on a stool with glass feet, placed near an electrified prime conductor. If he takes in his hand a rod of metal with a ball at one end and a sharp point at the other, and holds the point at a certain distance from the conductor, he will be able to electrify himself in consequence of drawing the electricity from the conductor, whereas if he holds the ball at the same distance, he will receive no electricity at all. On the contrary, if he connect himself with the prime conductor by a chain till he is charged with electricity, and then throws aside the chain, he will not be able to discharge the electricity quickly from his body by holding out the ball, whereas if he holds out the rod with the point, the electricity will be rapidly discharged from it, and will be seen streaming out from it in the dark.

The experiments contained in the preceding section afford a beautiful and satisfactory explanation of the action of points. We have already seen that the electricity communicated to a cylinder is so distributed that the electrical density of the extremity is 2·30, while that at the middle is 1; and that when the electrical density of a globe is 1, that of a cylinder two lines in diameter and thirty inches long is 9. But we may consider points as cylinders of small diameter and great length, and, following the result now mentioned, we shall find that the electrical density at the rounded extremity of a cylinder two lines in diameter will be $9 \times 2{\cdot}3 = 20{\cdot}7$, while that of the globe which the cylinder touches is only one. In order to make this plain, we have represented in fig. 7 a cylinder or rod AB, in which the ordinates of the curve McN represent the electrical density at different points of the cylinder, or the thickness of the stratum of electricity at these points. The ordinate *cd* being 1, the ordinates AM and BN will be 2·3. But it may be shown, from the law of repulsion, that the re-action of the electric fluid upon the adjacent air varies as the square of the thicknesses of the electric strata, or as the squares of the electric densities. Hence the squares of the ordinates *cd*, AM, or 1, and $2{\cdot}30 \times 2{\cdot}30 = 5{\cdot}27$, will represent the re-action at *d* and A, that is, the electric fluid will have five times the tendency to escape at A, from what it has at *d*.

Pl. CCXI. Fig. 7.

When the point A is connected with a ball B, as in fig. 8, the tendency of the electric fluid to escape at A will be seen from the ordinates of the curve BM, the ordinate at A being very great. We have already seen that the ordinate AM, or the electrical density at A, is 20·7 times as great as the electrical density at B. Hence $20{\cdot}7 \times 20{\cdot}7 = 428{\cdot}49$ will represent the tendency of the electricity to escape from A, the tendency to escape from B being only one. But this tendency to escape is resisted by the air; and as the amount of resistance varies with the density, moisture, and temperature of the air, there will obviously be some degree of electrical density which will overcome that resistance. This result experience completely confirms, for even in the common state of the air a very great quantity of electricity is not necessary to make its way from a pointed conductor.

Fig. 8.

This tendency of points to discharge their electricity against the resisting air, enables us to perform some beautiful electrical experiments, in which a motion of rotation is effected.

Electrical rotation. Fig. 9.

Exp. 1. If one, two, or any other number of wires are placed, as in fig. 9, so as to have beneath their centre of gravity A, a hollow cup, which rests on the top of an insulated stand AB; and if the points *m*, *o*, *n*, *p* of these wires are made short, and are turned in the same tangential direction; then, if we connect them with the prime conductor by a chain C, so as to electrify them, the electricity will issue from each point; and as it will be resisted by the air against which it presses, the arms will turn round in a direction opposite to that in which the electric fluid is discharged, in the very same manner as the rotatory motion is effected in Barker's mill. In the dark a stream of light will exhibit the discharge of the electricity, and when the velocity of rotation becomes sufficiently great, the four streams will form a beautiful circle of light.

Electrical orrery. Fig. 10.

Exp. 2. The *Electrical Orrery*, as it is called, is founded on the same principle. A spherical ball of metal S, fig. 10, representing the sun, has its inner concave surface supported on a pivot on the top of an insulated stand CD. From the ball S extends a wire SE, the turned-up extremity of which supports upon a pivot another ball E, which represents the earth, having a wire passing through it, and carrying at one end a small ball M, representing the moon, while the other end is bent into a sharp point *m*. A sharp point H is also fixed to the arm EF. If these balls are electrified as in the last experiment, by a chain A connecting them with the prime conductor, the discharge of electricity from the point H will give a rotatory motion to the arm CE and the earth E, while the electrical discharge from the point *m* will give a rotatory motion to the moon M round the earth E. In this manner the moon revolves round the earth, while the earth and moon are together carried round the sun.

Electrical bells.

Exp. 3. By the same principle a chime of bells may be rung in a more elegant manner than that which is exhibited in fig. 4, Plate CCIX. Five cross arms of wire are made to revolve upon the pivot A of an insulated stand AB, as shown in fig. 11, and each wire has its extremity pointed and turned in the same direction. To one of these arms C, which is purposely made longer than the rest, is suspended a glass ball or clapper *b*, by a silk thread *ab*, and immediately behind it a rod CD. Eight bells are placed upon the stand, and if a chain connects the point A with the prime conductor, the discharge of the electricity from the points will move the cross arms round, and cause the clapper *b* to ring the bells during its revolutions.

Fig. 11.

Electrical inclined plane.
Fig. 12.

Exp. 4. The electrical inclined plane, shown in fig. 12, acts upon the same principle. Two straight parallel wires, MO, NP, are stretched upon the insulating stands M, N, O, P, fixed on a base of wood. Across these wires is placed a wire *ab*, having another wire *cd* at right angles to it, terminated by two bent points lying in a plane passing through *cd*, and at right angles to *ab*. When the apparatus is electrified by a chain, the electricity is discharged at the points *a*, *b* in a vertical plane, the wires revolve, and the wire *cd* rolls up the inclined plane, in opposition to the force of gravity.

SECT. XI.—*Explanation of the Phenomena of Electrical Attraction and Repulsion.*

Electrical attraction and repulsion.

In order to explain the phenomena of attraction and repulsion which have been already described, we must avail ourselves of several principles which have been either previously deduced from experiment, or which may be readily proved.

1. The electric fluid has a tendency to escape from all electrified bodies, whether conductors or non-conductors, in consequence of the mutual repulsion of its particles.

2. The electric fluid is prevented from escaping from bodies so rapidly as it would otherwise do, by the pressure of the air with which they are surrounded, and which is itself a bad conductor of electricity.

3. If the pressure of the air is increased, the escape of the electricity is diminished; and if the pressure of the air is diminished, the escape of the electricity is increased.

4. In *conductors* the electric fluid passes with the utmost facility and rapidity among the material particles, and does not seem to be in any way acted upon by them.

5. In *non-conductors* the electric fluid escapes from them, and moves among their material particles with difficulty; so that there is some force by which the electric fluid adheres to or is detained by the material particles of non-conducting bodies.

With the aid of these principles, we are now able to explain the three different cases of electrical attraction and repulsion.

Pl. CCXI.
Fig. 13.

1. *When the two bodies are non-conductors.* Let A be a fixed electrified non-conducting body, and B another of the same kind capable of moving. The particles of the electric fluid in A will repel each other; but this repulsive force cannot produce any motion on the centre of gravity of the ball, as their united tendency is to produce rest. The same is true of the repulsive force of the electric fluid in B. Let us suppose that A and B are both electrified *positively*, or both *negatively*, then the repulsion between the electric fluid in A, and that in B, will cause B to recede from A, because the electric fluid in B adhering as it were to the particles of B, cannot recede from A without taking the body along with it. In like manner, if A is *positive* and B *negative*, or *vice versa*, the attraction of the positive electric fluid for the negative electric fluid will cause the electric fluid in the moveable body B to approach to that in A, and, by its bringing the material particles along with it, will produce the phenomena of attraction.

Hence it follows that the attractions and repulsions of non-conducting bodies are produced by the attractions and repulsions of the electric fluid, which, from its adhesion to their matter, causes them to partake in its motion.

Fig. 1
15.

2. *When the one body is a non-conductor, and the other a conductor.* Let A, fig. 14 and 15, be a fixed and *non-conducting* body, and B a moveable and conducting body. When these two spheres are separate, the electric fluid is distributed on the surface of each in a stratum or thin shell of equal thickness; but when they are brought near each other, the fluid is distributed as in fig. 14, when A and B are *oppositely* electrified, and as in fig. 15, when they are *similarly* electrified; the space between the dark circles and the dotted outlines representing the section of the stratum of electrified fluid upon each sphere. The arrangement of the fluid in fig. 14 is produced by the attraction of the fluid in A for the fluid in B, and *vice versa*, producing an accumulation of it on each sphere on the sides nearest one another; and the arrangement of the fluid in fig. 15 is produced by the repulsion of the two opposite fluids, producing an abstraction of the fluid from the sides nearest one another, and an accumulation of it on the sides farthest from each other. But since the non-conducting sphere A is fixed, the adhesion of its fluid to its material particles cannot produce any motion; and since there is no adhesion between the fluid in the conductor B and its material particles, these particles, or the body which they compose, cannot move along with the fluid. The accumulated fluid, however, at the points O, O, fig. 14 and 15, tends to escape from the spheres in virtue of the mutual repulsion of its own particles; but it is restrained by the pressure of the air, which re-acts upon it. But the pressure of the air is an uniform force on every part of the sphere; and as the force with which the electric fluid resists this uniform pressure is greatest at the sides O, O, the ball B, in fig. 14, will recede in virtue of this force from A; and the ball B, in fig. 15, will from the same cause approach to A. The *attraction*, therefore, of the two *opposite* fluids in fig. 14 produces, through the agency of the atmosphere, a *repulsion* of the moveable sphere; and the *repulsion* of the *similar* electric fluids in fig. 15 produces, through the same agency, an *attraction* of the moveable to the fixed sphere.

Hence it follows that the attractions and repulsions of two bodies, one a conductor and the other a non-conductor, are merely apparent, and are produced solely through the agency of the atmosphere.

3. *When the two bodies are conductors.* In this case the phenomena will be nearly the same as in the last; for, by making A a conductor, we have only removed the adhesion between its fluid and the particles of which the body is composed, a force which was not brought into play in case 2, owing to A being fixed.

henome-a and Laws.

In the preceding observations we have taken no notice of the decomposition of the natural electricities of the two bodies, as the reader is not yet prepared for this consideration. We have supposed one of the spheres to be fixed and the other moveable, merely to simplify our illustrations; but it is obvious that the same effects would have been produced, but only with different degrees of intensity, if the two spheres had been moveable.

In order to show that apparent attractions and repulsions may be produced by the mere resistance of the air, and without any mutual action between the particles of the two bodies which are attracted and repelled, M. Biot has employed a very happy illustration, on which we have ventured to make a slight improvement. Let B, fig. 16, be a glass globe filled with water, and suspended by a string A. Make a hole in two opposite points of it, C and D, from which the water can flow, and having closed them with wax, fill the globe with water. With a burning mirror M, whose focus is at C, condense the sun's rays RR, and melt the little plug of wax at C. The water will instantly rush out, and the globe B will move away from M as if it had been repelled by the mirror. Repeat the same experiment by placing the mirror at M′, N′, and throwing the sun's rays upon the opposite plug D by reflexion from the plain mirror *mn*. The plug D being melted, the water will flow out at D, and the globe B will approach to M, N, the mirror having appeared to repel the globe in the first case, and to attract it in the second, though the motion in both cases arises neither from attractive nor repulsive forces, but merely from an unbalanced pressure at D when the water flowed out at C, and an unbalanced pressure at C when the water was discharged at D.

g. 16.

SECT. XII.—*On Electrical Induction, or the Decomposition of the Combined Electricities by Actions at a distance.*

lectrical duction.

In the preceding sections we have considered the phenomena of electricity as produced by friction, and as communicated or transmitted by conductors to other bodies. But it has been found that electricity may be developed in bodies by the mere influence of an electrified body placed at a distance, and we shall now proceed to investigate the laws which regulate this interesting class of phenomena.

.CCXII. g. 1.

Let AB be a cylindrical conductor supported horizontally upon an insulating stand S, and having hemispherical ends at A and B. Suspend from the points A, B, C, D, E, F, similar pairs of pith balls attached to wires or linen threads, and, having insulated it carefully by the stand S, touch it with the finger in order to see that it contains no free electricity. Let an electrified sphere M be now brought near it, so that A, B, M are in the same straight line, and that no spark can pass from M to B. When this has been done, it will be observed that the pith balls diverge as in the figure, the divergency being a maximum at A and B, and equal at these points, becoming less at C and D, where it is also equal, and still less at E and F, where the equality of divergence still exists. Between E and F there will be found some neutral point where the pith balls exhibit no divergence, and this point will shift its position according to the distance of the electrified body M. If we now suspend an unelectrified pith ball by a silk thread, and bring it near to different parts of the cylindrical conductor, we shall find that it is attracted to it in all places except the neutral point between E and F.

From these experiments we are led to the important and curious result, that an *unelectrified body may be electrified by the influence of an electrified body acting upon it at a distance.* The electricity is in this case said to be *induced*, and the phenomenon is called *electrical induction.*

Phenomena and Laws.

If we now electrify the pith ball which was suspended by a silken thread, and bring it near to the cylinder AB, we shall find that it is *attracted* by one half of the cylinder from A, for example, to the neutral point between E and F, and *repelled* by the other half from B to the same neutral point.

From this experiment we infer that *the electricity on one half of the cylinder, from one extremity to the neutral point, is POSITIVE, while the electricity in the other half is NEGATIVE.*

Bring the electrified pith ball near the electrified body M, and it will be found that, if it was formerly repelled from B, it will be attracted by M, and *vice versa;* so that we conclude that *the electricity induced upon the half of the cylinder nearest the electrified body is always opposite to that of the electrified body.*

If we now measure the electricity of the body M, both before and after the preceding experiments, and make allowance for the dissipation of it through the agency of the adjacent air, we shall find that no part of its electricity has been communicated to the cylinder AB; and if, while the cylinder AB is electrified by the inductive influence of M, we either remove M to a distance, or discharge its electricity by touching it with the finger, the electricity of the cylinder AB will instantly disappear. In like manner, AB will recover its electrical state the moment that M is brought near it.

Hence it follows that *the positive and negative electricities developed in a conducting body by the presence of an electrified body are not communicated to it by that body, but have existed in a state of combination in the substance of the conductor, and have only been separated from their state of combination by the action of the electrified body.*

As the intensity of the *positive* electricity, as well as its quantity, is the same in one half of the conductor as that of the *negative* electricity is in the other half, and as there is no remaining or *free* electricity in the cylinder AB when the body M is withdrawn, it follows that the union or recombination of the two electricities has neutralized or saturated each other. But as the two united electricities have not been destroyed by their union, they exist in a new state, which is called the *natural electricity* of bodies. The electricity, therefore, which thus naturally resides in conductors, consists of equal quantities of *positive* and *negative* electricity, which neutralize each other's action, and are consequently incapable of producing any of the phenomena of *free* electricity, or of a portion of positive or negative electricity existing in a separate state.

With these explanations, we are now able to understand how the cylinder AB is electrified by the influence of the electrified body M. We have clearly proved, by direct experiment, that bodies similarly electrified repel each other, while bodies oppositely electrified attract each other; and we have shown in Section X. that this repulsion and attraction does not take place between the material particles of the bodies, but between their electricities, or the electric fluids which they respectively contain. Hence we may enunciate the law in the following manner: *Similar electricities repel each other, and dissimilar electricities attract each other.* Now when the sphere M, which we shall suppose to be electrified positively, is brought near the cylinder AB, in which the electricity exists in its natural or combined state, it will repel all the *positive* electricity, and attract all the negative electricity, overcoming the tendency which each has to diffuse itself in virtue of the mutual repulsion of its own particles, and the tendency which the two opposite electricities have to recombine by their mutual attraction. Hence all the *nega-*

tive electricity will be *attracted* to and occupy the half FB of the cylinder, and all the *positive* electricity will be *repelled*, and occupy the remoter half EA. If M is *negatively* electrified, the opposite effects will be produced. Let the body M be now withdrawn, the repulsive and attractive forces which it exercised upon the natural electricity of AB will cease, and the two electricities, separated by its action, will recombine by their mutual attraction, as well as by the mutual repulsion of the particles of each, and the cylinder AB will be restored to its natural state of electricity.

The principle of electrical induction which we have now illustrated enables us to give a satisfactory explanation of the phenomena of attraction which have been described in Section II. It was there shown that electrified bodies attracted light and unelectrified bodies that were brought near them; but it will now appear that these apparently unelectrified bodies were first electrified by induction, and, in consequence of the decomposition of their natural electricities, were attracted by the excited body. Thus, if M, Plate CCXII. fig. 1, is an electrified body placed in a perfect vacuum, and AB a small light body suspended near M, and capable of moving towards it, then AB will be so electrified by the influence of M, that the electricity of the same name as that of M will be accumulated in the half FB of the cylinder, and the other electricity in the half EA. But the electricity of M attracts that of BF more powerfully than it repels that of EA, and consequently the light body AB will be attracted to M in consequence of the previous decomposition of its native electricity. If this decomposition cannot be effected by M, or if it takes place with difficulty, the body AB will not be attracted, or will be attracted less readily. M. Biot has illustrated this position by the following simple experiment. Suspend by fine silk threads two small balls of equal dimensions, one of them being made of pure gum-lac, and the other of gum-lac either gilt on its surface or covered with a thin plate of tinfoil. When these two balls are placed beside each other, and at a small distance, bring near them an electrified tube of glass or sealing-wax, and it will be seen that the gilt ball will be more strongly and easily attracted than the other. The uncoated ball of lac will not begin to be attracted till after a certain time, when the decomposition of its natural electricity has been effected; and thus its electrical state will continue after the removal of the electrified body. The first ball, though gilt, acquires also in this manner a permanent electricity, because the gum of which it is composed is impregnated with the electricity developed at its surface, and both of them are in this respect assisted by the contact of the air, which, under the influence of the electrified body, tends especially to carry off from them the one of the two electricities, which is repelled by this body, while it has less effect upon the other, whose proper repulsive force is concealed by attraction. Hence, says M. Biot,[1] we observe in general, that insulated bodies which have for some time been under the influence of an electrified body, end in having an excess of electricity of a kind opposite to its own, and the effects of which are seen when they are withdrawn from the influence of that body.

Pl. CCXII. Fig. 1.

In examining the action of M upon AB, fig. 1, we supposed that no change took place in the electrical condition of M; but this is not the case, for the body AB, as soon as its natural electricity has been decomposed, begins to re-act upon M, through the agency of its separated electricities. These separated electricities not only tend by their attractive and repulsive forces to change the distribution of the free electricity which exists in M, but also to decompose its natural electricity, and thus to increase its free electricity by one of the two separated electricities. When this change has been effected upon the electrical state of M, its action upon AB will also change. It will decompose a new quantity of the natural electricity of AB, and distribute the positive and the negative electricities of which it is composed in the halves AE, BF; and these new portions will again re-act upon M, till a permanent equilibrium is effected among all the attractive and repulsive forces which are thus brought into play.

Supposing such an equilibrium to be established between the two bodies M and AB, we shall proceed to examine the phenomena which are produced by the introduction of a third body. For this purpose let AB represent the conducting cylinder, and M the electrified body, as in fig. 2. Let an insulated conducting body O, in its *natural state* of electricity, be now brought near AB, so as to touch it, and let us suppose that the electricity of M is *positive*, and consequently that the electricity in the half BE is *negative*, and that in AE *positive*. If we now remove the body O, and examine its electrical state, we shall find that it has acquired *positive* electricity, and we shall observe that the divergency of the pith balls at A has diminished, while their divergency at B has increased. If we again remove the cylinder AB from the influence of M, or remove M from it, we shall find that AB is charged with *negative* electricity. Previous to the contact of O with A, the *positive* electricity in AE repels the *negative* electricity in M, and attracts the *negative* electricity in BE. Hence it contributes by both these actions to weaken the attraction of the *positive* electricity in M for the *negative* electricity in BE, and its repulsion for the positive electricity in AE. But when, by the contact of the third conductor O with the end A of AB, we withdraw a portion of the positive electricity in AE, we at the same time increase the attraction between M and BE, and the repulsion between M and AE, by diminishing the force by which that attraction and repulsion were weakened. Hence the increased action of M will decompose an additional portion of the natural electricity of AB, drawing the *negative* part of it to EB, and repelling the *positive* part of it to AE. The electricity, therefore, which is accumulated at B or in EB is greater than that accumulated at A or in EA, because the third conductor O has taken away a part of the positive electricity in AE. Hence, when we remove AB from the influence of M, so as to allow its separated electricities to re-combine, there is an excess of negative electricity, with which of course AB will be found charged. It is therefore obvious that the divergency of the balls should be greater at B than at A, as was found to be the case from the excess of *negative* electricity which existed at B while the cylinder was under the influence of M.

Pl. CC I. Fig. 2.

In the experiment, as above described, the third conductor O was insulated, and could therefore carry off only a portion of the positive electricity in AE, corresponding to its size: but if we use a conductor which communicates with the ground, the whole of the free electricity in AE will escape; the pith balls at A will exhibit no divergency, while those at B will diverge still more than they did formerly; and this divergency will suffer no diminution by again touching the end A with the insulated conductor. If the conductor AB is now removed out of the influence of M, the divergency of the balls at B will be still further augmented. The cause of these phenomena is very obvienome-na and Laws.

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[1] *Traité de Physique*, tom. ii. p. 233-4.

ous. When all the positive electricity in AE has escaped into the earth, it no longer counteracts the action of M upon BE, so that this action is augmented; and the consequence of this is, that M decomposes a fresh portion of the natural electricity of AB, the positive part of which passes off, by the mutual repulsion of its own particles, into the earth, while the resinous part is collected in BF, and increases the divergency of the balls at B. Hence, when AB is removed from the influence of M, the excess of *negative* electricity will be greater than previously, and the divergency of the balls at B will increase conformably with observation. The very same phenomena will be observed if the body M is charged with *negative* electricity, and may be described in the very same words by changing only the terms *positive* for *negative* and *negative* for *positive*.

CHAP. II.—ON THE ELECTRICITY PRODUCED BY HEAT, PRESSURE, AND SEPARATION OF PARTS.

In the preceding chapter we have given a general and popular view of the phenomena of electricity, and we have explained the remarkable phenomena of electrical induction. In our experiments and observations on these subjects we have made use of the electricity which is generated by the friction of tubes of glass or sticks of sealing-wax, or which is obtained from the common electrical machine. But electricity can be obtained from various other sources, and its properties are the same, from whatever source it is obtained, provided it is used in the same quantities and of the same intensity.

As there is no part of the science more interesting to the general reader than that which relates to the different modes in which electricity can be obtained from organized and unorganized bodies, we shall enter fully into this branch of the subject, and shall treat, in successive chapters, of the electricity produced by heat and pressure, by change of form and separation of parts, by animal bodies, and by the elements of our atmosphere.

SECT. I.—*On Pyro-electricity, or the Electricity produced in Minerals by Heat.*

ro-elec-city.

In our history of the science we have already given a general view of the progress of discovery in this interesting branch of electricity. We shall now, therefore, proceed to describe the phenomena which are developed by heat in various minerals and artificial salts.

1. *On the Pyro-electricity of Tourmaline.*

urma-e.

The tourmaline is a very common mineral, which crystallizes in long slender prisms. Its primitive form is an obtuse rhomb, the axis of which coincides with the axis of the prism. It has also one negative axis of double refraction, which is coincident with the axis of the rhomb; and it possesses some remarkable properties in reference to the absorption of common and polarized light, which will be described in another article. This mineral acquires *vitreous* electricity by friction; and when two tourmalines are rubbed together, the one acquires *vitreous* and the other *resinous* electricity.

In order to observe the electricity which heat develops in certain minerals, we have found it convenient to use the thin internal membrane of the *Arundo Phragmites*, which was cut with a sharp instrument into the smallest pieces, or, what is still better, the thin transparent scales which cover the buds of several plants of the genus *Pinus*, and which are pushed off at the expansion of the bud in spring. These minute fragments are well dried, and the pyro-electricity of any mineral is determined by its power of lifting one or more of these light bodies after the mineral has been exposed to heat. When we wish, however, to determine the kind of electricity which is developed in any pole of a mineral, we must employ a small instrument, called an electroscope, such as that used by Haüy, which is shown in Plate CCXII. fig. 3, where AB is a needle of silver or brass, terminated on one side by a globule B of the same metal, and on the opposite side by a small bar or narrow plate G of transparent Iceland spar, fixed to A by wax or any other means. This needle carries at its middle point D a cup of rock-crystal, by which it rests on a steel pivot at the upper end of the piece of wire D, fixed in a cylinder E of gum-lac or sealing-wax. A small weight G is made to move along the arm BD to balance the needle in a horizontal position. In order to prepare this little instrument for observation, take the lever by the end B, with the right hand, and with two of the fingers of the left hand press two of the opposite faces of the crystal G, and then place the lever upon its pivot D. Haüy calls this apparatus a *vitreous* or *positive* electroscope.

Phenomena and Laws.

Haüy's vitreous electroscope. Pl. CCXII. Fig. 3.

The *resinous* or *negative electroscope*, which is shown in Plate CCXII. fig. 4, differs from the preceding only in having a simple needle of silver or copper AB, with two globules A, B at its extremities, and having a cup C of the same metal. In order to prepare this electroscope for use, a stick of sealing-wax is rubbed with a piece of woollen cloth, and then made to touch one of the globules of the needle, which is immediately repelled.

Haüy's resinous electroscope. Fig. 4.

In order to determine the kind of electricity generated in any pole of a crystal by heat, we have only to apply it to either of these electroscopes. If it attracts the globule of the vitreous electroscope, or repels that of the resinous one, its electricity will be resinous; and if it repels the globule of the vitreous one, and attracts that of the resinous one, the electricity will be vitreous.

Haüy's general apparatus. Fig. 5.

Haüy used another apparatus in his experiments with tourmaline, which he considers preferable to all others. A rectangular plate of metal *hk*, bent up at right angles at its two ends *h*, *k*, is balanced on a steel needle *ab* by a cup of agate *x*, which is confined by a circle of silver and two screws *s*, *z*. Towards the extremities of the lower surface of the plate *hk* are fixed two silver wires *pi*, *uy*, having a slightly oblique direction, and terminated by two silver globules *i*, *y*. The use of these little balls is to lower the centre of gravity of the apparatus, so that the plate *hk* may always remain supported during its revolution on the pivot. Let us now suppose that we wish to determine the two kinds of electricity which exist in the poles of a tourmaline. Take one of the Spanish crystals, which is the best for the purpose, both from their thinness and their length, and having heated it either at the fire or at the flame of a spirit-lamp, by holding it in a pair of iron pincers with a wooden handle, place it at *mn*, as shown in fig. 5, in the two notches made on purpose in the bent-up pieces *h*, *k*; and having held near its poles in succession a stick of excited sealing-wax, that pole, *v*, will be the *vitreous* one which is attracted by the wax, and the other, *r*, the resinous one which will be repelled by it.

After measuring the intensity of the electricity in different points of the tourmaline, Haüy found that the electricity was distributed nearly in the same manner as in a cylindrical conductor electrified by induction. The *vitreous* electricity was a maximum near one extremity of the crystal, and gradually diminished towards the middle of the crystal, where it disappeared. Here the *resinous* electricity appeared very faintly, and gradually increased towards the other end of the crystal, near which it was a maximum.

If tourmaline, when rendered electrical by heat, is broken in pieces, each piece will have a vitreous and a resinous pole, whether it is broken from the vitreous or the resinous end, the extremity of the fragment always possessing the same kind of electricity as that of the pole to which it was nearest when it formed part of the crystal.

It had been early noticed that the tourmaline became electrical only at a particular temperature, and that its electricity disappeared at temperatures above and below that particular degree of heat. If we heat the tourmaline beyond this temperature, and allow it gradually to cool, it will soon arrive at that temperature (between 30° and 80° of Reaumur, 99° and 212° of Fahr. according to Æpinus) at which it exhibits its electrical properties. As the temperature falls, its electricity becomes progressively feebler, and finally disappears. Haüy, however, found that other changes take place as the cooling of the mineral increases. At a certain degree of coldness its electricity re-appeared, and gradually increased till it reached its maximum, when it again disappeared gradually. But, what was very interesting, the electricity was not the same as before; the pole which was formerly *vitreous* was now *resinous*![1] It is extremely probable that the same changes would continue to take place both above and below the temperatures at which these two opposite states were produced. Haüy caused the foci of two burning-glasses to fall upon the poles of a tourmaline, and he observed that, after each pole had acquired its electricity, it then ceased to act, and finally exhibited an electricity of an opposite kind.

Haüy has ingeniously explained the phenomenon of each fragment of a tourmaline having two different poles, like the crystal to which it belonged, by supposing that every integrant particle of a tourmaline is itself a little tourmaline with its two poles. "Hence it follows," says he, "that in the entire tourmaline there will be a series of poles alternately vitreous and resinous; and such are the quantities of free fluid which appertain to these different poles, that in all the half of the tourmaline yet unbroken, which manifest the vitreous electricity, the vitreous poles of the integrant molecules are superior in force to the resinous poles in contact with them; while the contrary obtains in the half which manifests the resinous electricity; whence it follows that the tourmaline is in the same state (speaking generally) as if each of its halves were only solicited by quantities of vitreous or resinous fluid equal to the differences between the fluids of the neighbouring poles. Now, if the stone be cut at any place whatever, as the section can only take place between two molecules, the part detached will necessarily commence with a pole of one kind, and terminate with a pole of a contrary nature."

Mr Sievright of Meggetland fitted up a tourmaline so as to bring the action of its two poles very near each other. It resembles the letter D with an opening in its round part, the straight line representing the tourmaline, and the two bent portions are pieces of silver wire rising out of two silver cups, one of which embraces each pole of the tourmaline. If a pith ball, or a ball of sola, is suspended between the two ends of the silver wires, it will vibrate in a beautiful manner, in virtue of their opposite actions. Æpinus, it appears, fitted up the tourmaline in a manner somewhat resembling that which has been described. Sir Humphry Davy has stated the curious fact, which we believe has never been verified by any subsequent observer, that "when the stone is of considerable size, flashes of light may be seen along its surface."[2]

On the Pyro-electricity of thin Plates of Tourmaline.

Pyro-ele tricity o thin pla of tourn line.

The electricity exhibited by ordinary crystals of tourmaline is very feeble; and though two good tourmalines, when floated in water upon corks, will approach and recede from each other when they are excited by a suitable temperature, yet these tourmalines are not capable of lifting one another, or of adhering to an unelectrified body, by decomposing the natural electricity of the part of it with which they are brought in contact.

Pl. CCX Fig. 6.

A method of increasing the electrical action of tourmaline, and of enabling one large piece to lift another, and even to adhere to other bodies, has been used by Sir David Brewster. He cut thin slices out of a large crystal of tourmaline so that they had parallel faces perpendicular to the axis of the original crystal, as represented in fig. 6, where VVVV is the vitreous face of the plate, corresponding to the vitreous pole of the crystal; and RRRR the resinous face; each of these faces being perpendicular to the edge VR of the prism, and consequently to the axis of the crystal. When the two faces of the plates thus formed are ground flat and well polished, one plate will readily lift another. If we place one of these plates upon a piece of flat plate glass, placed horizontally upon a table, the tourmaline will slip off the glass if the latter is slightly inclined to the horizon. But if the glass has been previously heated, the tourmaline plate will adhere to it; and by inverting the glass, the tourmaline will adhere to it even in that position, supporting its own weight by its attraction for the glass. The intensity of the electricity may be easily measured at different temperatures, by ascertaining the angle of inclination at which the weight of the tourmaline overcomes its adhesive force. The plate which exhibits this powerful action obviously consists of an infinite number of minute crystals of tourmaline, with vitreous and resinous poles; and as the point of maximum intensity is situated near the extremity of each crystal, all the vitreous poles will be situated in a plane near the vitreous surface VVVV, while all the resinous poles will be situated near the resinous surface RRRR. If a rectangular plate of the same size, like VVRR, fig. 7, is cut out of a crystal, so that its surfaces are parallel to the axis of the prism, it will adhere to the heated glass plate with much less force than in the preceding case. These plates of excited tourmaline adhere to all metallic bodies, to wax, and to all minerals that have been tried.[3]

If there was no mistake in the experiment by Sir H. Davy, described in a former paragraph, respecting the appearance of a flash of light in a mounted tourmaline, it will doubtless be best verified by mounting several plates of equal thickness, cut out of a broad tourmaline, placing them all in the same plane, and combining their effects in two wires. A powerful little pyro-electrical battery might thus be made, from which both a shock and a flash might be obtained.

Having found that the electricity of plates of tourmaline was more powerful than crystals of it, Sir David Brewster conceived the idea of examining its pyro-electricity, when its fragments were infinitely small, or when it was reduced to the finest powder or dust. The analogy of magnetic bodies led to the notion that the pyro-electricity would disappear, while the results obtained with short prisms in the form of plates strengthened the opposite opinion, that the pyro-electricity might even be increased by this process. He therefore "pounded a portion of a large opaque tourmaline in a steel mortar till it was reduced to the finest dust. I then placed the powder upon a plate of glass, from which it slipped off by inclining the glass, like all other hard powders, without exhibiting any symptoms of cohesion, either with the glass or with its own particles. When the glass was heated to the proper temperature, the powder stuck to the glass; and when stirred with any dry substance, it collected in masses, and adhered powerfully to the substances with which it was stirred. This viscidity, as it were, or disposition to form clotted masses, diminished with the heat, and at the ordinary temperature of the atmosphere it recovered its usual want of coherence."[1]

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[1] This inversion of the poles was discovered by Mr Canton.

[2] *Elements of Chemical Philosophy*, vol. i. p. 130.

[3] See *Edin. Phil. Journal*, 1819, vol. i. p. 205.

M. Becquerel has lately made some experiments on the pyro-electricity of the tourmaline. He found that when the crystal was of a certain length it became electrical both by heating and cooling; and that crystals of a greater length ceased to become electrical by heating. When the length of the crystal was eight centimeters, or three inches and one ninth of an inch long, they ceased to exhibit electricity either by heating or cooling. M. Becquerel remarks, that if this law is inversely true, that is, for very small lengths, *the atoms of the tourmaline ought to acquire a considerable electrical polarity by the smallest changes of temperature.*[2]

2. *On the Pyro-electricity of the Borate of Magnesia.*

ate of gnesia.

The electricity developed in boracite by heat is considerably less than that of the tourmaline. In 1791 the Abbé Haüy discovered the pyro-electricity of this mineral; but he found it extremely difficult to determine the vitreous and resinous poles. He naturally expected to find two opposite poles, as in the tourmaline; but a succession of attractions and repulsions which took place very rapidly perplexed him extremely. Considering, however, that the boracite was a cubical crystal with three axes, and the tourmaline a rhombohedral one with only one axis, he conceived that the former crystal has a vitreous pole at the one end of each axis, and a resinous pole at the other end. This conjecture he verified by experiment; and the poles were found to be so placed that each alternate pole possessed the opposite electricity: the experiments, however, which are necessary to establish this result require to be made with great care, particularly in reference to the repulsive actions, which take place only within a very limited space; so that, in order to obtain the repulsion of one of the resinous poles on a body which is itself in a resinous state of electricity, we must direct this body exactly to the repulsive point, otherwise it will be attracted towards the neighbouring points, which are in their natural state, or nearly so.

It is a curious fact in reference to the preceding results, that the boracite has been lately found by Sir David Brewster to possess distinct double refraction; and consequently it cannot, as he concludes, have the cube for its primitive form, or three axes of crystallization. He infers that its primitive form is a rhombohedron of ninety degrees, the form which separates the obtuse and acute rhombohedrons; and hence it is a most remarkable circumstance that its electrical poles should be arranged in the manner described by Haüy. We hope, however, to be able to reconcile these discordant results.

3. *On the Pyro-electricity of the Topaz.*

opaz.

The pyro-electricity of the Brazilian topaz was discovered by Mr Canton in 1760. The Abbé Haüy detected the same property in the topaz of Siberia, and found that the poles resided in the two opposite summits of the secondary form of the crystal. Haüy at first thought that the Saxon topazes did not possess pyro-electricity, although they often preserved excited electricity for more than half an hour when the weather was favourable. He afterwards found, however, that they became electrical by heat if previously insulated. Sir David Brewster found pyro-electricity in the greenish-blue topazes of Aberdeenshire.

Haüy observed that the Siberian topazes often preserve their pyro-electricity during several hours, and sometimes from *twenty* to *twenty-four* hours.

Among some topazes which Haüy received from M. Langsdorf, there was one which exhibited resinous electricity at both of its poles, and indications of vitreous electricity in the middle of the crystal. This effect was probably owing to one or more strata of cavities containing fluids, which may have interrupted the distribution of the electricity in the same manner as a fissure.

4. *On the Pyro-electricity of Mesotype.*

Mesotype.

Haüy discovered that some crystals only of this mineral were electrical by heat; but as he was not able to obtain complete crystals, he detached from its support one about five and a half lines long, and found the pyramidal summit to be resinously electrified. *Mem. Instit.* tom. i. p. 54–55. In the first edition of his mineralogy, however (vol. iii. p. 168), he states that the pyramidal summit exhibits *vitreous* electricity by heat, and the fractured end *resinous* electricity; but in the *second* edition of his mineralogy he has omitted altogether that passage, and said nothing whatever on the subject.

The mesotype of Haüy's first edition included the Auvergne mesotype, the apophyllite, the scolezite, and the nadelstein; and therefore it is difficult to say to which of these minerals his observations are applicable.

Sir David Brewster found distinct pyro-electricity in the mesotype of Auvergne.

5. *Pyro-electricity of the Scolezite.*

Scolezite.

The scolezite is a compound crystal, in which the faces of composition are parallel to the axis of the prism. Sir David Brewster found it to possess pyro-electricity, the pyramidal summit having vitreous, and the fractured end resinous electricity.

6. *Pyro-electricity of Mesolite.*

Mesolite.

The mesolite, which has been separated from the scolezite both by distinct chemical and optical characters, is distinguished still further by its being composed of four simple crystals, whose faces of composition are parallel to the axis of the prism, whereas the scolezite consists of two prisms separated by a thin film or vein. Sir David Brewster likewise observed the pyro-electricity of this mineral, and found that its crystallized summit possessed vitreous electricity, and its fractured end resinous electricity, when heated.

7. *On the Pyro-electricity of the Powders of Scolezite and Mesolite when deprived of their Water of Crystallization.*

In the experiments above recited on the powder of tourmaline, the mineral had suffered no other change by trituration than that of being reduced to minute fragments. It became interesting therefore to compare the pyro-electricity of such a powder with that of the powder of a pyro-electrical mineral, on which an essential chemical change had been induced. With this view Sir David Brewster reduced to powder the crystals of scolezite and mesolite, and by the application of heat drove off their water of crystallization, which is doubtless an essential ingredient in every mineral species. When the powder was exposed to a proper heat on a plate of glass, it adhered to it like the powder of tourmaline; and when stirred about by any substance whatever, it collected in masses like new-fallen snow, and adhered strongly to the body which was used to displace it. "This fact," says Sir David Brewster, "is a very instructive one, and could scarcely have been anticipated. As several minerals differ only in the quantity of their water of crystallization, the powder which was thus pyro-electrical could not be considered either as scolezite or mesolite, but as another substance not recognized in mineralogy. The pyro-electrical property, therefore, developed by the powder, cannot be regarded as a property of the minerals of which the powder formed a part, but merely as a property of some of their ingredients. In which of the ingredients, or in what combination of them, the pyro-electricity resides, may be easily determined by further experiments."

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[1] *Edin. Journal of Science*, October 1824, No. ii. p. 213.

[2] *Edinburgh Journal of Science*, 1828, No. xvi. p. 365.

8. *Pyro-electricity of Axinite.*

Axinite.

In his *Manual of the Mineralogist and the Geological Traveller*, M. Braard has stated that some crystals of this mineral become electric by heat. Haüy has confirmed this observation, but no accurate experiments on the position and electricity of its poles have been made.

9. *Pyro-electricity of Calamine.*

Calamine.

So early as 1785 M. Haüy discovered the pyro-electricity of this mineral, which being an oxide of zinc, is the more remarkable, as it is the only metallic body in which this property is very distinctly developed. Haüy found that every crystallized specimen which he tried was pyro-electrical, and that it acquired this property also by cooling. His first observations on the return of the electric action were made on the crystals of oxide of zinc from Limbourg, near Aix-la-Chapelle; and a portion of the acicular variety from the Brisgau. In the winter of 1819 he placed a crystal on a window where the temperature was 11 degrees Cent. below zero, and having left it there a few seconds, he found that it acted very sensibly on a magnetic needle not insulated. He next placed it in a room whose temperature was four degrees above zero, and he observed that its polar action progressively diminished and disappeared. He then brought it within a yard of a fire, and had the satisfaction of observing its polarity return, the pole which was formerly vitreous being now resinous.

10. *Pyro-electricity of Sphene.*

Sphene.

Haüy has found that some crystals of this mineral possess pyro-electricity, but he has not determined the position or nature of its poles.

11. *Pyro-electricity of Prehnite.*

Prehnite.

This mineral crystallizes in right rhomboidal prisms. Haüy found it to be pyro-electrical, and that its poles are in a direction corresponding with the smaller diagonal of the crystal.

12. *Pyro-electricity of other Minerals.*

Other minerals.

The property of becoming electrical by heat has been found by Sir David Brewster to exist in a great number of minerals; and he has given the following list of those in which he succeeded in detecting it:

Calcareous spar.
Beryl yellow.
Sulphate of barytes.
Sulphate of strontites.
Carbonate of lead.
Diopside.
Fluor spar red.
Fluor spar blue.
Diamond.
Yellow orpiment.
Analcime.
Amethyst.
Quartz, Dauphiny.
Idocrase.
Mellite?
Sulphur native.
Garnet.
Dichroite.

13. *Pyro-electricity of artificial Crystals.*

Artificial crystals.

In examining the physical properties of artificial crystals, Sir David Brewster found that several of them, when well dried, were electrical when heated. The following is the list of those in which he detected this property.[1]

Tartrate of potash and soda.
Tartaric acid.
Oxalate of ammonia.
Oxymuriate of potash.
Sulphate of magnesia and soda.
Sulphate of ammonia.
Sulphate of iron.
Sulphate of magnesia.
Prussiate of potash.
Sugar.
Acetate of lead.
Carbonate of potash.
Citric acid.
Oxymuriate of mercury.

Oxalate of lime.

Dr Faraday[2] has more recently discovered a remarkable degree of pyro-electricity in oxalate of lime. Having obtained some of this salt by precipitation, and dried it, when well washed, in a Wedgewood's basin, at a temperature of about 300° Fahr. till it was so dry as not to dim a cold plate of glass held over it, Dr Faraday remarked that, when it was stirred with a platina spatula, it became in a few moments so strongly electrical that it could not be collected together, but flew about the dish whenever it was moved from its sides into the sand-bath. This phenomenon took place whether the salt was placed in glass, porcelain, or metallic basins, or stirred with glass, porcelain or metallic rods. When the particles were well excited and shaken on the top of a gold-leaf electrometer, the leaves diverged two or three inches. The same phenomena took place when it was cooled out of the contact of air. When it was excited in a silver capsule, and left out of contact with the air, the powder continued electrical for a great length of time, proving its very bad conducting power, in which it probably surpasses all other bodies. Dr Faraday remarks, that oxalate of lime stands at the head of all other bodies yet tried, in its power of becoming positively electrical by heat.

14. *On the Connection between the Pyro-electricity of Minerals and their Secondary Forms.*

It is well known that the opposite and corresponding sides of crystals are similar in the number, disposition, and figure of their faces. Haüy, however, found that pyro-electrical crystals deviate from this symmetry, so that there are certain supernumerary planes at one pole which are not seen at the other. This is true of tourmaline, boracite, topaz, and oxinite, and may possibly be found to be a general fact among pyro-electrical crystals, though we do not expect that it will. In the crystals above mentioned, the vitreous electricity resides in that pole where the supernumerary planes are found, and the resinous electricity in the other.

Pl. CC
Fig. 8.

This deviation from symmetry as existing in the tourmaline is shown in fig. 8, where A is the vitreous pole at the summit of a pyramid with *five planes*, and B the resinous pole at the summit of a pyramid with *three planes*.

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[1] *Edinburgh Journal of Science*, October 1824, p. 212.

[2] *Id.* October 1825; and *Quarterly Journal*, No. 38, p. 338.

The deviation from symmetry in the boracite is more remarkable. The resinous pole at *s*, fig. 9, is marked with one plane, while the vitreous one has the same plane *s* with other three planes *rrr*, fig. 10.

From the preceding facts, Haüy is of opinion that, during the formation of these crystals, the two electrical fluids have influenced, in an opposite manner, the laws by which the crystallization was regulated.

SECT. II.—*On the Influence of Heat upon the Electric Fluid in Metallic Bodies.*

The experiments which have been made on this subject we owe chiefly to M. Becquerel, of whose labours we shall endeavour to give a brief account. It had been long ago shown by M. Desaignes that metallic bodies are capable of electric excitation by heating and cooling. By raising the temperature of one end of a plate of silver, while the other retained the temperature of the surrounding air, he succeeded in producing contractions in a frog, by making the nerve communicate with one end of the plate, and the muscle with the other end. Other philosophers had observed the influence of heat, and they believed that it increased the repulsive force of each of the two fluids. In proof of this they sealed hermetically at a lamp a tube of glass which had been previously electrified interiorly, and by raising its temperature it gave very distinct signs of electricity. M. Becquerel, however, has remarked, that the glass, becoming a better conductor when heated, allowed a portion of the fluid accumulated in the interior of the tube to pass; so that the experiment does not prove that the electrical power of the tube was increased. In order to determine if any does take place, M. Becquerel made the following experiment.

Let AB, fig. 11, be a Leyden jar, at the surface of which is fixed a conductor RS. The jar is closed by a cork *gg*, through which there passes a rod *bb*, fixed at its upper end to a small glass receiver *abc*, and carrying at its opposite end a mass of metal P. When the jar has been electrified interiorly, it is placed in another vessel filled with ice, so that the conducting rod RS is without it. The cork *gg* and the metal P having been taken out, and the mass P heated and replaced as in the figure, the iron P will gradually heat the interior of the bottle without sensibly altering the temperature of its outer surface, which is surrounded with ice. If we then present the button S to an electroscope, there will be perceived an indication of free electricity, and consequently the heat has not increased the action of the electric fluid in the interior of the jar; for if it had done so, the electricity of the exterior surface would have been decomposed, and the rod RS would have communicated to the electroscope the repelled electricity.

But though heat exerts no action on the free fluid, this is far from being true with the natural fluid. When a metallic wire *mm'*, or a series of metallic molecules *m*, *m'*, *m''*, &c. connected together by the force of aggregation, is connected by one of its ends with a heated body, such as a piece of red-hot glass, the moment that the heat enters it this extremity becomes positively electrical, while the negative electricity is driven to the adjacent molecules; but *m'* receiving the heat of *m*, *m''* that of *m'*, &c. the second molecule, which is heated at the expense of the first, takes from this last its positive electricity, and gives to it negative electricity, and so on for all the other molecules. Hence there will arise a series of decompositions and recompositions of the natural fluids while the elevation of temperature lasts.

M. Becquerel's next experiment was to place on the upper plate of Bohnenberger's gold leaf electroscope (taking care to avoid the contact of metals) a platinum wire whose other end is coiled into a spiral. This outer end is brought to a red heat by a spirit-lamp, which is soon withdrawn, and the spiral is then touched with a band of wet paper. After having made the lower plate communicate with the common reservoir, the small band of paper is found to have carried away positive electricity, and negative electricity remains free on the surface of the metal. If we repeat the experiment in an inverse manner, that is, if we hold between the fingers the platinum wire by the end opposite to that of the spiral, and make this last communicate when it is red hot with a band of wet paper, we shall find that the band carries away positive electricity. This result, which takes place also with gold and silver, does not depend on the electricity which is disengaged during the combustion of the alcohol, since the experiment did not commence till the lamp was withdrawn. Nor can it be ascribed to the presence of water in the band of paper, nor to the alteration of the latter by the effect of heat, two causes which are capable of producing electricity, since the same result is obtained when we carry away the positive electricity of the metal by a tube of glass brought to the same temperature as the metal.

In order to make the experiment in this way, take a glass tube of a very small diameter, and whose length is little more than half an inch, and fix to one of its ends a platinum wire one fiftieth of an inch in diameter, soldering it with a lamp. A wire of the same metal, but of a very small diameter, is fixed at the other end of the glass tube, and the largest platina wire is then put in communication with one of the plates of the condenser, avoiding the contact of metals, and the free end of the other wire is held between the fingers. A red heat is then communicated to the end of the small tube to which this last wire is fixed. As its temperature is much higher than that of the other, which is larger and more distant from the focus of heat, and as the tube becomes at the same time a conductor of electricity, the natural electricity of each wire is decomposed. According to the disposition of the apparatus, we shall have the difference of the effects, which will be to the advantage of the small wire, whose end in contact with the tube possesses the highest temperature. In order to obtain this result, it is not necessary to use a heat so high as that of a red heat. By this process we avoid every foreign cause which is capable of modifying the result.

Iron and copper give similar results; but the electric effect produced by oxidation is in this case combined with that of difference of temperature. M. Becquerel has proved that the oxidation is not the sole cause of the electricity obtained with oxidable metals; and he concludes that heat exerts over the natural electric fluid of all metals a similar action, which probably varies in intensity in different metals, according to their nature. With bismuth, tin, and antimony, the effects are scarcely sensible.

The following is Becquerel's theory of the preceding phenomenon. It is an incontestable fact that all bodies contain between their molecules a neutral electric fluid; and M. Becquerel thinks that a rise of temperature establishes round two contiguous molecules an accumulation of opposite electricities, the quantity of which is proportional to this temperature, but whose recomposition is effected without there having been an apparent separation of the two electricities. It is therefore an electrical effect of motion. When the molecules are separated, each of them takes the excess of electricity relative to the portion of electricity which surrounds it.

Pl. CCXII. Fig. 12.

The influence of heat on the natural electricity of metals may be shown by means of the lamp without flame, in the two following experiments given by Becquerel. Let AB, fig. 12, be a copper lamp filled with alcohol, *cc* a tube, and *dd* a cork through which there passes a glass tube EF, covered with a varnish of gum-lac. A cotton wick passes through this tube, one end of it going into the alcohol, while to the other end there is fitted a platina spiral *g*, which becomes incandescent throughout as soon as its temperature is sufficiently raised. By means of this construction the platina spiral communicates with the interior of the lamp only by means of the vapour of alcohol and the wick. If we now place this apparatus on the upper plate of an excellent electroscope, whose lower plate communicates with the ground, and touch the spiral with an ordinary platina wire, it is evident that we carry off the negative electricity which the spiral takes during the combustion of the alcohol, and also the negative electricity furnished by the end of the wire which has the lowest temperature. In this case the spiral will be found to have become positively electrical. If we touch the spiral with a band of wet paper, a contrary result will be obtained; the spiral will become negatively electrical, because the incandescent metal transmits positive electricity to the wet paper, which is no doubt stronger than the negative electricity acquired by the spiral during combustion.

SECT. III.—*On the Electricity produced by Pressure.*

Experiments of M. Haüy.

The electricity produced by pressure seems to have been first observed by the Abbé Haüy in Iceland spar, which seems to be more susceptible of this species of excitation than any other mineral. If we take into one hand a rhomb of this mineral, holding it by two of its opposite edges, and at the same time lightly touch two of its parallel faces by two fingers of the other hand, and then bring it near to the small needle of the electroscope, it will exhibit *vitreous* electricity. If the two opposite planes, in place of being touched, are pressed between the fingers, a still greater degree of electricity will be developed.

M. Haüy has observed this property of becoming positively electrical by pressure in topaz, especially the variety which is colourless, euclase, arragonite, fluor-spar, and carbonate of lead, all of them substances which are capable of being mechanically cleaved into smooth laminæ. The experiments are always most successful with pure and transparent specimens. Sulphate of lime and sulphate of barytes do not evolve electricity by pressure.

In all the minerals above named which furnish positive electricity by pressure, positive electricity is also produced by friction; and in those substances which develope resinous electricity by pressure, such as a properly shaped piece of elastic bitumen, resinous electricity is also produced by friction. Hence it has been inferred, that in pressing minerals friction is produced, and that the preceding phenomena are only those of excitation by friction.

Experiments of M. Libes.

M. Libes, however, has stated a fact which appears to be hostile to this explanation of the phenomena. He took a metallic disc insulated by a glass handle, and having pressed it on the surface of varnished silk, either when single or several times folded, the *disc* acquired *resinous* and the *silk vitreous* electricity, and the quantity of electricity increased with the pressure. In order to ascertain if friction was a remoter cause of these effects, he set the disc lightly down upon the silk, and rubbing it backwards and forwards so as to produce the effects of friction, the *disc became vitreously and the silk resinously electrified*, a result the very opposite to that which was produced by pressure.

Experiments of M. Becquerel.

This curious subject has been recently examined with much attention and success by M. Becquerel. Having constructed an apparatus for compressing two bodies with a given quantity of pressure, and also an electrical balance of Coulomb, whose platinum torsion wire is sufficiently fine to compare very small electric forces, M. Becquerel sought to determine the phenomena which took place when two bodies were placed under the action of a given pressure and then quickly separated. He found that the excess of electricity acquired by each body was proportional to the pressure as long as it was not great enough to disorganize the body; but if the two bodies are exposed to a certain pressure, and if this pressure is reduced to one half without changing the contact, the effect of the pressure lost subsists during a time, which depends on the degree of conducting power, so that if we immediately withdraw the bodies from compression, each of them will carry off an excess of the opposite electricity greater than that due to the remaining pressure. In place, however, of separating the bodies when the pressure has been diminished, let the pressure taken away be restored, and let this mode of action be several times repeated, the following results will be obtained:

Let a very thin disc of cork be pressed against a plate of Iceland spar with a weight of four kilogrammes; without changing the contact, let this pressure be reduced to one half, and after a minute let the bodies be separated. The tension or intensity of the electricity of each disc is represented by 170. When the separation took place during the whole pressure of four kilogrammes, the intensity would have been 250; and during a pressure of two kilogrammes it would have been 125, or one half. Hence it appears, that in the first case the effect produced by the pressure which was lost still subsisted in part, for it would only have been 125 for two kilogrammes, in place of 170, as given by experiment.

In place of separating the bodies when the pressure has been reduced from four to two kilogrammes, let the pressure of two kilogrammes which was removed be restored, and let us repeat several times the alternate action of simple and double pressures; it will then be found that the disc of each never possesses a greater electrical intensity than 250 relative to the strongest pressure. From these results M. Becquerel draws the following conclusions: first, that the electricity developed by pressure is proportional to the pressure; and, second, that when the molecules have been compressed, the effect of the pressure lost will subsist for some time, even though the contact has not ceased to subsist. This is not the case with conducting bodies, seeing that the two electricities disengaged instantly recombine whenever the pressure ceases.

The following are some of the numerical results obtained by M. Becquerel:

Cork pressed against Iceland spar.

Pressures.	Intensity of Electricity.
1	1·5
2	3·4
3	5·6
4	6

Cork pressed against polished crystals of sulphate of barytes.

1	1·05
2	2·1
3	3·1
4	4·2
6	6·3

Cork pressed against polished quartz.

4..............................3·9

Cork pressed against sulphate of lime.

4..............................1·9

When two insulated discs, one of cork and the other of caoutchouc, are pressed against each other, the cork after pressure is negatively electrical, and the caoutchouc positively electrical. When the cork is pressed against the skin of an orange, the cork is positive and the skin negative.

When cork is pressed against Iceland spar, sulphate of lime, fluor spar, sulphate of barytes, the cork is negative and the minerals positive; but when cork is pressed against kyanite, retinasphaltum, pit-coal, amber, zinc, silver, &c. the cork is positive, and the minerals or metals negative.

When insulated cork is pressed against any part of the animal body free from moisture, the cork receives an excess of negative electricity. The hair and down of animals produce nearly as much electricity by pressure as Iceland spar, but of the opposite kind. Cork pressed lightly against inspissated oil of turpentine is negatively electrified.

When two discs of the same substance, such as skin or amadou, are pressed against each other, the one becomes negative and the other positive.

The electricity thus developed by pressure is lasting. Haüy found it to continue eleven days with Iceland spar. Sulphate of barytes of Royat parts with it instantly unless well insulated; but a well insulated crystal retains it half an hour. The duration of the electricity seems to be inversely as the conducting power. Becquerel supposes the internal surface of the body to be, like the Leyden jar, charged with the opposite electricity; so that dissipation is prevented by the action of the two electricities.

In these phenomena the electricity never appears till the bodies are separated.

When the temperature of any body is raised, it has the greater tendency to acquire negative electricity by friction. In like manner, by heating Iceland spar, it may be made to give *negative* electricity by pressure against cork. If we cut a piece of well-dried cork into two pieces by a very sharp knife, and press the cut surfaces against each other, no electricity is developed; but if one of the pieces is heated slightly near the flame of a candle, and the pressure applied, each surface will, when separated, exhibit opposite electricities. The same is true of two pieces of Iceland spar.

SECT. IV.—*On the Electricity produced by Cleavage and Separation of Parts.*

ctricity separa- n of ts.

It has been long known that electricity is produced during the violent disruption of a body, or by tearing it asunder, or by separating a laminated body, or by breaking a body across, or by crushing it, or even by cutting it into portions.

Mr Bennet observed that when an unannealed glass tear, or Prince Rupert's drop, was put upon a book, it electrified the book negatively. Mr Wilson noticed that if a piece of wood, when dry and warm, is rent asunder, one of the separated surfaces becomes vitreously and the other resinously electrified. When a stick of sealing-wax is broken across, one of the surfaces of fracture is vitreously and the other resinously electrified.

ash from pert's ps.

The electricity developed by the bursting of a Prince Rupert's or unannealed glass drop was found by Sir David Brewster to be accompanied with a flash of light. "These drops," says he, "have three different cleavages, one like the lines of a melon diverging from the apex of the drop, another concentric with the surface of the drop, and another oblique to the axis. Having laid one of these drops upon a table in a dark room, and covered it with a plate of thick glass to prevent any of the fragments from reaching the eye, the drop was burst by breaking off a part of its tail, and the whole of it appeared luminous, so that at the instant of the fracture a quantity of faint light, of the same shape and size of the drop itself, was distinctly visible. The drop which gave this singular result was made of flint-glass, and was the largest that he had ever seen. Every other flint-glass drop produced a distinct electrical light; but in none of them except the large one could he see the luminous shape of the drop. The same light appeared when they were burst under water. The small glass drops made of bottle-glass never exhibited any light at the moment of bursting; but it was almost always visible, in small sparks, in bottle-glass drops of a larger size." The same author observed also a bright electric light when the water-proof cloth manufactured by Charles Mackintosh, Esq. was separated by tearing it into its two component pieces, which are united by a thin film of caoutchouc. He found also that the same light was produced by tearing quickly cotton and other cloths, and by separating the films of mica. The same effects are produced by breaking barley-sugar or sugar-candy.

When the plates of mica, or the laminæ of sulphate of lime, are quickly separated, each of the two plates, when separated, carry off an excess of the opposite electricities, the one being vitreously and the other resinously electrified. If these two plates are again placed together in the position which they occupied previous to their separation, and a slight pressure used to make them adhere, M. Becquerel found that the same phenomena took place as at the instant of their first separation, that is, each plate took the same kind of electricity. This property continued only a few moments, perhaps till the molecules had taken their ordinary state of equilibrium, which is aided by increasing their temperature. The effects above described he found to be more distinct in proportion as the crystal was more heated previous to the cleavage.

Cleavage.

The electrical phenomena produced by cleavage, and by tearing asunder and crushing bodies, differ in degree only from those produced by pressure, as in every case of a separation of parts there must be an approximation of the molecules in one direction. If we press, for example, a piece of caoutchouc in one direction, or draw it out in an opposite direction till it breaks, the effect of both these mechanical actions is an approximation of the molecules in the same direction. Hence the electrical phenomena are nearly the same. The light produced by the collision of hard bodies, or by the separation of the parts of bodies, is no doubt produced by the rapid recombination of the two electricities when developed at the points of pressure.

Cleavage of topazes.

A very curious phenomenon was observed by Sir David Brewster during his numerous experiments on the cleavage of topazes, in which there were cavities containing very highly expansible fluids. His practice was to make the cleavage plane pass through a fluid cavity, and thus to open the cavity and allow its contents to be seen and examined. When this was done, the most expansible of the two fluids flowed from the cavity upon the polished and electrified face of cleavage, and continued to expand and contract itself alternately, now collecting itself into a drop, and then expanding itself into a flat disc. These motions continued till the fluid evaporated; and the effect was no doubt owing to the electricity produced by evaporation, as well as to that produced by cleavage.

Wood shavings.

"The experiments of Mr Wilson on the electricity of wood shavings belong, to a certain extent, to the present section. Having had occasion to work very dry wood that had lain for several hours over a very large fire, he observed the shavings adhering to the tools and to every thing that they came in contact with. When the dry wood was scraped with a piece of window glass, the shavings were always vitreously electrified; but when it was chipped with a knife, the electricity of the chips was vitreous when the wood was hot and the knife not very sharp, but resinous when the wood was perfectly cold. The electricity of the knife was always opposite to that of the chips. The surface of the shaved or chipped wood was seldom electrified, but when it was, the electricity was very feeble, and of the same kind as the weakest of the other two. The wood used in these experiments was beech and cherry tree.

SECT. V.—*On the Electricity of Sifted Powders.*

Sifted powders.

As it has not been determined whether the electricity produced by the falling of sifted powders arises from friction, pressure, or separation of parts, we have thought it best to describe them in a separate section.

Bennet's experiments.

In 1786 Mr Bennet observed that when powdered chalk was blown from a pair of bellows upon the cap of his gold-leaf electrometer, *vitreous* electricity was produced when the cap was *six* inches from the pipe of the bellows, and *resinous* electricity when the distance of the pipe was *three feet.* The vitreous electricity first produced was changed to resinous by breaking the stream of air in the bellows-pipe with a bunch of wire, silk, or feathers, or by removing the pipe so as to make air issue in a wide stream.

When the plate which receives the powders at a distance of *three* inches was moistened or oiled, Mr Bennet found that the electricity was opposite to that produced when the plate was dry.

When powdered chalk fell from one plate to another placed upon the electrometer, resinous electricity was produced; and Mr Bennet obtained the same result when he used red ochre, yellow rosin, coal ashes, black lead, powdered quicklime, powdered sulphur, flowers of sulphur, sand, rust of iron, or iron filings.

When powdered chalk was placed on a metal plate upon the cap of the electrometer, and blown away with the mouth or bellows, it produced permanent vitreous electricity; and the same result is obtained if the chalk is merely blown over the plate, or if a piece of chalk is drawn over a brush placed on the plate.

When chalk or other powders were sifted upon the cap of the electrometer, *resinous* electricity was produced; but when the instrument was placed in a dusty road, and the dust excited by a stick fell upon the cap, *vitreous* electricity was developed.

Cavallo experiments.

M. Cavallo repeated these experiments with some important variations. He insulated a metallic plate upon a glass stand, and having connected it with a cork ball electrometer, he made the dry powder fall from a spoon about six inches above the plate. The electricity communicated to the plate was conveyed to the electrometer, and its nature indicated in the usual manner. When the powder was of a conducting nature, like the amalgam of metals, it was placed in a glass phial, or upon a plate of wax; and sometimes the spoon was insulated, in which case it was always found to possess an electricity opposite to that of the plate. In this manner M. Cavallo obtained the following results:

Powders.	Spoon.	Electricity of Plate.	Strength of Ditto.
Rosin.	Glass or paper.	Negative.[1]	Strong.
Flowers of sulphur.	Ditto.	Negative.	Less strong.
Powdered glass.	Dry paper, warm.	Negative.	Weaker.
Ditto.	Brass.	Positive.	Very weak.
Steel filings.	Glass or paper.	Negative.	
Brass filings.	......	Positive.	
Gunpowder.	Glass.	Negative.	
Fine emery.	Glass.	Negative.	
Amalgam of tin and mercury.	Glass.	Negative.	
Mercury.	Glass.	Positive.	
Soot.	Glass.	Negative.	
Ashes of pit-coal.	Glass.	Negative.	

Experiments of Mr Singer.

The most accurate experiments on the electricity of powders were made by Mr Singer. The following results were obtained by sifting the powders on the cap of a delicate electrometer, through sieves of hair, flannel, or muslin, the sieve being cleaned after every experiment.

The following bodies produced *negative* electricity.

Copper.
Zinc.
Tin.
Iron.
Bismuth.
Nickel.
Black lead.
Lime.
Magnesia.
Barytes.
Strontites.
Alumine.
Silex.
Brown oxide of copper.
White oxide of arsenic.
Red oxide of lead.
Litharge.
White lead.
Red oxide of iron.
Acetate of copper.
Sulphate of copper.
Sulphate of soda.
Phosphate of soda.
Carbonate of soda.
Carbonate of ammonia.
Carbonate of potash.
Carbonate of lime.
Muriate of ammonia.
Common pearl ashes.
Boracic acid.
Benzoic acid.
Oxalic acid.
Citric acid.
Tartaric acid.
Cream of tartar.
Oxymuriate of potash.
Pure potash.
Pure soda.
Rosin.
Sulphur.
Sulphuret of lime.
Starch.
Orpiment.

The following bodies produced *positive* electricity.

Wheat flower.
Oat meal.
Lycopodium.
Quassia.
Powdered cardamum.
Wood charcoal.
Sulphate of potash.
Nitrate of potash.
Acetate of lead.
Oxide of tin.

Mr Singer obtained the following results by bringing an insulated copper plate repeatedly in contact with extensive surfaces of powders spread upon a dry sheet of nome- and aws.

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[1] Strongly positive when the spoon was insulated.

paper, the copper plate being brought in contact with the condenser after every repetition of the touching, until a sufficient charge was communicated. Very distinct effects were produced with the alkalies by contact with a copper or silver plate, an experiment which had failed in the hands of Sir H. Davy. The pure alkali being broken into small pieces, was exposed in an open phial for a quarter of an hour to a moderate heat not sufficient to fuse the alkali. It was then reduced quickly to a powder in a dry and warm mortar, and distributed instantly over a dry sheet of card paper, which for some time continued to attract moisture from the alkali as rapidly as the alkali absorbed it from the air. The whole operation was performed as rapidly as possible. The following tables contain the substances that gave positive and negative electricity, the copper plate being always electrified oppositely to the powders.

Electricity Positive.

Lime.
Barytes.
Strontites.
Magnesia.
Pure soda.
Pure potash.
Common pearl ashes.
Carbonate of potash.
Carbonate of soda.
Tartaric acid.

Electricity Negative.

Benzoic acid.
Boracic acid.
Oxalic acid.
Citric acid.
Silex.
Alumine.
Carbonate of ammonia.
Sulphur.
Rosin.

From the preceding experiments, which were several times repeated with uniform results, Mr Singer infers that they are unfavourable to the idea of natural electric energy; and he considers the result with sulphur and resin, viz. that the electricity is similar to that produced by their friction, as almost establishing the opinion that the contact of dissimilar bodies is in general the primary source of electrical excitation.

CHAP. III.—ON THE ELECTRICITY PRODUCED BY CHANGE OF FORM.

It has been long ago observed that electricity is developed when bodies change their form, or pass from one state into another. This important fact is exhibited when melted bodies pass from the fluid into the solid state, when fluids are converted into vapour, and when bodies are decomposed by combustion. The phenomena exhibited in these three cases of change of form are very interesting, and will be described in the following sections.

SECT. I.—*On the Electricity developed during the Melting and Cooling of Resinous Bodies.*

ctricity nelted ies.

In our history of electricity we have already given a general account of the experiments by which Mr Stephen Gray discovered a method of developing electricity by the fusion and cooling of resinous bodies. In his nineteenth experiment he formed a large cone of stone sulphur of thirty ounces avoirdupois, by melting the sulphur in a tall glass. The cone began to attract bodies two hours after it was taken out of the glass, and the glass itself exhibited a feeble attractive power. When the sulphur was lifted out of the glass on the following day, its attractive force was very strong, and that of the glass imperceptible. In making these experiments Mr Gray had occasion to place the cone of sulphur on its base between the two windows of his chamber, and to invert the glass over it. Whenever the glass was removed from the cone of sulphur, it exhibited electrical attraction as strongly as the cone, and they both preserved the property for several weeks. The glass, however, at last attracted at a less distance than the sulphur, that is, its attractive force diminished most quickly.

Phenomena and Laws.

Experiment of Wilcke.

These interesting inquiries were resumed by Mr Wilcke of Rostoch, who gave the name of *spontaneous* to the electricity developed by cooled resins. He found that the sulphur acquired a strong electricity whether the glass in which it was fused was insulated or not; but it was always stronger when the vessels were not placed on electrics, and strongest when the glass vessel had a metallic coating. The electricity of the glass was always *positive*, and the sulphur *negative*. The electricity of the sulphur did not appear till it began to cool and contract, and it was a *maximum* at its point of greatest contraction. At this time the electricity of the glass was a *minimum*, having previously reached its *maximum* at the time when the sulphur was shaken out of it. Melted *sealing-wax* becomes *negatively* electrical when poured into *glass*, and *positively* electrical when poured into sulphur. Sealing-wax poured into a vessel of baked wood showed negative, and the wood positive electricity. When sulphur was poured into wood it was negative, but it acquired no electricity whatever when poured into sulphur or rough glass.

Of Æpinus.

Æpinus pursued this subject by melting the sulphur in metallic dishes. The sulphur and the dish showed no electrical signs when they were cooled, but the moment they were separated the electricity of each was very strong, that of the dish being always negative, and that of the sulphur positive. The electricity invariably disappeared when the sulphur was replaced in its dish, and reappeared upon their separation.

If the electricity was abstracted either from the sulphur or from the dish when they were separated, they both exhibited, when re-united, the electricity which had not been taken away, and which always existed *on the surface* of the sulphur.

Electricity of melted chocolate.

Mr Sanders, a maker of chocolate, having observed that the chocolate exhibited electricity during its cooling, communicated the fact to Mr Henley, who having previously repeated the experiments of Mr Gray, resumed the subject. From several experiments made by Mr Sanders under his direction, he found that by heating the chocolate over and over again, the electrical property gradually disappeared; and that it could at any time be restored by the addition of a small quantity of olive oil.

Experiments of Van Marum.

The most elaborate series of experiments on this subject were made by MM. Van Marum and Van Troostwyck. The substances which they employed were sulphur, sealing-wax, gum-lac softened with rosin, rosin, pitch, and wax. These substances were all poured when in a fluid state on the surface of mercury, and all of them, except the sulphur, were electrical after their removal from the metallic surface. These soft solids were next melted in insulated vessels of baked clay, and also in linen and gauze insulated by silk cords; but though Volta's condenser was employed, no proof could be obtained that they had lost any portion of their natural quantity of electricity.

The electricity owing to friction.

In order to verify the suspicion that friction was the source of the electricity generated in the melting and cooling of soft solids, they poured them upon copper, tin, lead, glass, and porcelain, and they invariably found *that they acquired the same kind of electricity as if they had been rubbed by the body on which they were poured.* In confirmation of this opinion they found that the lower surface of each plate was much more strongly electrified than the upper one, and no difference of effect was perceived when the plates were even one inch and a half thick. To obtain still more complete evidence of this conclusion, they melted gum-lac and rosin, and having suspended plates of copper by silk cords, they caused the plates to come in contact with the melted gum, without producing any friction. After the gum was cooled, and the plates again raised, not a trace of electricity could be discovered.

From these results their authors infer that the electricity exhibited in this class of phenomena is not produced either by the separation of the fused substance from the electric on which it is melted, or by the fusion or subsequent cooling of the body, but that it is generated by the friction which the particles of the electric bodies undergo when they disperse themselves over the surfaces of the dishes into which they are poured. The electricity thus produced is masked or counterbalanced by the opposite electricity acquired by the dish, and therefore does not appear till the one is separated from the other.

Electricity of congelation and sublimation.

The electricity produced during the congelation of glacial sulphuric acid and other substances has probably a similar origin; and it is likely that the electrical effects which are observed when calomel fixes itself by sublimation to the upper part of a glass vessel, may belong to the same class of facts. This branch of the subject, however, has been but very imperfectly studied, and will form a fine topic of research for some young and active philosopher.

SECT. II.—*On the Electricity developed during Evaporation and the Extrication of Gases.*

Electricity of evaporation.

Experiments of Lavoisier, Laplace, and Volta.

The development of electricity during the transition of bodies from the solid or fluid state into the state of vapours or gases, was first investigated by MM. Lavoisier and Laplace, with the assistance of M. Volta. Two kinds of apparatus were used in these experiments. In both of them the bodies to be vaporized were insulated by varnished supports of glass; and in those cases where the electricity was quickly disengaged, a common electroscope communicating with the body was used to indicate it, whereas, when the effect was likely to take place continuously, Volta's condenser was employed.

Electricity of chemical action;

When hydrogen gas was rapidly disengaged from iron filings by the action of sulphuric acid, the condenser of Volta afforded a strong spark, and the electricity was negative.

When carbonic acid gas was evolved from powdered chalk, no sensible spark was educed, but the electricity generated was negative.

When nitrous acid diluted with two parts of water was poured upon iron filings placed in six separate vessels, so as to generate nitrous gas, a distinct negative electricity was obtained without a spark.

of combustion;

During the combustion of charcoal in three insulated chafing dishes strong negative electricity was generated; and a spark could easily have been obtained, by increasing the quantity of charcoal.

of evaporation.

Having arranged three insulated furnaces of hammered iron, and made them communicate with the electroscope, water was thrown upon them when heated. In the first experiment the electricity generated was *negative*, and in the other two *positive*; a discrepancy which they ascribed to the cooling which accompanied the evaporation, the positive electricity produced by cooling being supposed to counterbalance the negative effect occasioned by evaporation.

Bennet's experiments.

Mr Bennet, before whom Volta had repeated his experiments in England, published, in the *Phil. Trans.* for 1787, the following interesting facts on the same subject. Having placed a metallic cup with a red-hot coal in it upon the cap of his gold-leaf electrometer, he threw a spoonful of water into the cup. The cup was electrified *negatively*, while the ascending column of vapour exhibited *positive* electricity. When water is poured through an insulated cullender, containing hot coals, the *descending* drops of water are *negatively*, and the *ascending* vapour *positively* electrified; and Mr Bennet regards this as a good illustration of the electricities of fogs and rain. A more simple and certain method of making these experiments consists, according to Mr Bennet, in heating the small end of a long tobacco pipe, and pouring water into the head. The water, being allowed to run through the heated end, is suddenly expanded into steam, and, when projected upon the cap of the electrometer, exhibits signs of electricity. If the pipe, when fixed in a cleft stick, is fixed on one electrometer, while the steam is received upon the cap of another, the two opposite electricities will be simultaneously exhibited. The vapour of alcohol and ether exhibits the same phenomena as that of water, but sulphuric acid and oil generate only smoke, and exhibit no electrical indications.

Experi- ments o Saussur

M. Saussure devoted much attention to this interesting branch of electricity. He confirmed the general results obtained by Volta, Lavoisier, and Laplace, and proved that negative electricity was constantly produced by the evaporation of water. He then determined the degree and kind of electricity produced by evaporation when it was carried on in vessels of different metals, and kept at different temperatures. The apparatus which he employed consisted of a well-baked vessel of clay, four inches in diameter and fifteen lines thick, which was insulated upon a clean and dry goblet of glass. Upon this clay vessel he placed a crucible, or any other dish powerfully heated; and this crucible was made to communicate with the electrometer by means of a wire. Fifty-four grains of distilled water were thrown upon the crucible, and, by means of a time-piece and an electrometer, he observed the duration of the evaporation, and the intensity and character of the electricity.

In his first series of experiments the crucible was of iron; the number of projections of the water varied from 1 to 21, the time of the projection from 0″ to 17′, the duration of the evaporation from $2\frac{1}{2}$″ to 118″, and the degree of electricity from 1 to 18 tenths of a line. In *ten* of these experiments the electricity was *positive*, and in *six negative*. In four of the negative experiments the strongest electricity was 7, 13, 17, and 18 tenths of a line, and in four of the positive experiments the strongest was 3, 3, 5, and 8 tenths; thus showing, as might have been thought, that the weak positive electricity was produced by some secondary cause.

But in repeating the same series of experiments with the same iron crucible, he found very different results. The projections of water varied from 1 to 23, their time from 0′ to 14′ 10″, and the duration of the evaporation from $2\frac{1}{2}$″ to 120″. The electricity was now *always* positive, and its intensity varied from 0 to 30 tenths of a line.

When the experiment was repeated with a *copper crucible* $3\frac{1}{2}$ inches wide at top, 2 inches wide at bottom, 3 inches high, and weighing 57 ounces, the electricity was always *positive*, and its intensity varied from 0 to 33 tenths of a line, the maximum effect taking place when the duration of evaporation was 165″, a mean between the shortest and longest times. In another experiment with the same *copper* crucible, made under the very same circumstances, the electricity was negative at the end of the first projection, but afterwards became positive, and continued so till the experiment was complete.

In the next experiment the crucible was of *pure silver*,

$2\frac{3}{4}$ inches wide at top, $1\frac{1}{2}$ at bottom, $12\frac{1}{2}$ inches high, $1\frac{1}{2}$ line thick, and weighing 16 ounces. At the first trial, when the evaporation was very slow, the electricity, which was always very feeble, was *thrice negative*, and thrice 0. In a second trial it was also negative at first, but it became *positive* afterwards, and then vanished. In a third trial the electricity was stronger and negative. The balls of the electrometer now diverged $3\frac{1}{2}$ lines. It then became *positive*, when the balls diverged $\frac{7}{10}$ths of a line; and at the third projection, when it was still positive, the separation of the balls was so great as *six* lines.

Saussure's next experiment was made with a cup of white *porcelain*, surrounded with sand in a clay crucible. The electricity was *negative*, and the evaporation remarkably rapid. Its intensity varied from 0 to 8 lines. The same results were obtained with different porcelain crucibles.

When *alcohol* and *ether* were substituted for water, and the silver crucible used, the electricity was *negative*. With the former the greatest intensity was 1 line, and with the latter 4·2 lines.

From these experiments Saussure infers, with great hesitation, that the electricity is positive with those bodies which are capable of decomposing water, or of being themselves decomposed by their contact with water; and that it is negative with those which are not decomposed. He ascribed the result with silver to its being adulterated with copper or other oxidable metals. The negative electricity of burning charcoal he supposes to arise from the readiness with which it loses its heat in contact with water.

Saussure was unable to procure electricity either from combustion or by suddenly exploding heaps of gunpowder; and all his attempts failed to develope electricity, *without ebullition*, by evaporation, from large surfaces of wet linen or white iron.

Eperi- mts of Cllo.

M. Cavallo followed Saussure in this inquiry, though he does not seem to have been acquainted with the labours of the Swiss philosopher. He found that evaporation from iron produced negative electricity when the iron was free from rust, but positive when it was very rusty. He found also that white and clear flint glass produced *positive*, while bottle glass evolved *negative* electricity. From these various researches it is not easy to deduce any thing like a general principle. The subject indeed requires to be resumed, and great attention paid to the chemical changes which take place during the progress of the experiments.

SECT. III.—*On the Electricity developed in Flame and Combustion.*

Etricity ome.

We have already seen, in the preceding section, that MM. Lavoisier and Laplace obtained distinct indications of electricity by the combustion of charcoal, and Volta informs us that he never failed to obtain it. Saussure, on the contrary, as has been mentioned, never could develope electricity either by combustion or the explosion of gunpowder; and Sir Humphry Davy equally failed to procure it by the combustion of iron or of charcoal in air or in pure oxygen.

The electrical relations of flame have been subsequently examined by M. Erman of Berlin and Professor Brande. M. Erman concluded, from some experiments, that the insulated flames of *wax, oil, alcohol*, and *hydrogen gas* conduct *only positive* electricity, while the flame of *phosphorus* conducts only *negative* electricity. It was noticed by Mr Cuthbertson that when the flame of a common candle was placed halfway between two equal balls, the one positively and the other negatively electrified, the flame was attracted to the *negative* ball, which consequently became very warm, while the positive ball continued comparatively cold.

Experiments of Brande.

In pursuing this idea Mr Brande placed the flames of various bodies between two insulated brass balls, one of which was insulated positively and the other negatively, and obtained the following results.

Flames, &c. attracted to the Negative Ball.

Olefiant gas.
Sulphuretted hydrogen, slightly.
Arseniated hydrogen.
Flame of hydrogen, weakly.
Sulphuret of carbon.
Potassium in combustion, and its fumes.
Flame of gum benzoin.
Smoke of benzoin.
Charcoal emitted by camphor in combustion.
Resinous bodies in combustion exhibit the same phenomena as charcoal.

Flames attracted to the Positive Ball.

Sulphurous acid vapour.
A *small* flame of phosphuretted hydrogen, slightly.[1]
Fumes of white arsenic, slightly.
Large flame of carbonic oxide.
Vapour of burnt sulphur.[2]
Flame of phosphorus.
Vapour of phosphorus.
Stream of muriatic acid.
Stream of nitrous gas.
Vapour of benzoic acid.

In order to explain these phenomena, Mr Brande supposes, that since some bodies are naturally negative, and others positive, the positive ones will be attracted by the negative ball, and the negative ones by the positive ball.

This conjecture was not confirmed by future observation, and did not lead philosophers to any certain conclusions. The subject, however, was resumed by M. Pouillet, who arrived at a general result, which explains in a satisfactory manner the errors and contradictions of preceding observers.

Experiments of M. Pouillet.

The first point which occupied his attention was the combustion of charcoal; and in his earliest experiments he found with surprise that he could sometimes obtain from it positive and at other times negative electricity, while at other times he could not obtain the slightest electrical indications. In explaining these discrepancies, he supposed that one of the electricities was taken by the charcoal, and the other by the oxygen or carbonic acid; and in order to determine the truth of this supposition he made the following arrangement. Having taken a cylinder of charcoal, he placed it vertically six or eight centimeters below a plate of brass which rests upon one of the discs of the condenser. The charcoal having a communication with the ground, was lighted at its upper end without the fire reaching the lateral surface, and there arose a column of carbonic acid, which struck the plate of brass, and in a few seconds charged the condenser. The electricity which the condenser received from the carbonic acid was *always positive*, whereas Lavoisier, Laplace, and Volta made the electricity *negative*. When the char-

Combustion of charcoal.

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[1] When the flame was *large* it was equally attracted by both balls.

[2] The direction of the flame could not be determined.

coal was held nearly horizontally, so that the carbonic acid which was generated could rise only by ascending along the base of the charcoal, which was now vertical, *no sensible effect was obtained;* and when the lateral as well as the upper surface of the charcoal, placed vertically, was lighted, an uncertain result was obtained.

In order to determine the electricity of the charcoal itself, M. Pouillet places the base of the cylinder upon the disc of the condenser; and after lighting the upper end of it, and keeping up the fire by a gentle blast of air, the condenser was charged, and showed that the electricity taken by the charcoal was negative. When the charcoal burnt on all its surface, or when it touched the condenser only in a few points, no electrical effects were observed. In the last of these cases a small quantity of electricity only can pass by a small number of points, and in the first case the positive electricity of the ascending carbonic acid was recombined with the negative electricity. In order to produce intense and rapid electrical effects, several cylinders of charcoal, of the same height, should be placed on their ends, and near each other, upon a sufficiently large plate of brass; and when all the cylinders are made to burn at their upper ends, and their united columns of carbonic acid received by another brass plate communicating with the condenser, and raised a few inches, or even a foot, above it, a strong charge of *positive* electricity will in a few seconds be communicated to the brass plate. When the electricity of the charcoal is required, we have only to unite the condenser to the brass plate upon which the burning cylinders are placed, and in a few seconds the condenser will be abundantly charged with *negative* electricity.

When the combustion is maintained by a current of oxygen, the electricity is not only much more intense, but is much more quickly developed; and the gold leaves of the condenser separate to their maximum divergency in an instant. The first point, however, to be attended to in every form of the experiment, is to burn only the upper horizontal surface, so that the carbonic acid forms and ascends in a moment, and without touching any other body till it deposits its electricity on the brass plate. So essential is this condition, that if we burn even a deep cavity on the circumference of a vertical cylinder of charcoal, and do this even with a jet of oxygen, the electrical indications are sometimes positive and sometimes negative, just as the electricity of the gas or the charcoal predominates.

Experiments of Pouillet.

M. Pouillet next entered upon the more arduous investigation of determining whether or not electricity is produced by change of condition or chemical affinity. Volta had supposed that carbon, in becoming gaseous, absorbed the positive and left to the remaining solid parts the *negative* electricity which we find in them. M. Pouillet, on the contrary, supposed that if electricity is disengaged from two elements which combine, positive electricity would be given out by the one and negative by the other; and that when these elements separate, each of them required to take up the fluid which they had lost.

Combustion of hydrogen.

By forming combinations unaccompanied by changes of condition, M. Pouillet resolved this question. He first tried that of oxygen and hydrogen. The flame of hydrogen, like charcoal, gave electricity, sometimes strong and sometimes feeble, sometimes *positive* and sometimes negative; and it was some time before he discovered the cause of these discrepancies. That the gases are not very good conductors of electricity, he found by the following very curious experiment. Having set a very small spirit-lamp upon a common electroscope, and about five or six feet above it a feebly charged body, such as a stick of electrified rosin or a plate of glass, he observed that the gold leaves diverged greatly, though the same charged body could produce no divergence if held even so near as an inch to the electroscope without flame. This apparatus enabled our author to discover the smallest trace of electricity. If we turn the plate of an electrifying machine, the air of the room is electrified; and the flame which ascends in that air is charged at the moment with electricity of the same name. A pile in action electrifies the air in the same manner, as the flame of the electroscope proves. A charcoal fire, or even a lighted candle, developes carbonic acid electrified positively, which is shown also by the electroscope. The atmospheric air, in short, is always electrified; and if it enters a room by any opening, it will preserve itself in an electrified state so long as to affect the results of experiments on small quantities of electricity.

These causes of error being excluded, M. Pouillet repeated his experiments on the combustion of hydrogen. The gas was emitted from a glass tube, and the flame, which was vertical, was about three inches long and four or five lines broad. The brass plate was now set aside, and the electricity conducted to the condenser by a platina wire, whose end is coiled into a spiral. The spire is vertical, and the circumvolutions are sometimes so large as to surround the flame without touching it, and sometimes so small as to be completely enveloped in the interior of the flame. When we approach this flame from the exterior outline of the spire, and keep it ten millimeters distant, we obtain indications of positive electricity. As the distance of the flame diminishes, the electricity becomes more and more intense; but when the flame touches the spire, the electricity becomes weak, and its nature uncertain. The same thing is observed when the flame passes to the interior of the spire, and in the direction of its own axis. Hence there exists round the apparent flame of the hydrogen a sort of atmosphere, more than ten millimeters in thickness, charged with positive electricity. Positive electricity being thus developed in the combustion of hydrogen, Pouillet tried to discover the negative electricity which must have been set free. He placed a small spiral in the centre of the flame, and when it was enveloped on all sides, negative electricity was collected by the condenser. If we plunge the spire half way into the bright part of the flame, no electricity is manifested. Hence it follows that the inside and outside of the flame are in opposite electrical states, the former being negative and the latter positive, and that there is an intermediate layer of the flame where the electricity disappears. On these facts M. Pouillet thus reasons. In the thickness of the exterior atmosphere of the flame, when the positive electricity appears, the combination of oxygen and hydrogen is not effected, for the hydrogen cannot arrive there. The electricity is therefore communicated, and it must come from the oxygen which predominates on the outside, and which envelopes in some measure all the jet of hydrogen. This combined oxygen must therefore disengage positive electricity, which communicates itself to the neighbouring strata of air sufficiently heated to conduct it. In like manner the hydrogen predominates in the interior of the flame, and the negative electricity must be disengaged from the hydrogen which burns, and which it communicates to the excess of uncombined hydrogen. If this view is correct, it is probable that, at a certain distance above the flame, the two opposite electricities ought no longer to appear, as they must have combined; and this is proved to be the case by the fruitless attempt to collect electricity at a distance sufficiently great above the vertical flame. At the distance, however, of a few inches, other phenomena appear. The two electrical fluids appear there in the same quantity, but they are not recombined; for if we present a solder-

Electri of flam

ed plate of zinc and copper, the zinc will attract the positive and the copper the negative electricity.

When the hydrogen issues from a metallic in place of a glass tube, and a communication is made with the condenser and not with the ground, the metal tube, which touches the hydrogen without touching the flame, always takes the negative electricity; and, on the contrary, if the tube communicates only with the ground, it loses in this manner the negative electricity which it had before taken to the condenser, and the product of the combustion preserves an excess of positive electricity.

In pursuing this inquiry in a similar manner, M. Pouillet found that the flames of alcohol, ether, wax, the oils, fatty substances, and several vegetable bodies, present exactly the same phenomenon as the flame of hydrogen. He observed, however, that the particles of charcoal which float in all these flames, and which, according to Sir H. Davy, give them the lustre with which they burn, render them also more fitted to manifest negative electricity. From these results M. Pouillet has deduced the general conclusion, *that in combustion the molecules of oxygen which combine disengage positive electricity, which may be communicated to the neighbouring molecules not yet combined; and that the combustible body, on the contrary, disengages negative electricity, which can, in like manner, be communicated to all the neighbouring combustible parts.*

Eri- mts of M Bec- qel.

The experiments of M. Pouillet were repeated by M. Becquerel in 1827, on the flames of hydrogen gas or alcohol; but he commenced them with some reserve, for, as they were made by means of platina wires plunged in the flame, he supposed that the phenomena were not only owing to the electricity disengaged during combustion, but also to some property which the metals acquired at a certain temperature. The following is the general fact, without entering into any of the details of his experiments: A platinum wire communicates by one end, through the intermedium of a band of wet paper, with one of the plates of a condenser, the other end being plunged in one of the envelopes of a flame produced by the combustion of alcohol, contained in a vessel of copper, which the observer holds in his hand. The end of the wire may even be placed without the flame, provided it is so near it as to become red hot. The wire soon takes a considerable excess of negative electricity, which ought not to be ascribed entirely to that which the alcohol carries off during combustion. In order to prove this, let us resume the last experiment but one. As soon as the end of the platinum wire attains a red heat, let us withdraw the lamp, and touch this end of the wire with a band of wet paper, or rather with the end of a tube of hot glass; the effect is the same as when the wire touched the flame, or was at a small distance from it. It is very probable that the disengagement of the electricity is due, in this last case, in part to the difference of temperature between the two ends of the wire, and that the flame has carried off the positive electricity of the wire, or the band of wet paper, as the hot glass tube had done. This opinion is confirmed by the circumstance that the effect is the same whether we bring the wire to a red heat in the interior or in the exterior of the flame, neither of which possesses the same kind of electricity. Notwithstanding this result, M. Becquerel still admits, that during the combustion of alcohol and hydrogen, the exterior envelope of the flame is charged with positive electricity.

M. Becquerel has endeavoured to explain the curious fact discovered by M. Erman, and already referred to. Having placed upon an electroscope a lamp without flame, whose platinum wire was kept at a red heat by the burning vapour of the alcohol, he held above the spiral the negative pole of a dry pile, and the two gold leaves instantly diverged. He next held the positive pole above the spiral, but there was now no divergence of the leaves. Hence the platinum wire afforded a passage only to the negative electricity. The contrary effect took place when the electricity passed from an incandescent wire to another which was not so; and hence M. Erman found that the incandescent wire was reciprocally a conductor and insulator of each fluid.

In order to show that this conclusion is incorrect, M. Becquerel presented successively to a red-hot platinum wire the two poles of a dry pile, and it conducted equally well both kinds of electricity. Besides, as he remarks, it appears, from our knowledge of the electrical effects produced in gaseous combustion, and by increase of temperature, that part of the air which surrounds the red-hot wire of the lamp without flame ought to be in a positive state of electricity, and the wire which is in the middle of the alcoholic vapour in a negative state. Moreover, it is evident, from what has been already stated, that the part of the wire which is red hot ought easily to yield positive electricity to contiguous bodies. This being admitted, when we present to this wire the negative pole of a dry pile, there are two reasons why the negative electricity should neutralize both the positive electricity of the surrounding air, and that of the red-hot wire which tends to escape from it. The negative electricity of the wire then becoming free, manifests its action upon the electroscope. In repeating the experiment in an inverse manner, that is, by causing each of the two electricities to escape successively by the red-hot wire, as this last tends to be negative, it neutralizes the positive electricity which arises, and sets free that of the surrounding air and of the red-hot end of the wire. It is not therefore necessary to have recourse to a reciprocity of insulating and conducting action in the red-hot wire in order to explain the phenomenon, for the fact admits of an easy explanation on the properties above explained.

SECT. IV.—*On the Electricity of the Solar Rays.*

Electricity of the solar rays.

Our readers are no doubt aware that Dr Morrichini and others succeeded in magnetising needles by the action of the blue rays in the solar spectrum. Other philosophers have failed, even in good climates, in obtaining decided indications of magnetism, so that accurate researches are still wanting to remove this opprobrium from our experimental physics. The very same observations are applicable to the development of electricity by the influence of solar light; but still it is necessary, in a work like this, that we should give some account of the experiments from which this electrical action has been inferred.

Experiments of Barlocci;

In a memoir on the influence of solar light in the production of electric and magnetic phenomena, Professor Saverio Barlocci of Rome relates the following experiments: Having formed the prismatic spectrum by the solar rays, he caused the red rays and the violet rays to fall upon two discs of blackened copper, each of which was attached to a copper wire. Two copper nuts sliding upon a vertical glass rod, and to which the two wires were fixed, allowed the discs to be brought near each other or separated at pleasure. A prepared frog was then suspended by the body to the upper wire, and the legs were placed upon the lower one. The red rays being made to fall on one disc, and the violet on the other, the extreme parts of the two wires were brought into contact, and distinct signs of contraction were observed in the frog.

of Matteucci.

M. Matteucci of Forli has more recently investigated the same subject. Having exposed to the sun a delicate condensing electrometer of gold leaf, he soon perceived the leaves diverge and open themselves on that side of the glass which was directly exposed to the solar action, as if they had been attracted by it. Hence he was led to suspect that glass thus exposed was electrified; and in order to ascertain this, he placed some plates of it in the sun, and having in a few minutes touched them in different places with the ball electrometer, a perceptible divergence took place. This divergence was much more apparent when he touched the plates even lightly with a flat surface, as the effects of the friction did not afford a doubtful result.

Having inferred from these results that the solar rays had the power of developing electricity in glass, M. Matteucci endeavoured to ascertain whether this was owing to the existence of electricity in the rays themselves, or to the increased temperature of the glass. He therefore heated a plate of glass repeatedly, and having tried it with the electrometer, he never could discover in it any signs of electrical action. M. Matteucci likewise observed that the glass plate exposed to the rays of the sun never became electric if placed beneath another glass plate, or if the face of the sun was obscured by a cloud.

Experiments of Dr Faraday.

Dr Faraday likewise made experiments on the solar spectrum, in the same manner as that used by M. Barlocci, with the exception that he used a very delicate galvanometer in place of a frog; but, to use his own words, "no electricity could be obtained by means of an English sun."

M. Delarive has still more recently (*Bibl. Univers.* July 1833, p. 326) stated that, after taking every precaution to avoid the action of extraneous causes, he could not discover in the solar rays the slightest trace of electricity.

SECT. V.—*On the Electricity produced by Vegetables.*

Electricity of vegetation.

Mr Read seems to be the only author who, previous to the researches of M. Pouillet, had made any distinct statement respecting the electricity of vegetable bodies. He had concluded, from several experiments, that vegetable putrefaction is always electrified negatively, while the surrounding atmosphere is electrified positively. It is to M. Pouillet, however, that we owe all our knowledge on this subject, and in the present section we shall communicate to our readers a general abstract of his researches.

Researches of M. Pouillet.

That the various parts of plants act upon atmospheric air is well known. At the expense of the oxygen they sometimes form a large quantity of carbonic acid gas, which disengages itself insensibly; and sometimes they exhale pure oxygen, proceeding from some combination which goes on in the interior of the plant.

As carbonic acid gas is electrified vitreously at the moment of its formation, from charcoal in combustion, M. Pouillet conceived that a considerable quantity of electricity ought to be produced during the exhalation of this acid from growing plants. This idea was soon confirmed by experiment, and M. Pouillet was led to the important conclusion that vegetation is an abundant source of electricity, and is therefore a powerful cause in the generation of the electricity of the atmosphere.

He took twelve capsules of glass, about nine inches in diameter, and coated them externally, but only to a distance of one or two inches towards the edge, with a film of gum-lac varnish. They were then arranged in two rows at the side of each other, either on a table of very dry wood, or on a table which was itself varnished with gum-lac. When they were filled with vegetable mould, they were made to communicate with each other by metallic wires, which went from the interior of the one to the interior of the other, passing over the edges of the capsules. In this manner all the insides of the twelve capsules, and the mould which they held, formed only one conducting body. If electricity is communicated to such a system, it will be distributed over the twelve capsules, and will remain there, as it cannot pass into the ground, nor even into the exterior surfaces of the capsules, on account of the film of gum-lac round their edges. The upper plate of a condenser is now put in communication with one of the capsules by means of a brass wire, and its lower plate with the ground by the same means; and these communications are so made that they may be kept up even for several days. The grain of which we wish to study the effects is then sown in the earth in the capsules, and from this moment the laboratory must be closely shut, and neither fire nor light, nor any electrical body, admitted.

This experiment was made during the dry north and east winds of the month of March. During the two first days the surface of the mould was dried up, and the grains swelled; the germ projected about a line out of its envelope, without, however, appearing above the thin stratum of earth which covered the grain; and the condenser, after several trials, gave no signs of electricity. On the third day the germs had come out of the mould, and began to raise their points towards the window, which had no shutters. Upon now trying the condenser, M. Pouillet saw a divergence in the gold leaves, and he found the electricity to be negative in the capsules, and positive in the gases which were disengaged. Hence M. Pouillet infers that the rapid action which the rising germ exercises on the oxygen of the air disengages electricity.

The apparatus was then put into its usual state, and after the lapse of some hours the action of the germ again charged it with electricity. Upon visiting the apparatus next morning, M. Pouillet found that it gave a very strong electric charge, and the electricity was of the same kind as before. During the next eight days the vegetation continued active, and at all times of observation, both during the day and night, the condenser exhibited more or less electricity, according to the time that had elapsed. After twelve hours the divergence of the gold leaves was more than an inch, and the electricity of the earth in the capsules was always *negative*. Damp weather followed, and it was then impossible to collect the least quantity of electricity.

M. Pouillet's next experiment was to make two vegetations of corn, two of cresses, one of gillyflower, and one of lucerne; but he was obliged to maintain in his laboratory an artificial dryness, by spreading in a very large apartment several bushels of quicklime broken into very small fragments, and he also distributed in porcelain saucers several kilogrammes of muriate of lime, and placed them near the capsules. The condenser now exhibited a more intense electricity than before, and in each operation the development of the vegetable action, and that of the accompanying electrical phenomena, were observed during ten or twelve days. So rapid was the development of electricity, that after the three or four first days of vegetation, if the condenser was put into the natural state after one observation, and it was then replaced for experiment only during *one second*, it was then found to be charged with electricity. "But," as M. Pouillet observes, "it is evident that, during one second, the weight of oxygen which combines and disengages during a languid vegetation, of only three or four square feet, is a weight so feeble, and a fraction of a millegramme so imperceptible, that the electricity which it disengages is not sensible to the condenser. One is apt to fear, after this, that the electricity has another source, and that it can only be developed by some foreign cause; but upon reflection we see that the earth of the capsules is so dry that it becomes an imperfect conductor, that the electricity is retained, and that it is it which charges the condenser. To be certain of this, it is sufficient to place successively in contact with the condenser, one, two, three, or a greater number of capsules, and we shall see the charge increase in proportion as the number increases; in short, it is sufficient to place them in communication with the ground for a long time, when they will no longer give a charge to the condenser, and it will be many hours after that before they communicate a sensible electricity. It is without doubt this imperfect conductibility of the dried earth which has rendered it impossible for me to observe until now any electrical charges during the periods of day or night, although I took every precaution to observe it, presuming that if the disengagement of carbonic acid produce resinous electricity in the ground, the disengagement of oxygen ought, on the contrary, to produce vitreous electricity.

"It is perhaps the same cause which has given birth to another phenomenon, which I have not yet studied sufficiently to give an exact account of it. It happened twice that the electric signs had ceased during two or three days, and that they were then presented in opposite directions, that is to say, the capsules had exhibited vitreous electricity, and had continued to exhibit it, with a very weak intensity, during the rest of the vegetation."

Sect. V.—*On the Electricity of Living Animals.*

tricity ving als.

When we consider the structure of organized bodies endued with life and motion, we should naturally expect, from the phenomena described in the preceding section, that electricity would be developed in the chemical processes and changes which are incessantly taking place. During the processes of digestion and assimilation, for example, in which both solid and fluid bodies are changing their form, and in the process of respiration, in which the atmospheric air is decomposed, electricity cannot fail to be developed in greater or less intensity.

Another source of electricity in animal bodies is no doubt the friction between the clothing and the skin; and the electricity thus generated will be more or less intense, according to the state of the atmosphere, the nature of the clothes, and the constitution and habits of the individual.

But, independent of the electrical phenomena which arise from these causes, we find in certain fishes a regular system of electrical organs, by which they either defend themselves from the attacks of their enemies, or seize the prey which nature has provided for their use. The curious phenomena which have been observed relative to these subjects will be described under separate heads.

Art. 1. *On the Electricity of the Human Body.*

tricity e hu- body.

Long before electricity had become a science, electrical phenomena had been distinctly observed. Cardan relates, that sparks were emitted from the hair of a Carmelite monk, whenever it was stroked backwards; and Faber mentions a young woman from whose hair sparks of fire always fell when it was combed. Cassandra Buri, a Veronese lady, often terrified her maid-servants by brilliant sparks, and a crackling noise, which were emitted when her body was rubbed, or even touched slightly, by a linen cloth. Antonio Ciampi, a bookseller at Pisa, emitted sparks from his back and arms with a crackling noise, whenever he pulled off a narrow shirt and a piece of cloth which he wore upon his breast.

Gesner relates, that in Germany, where heated stoves prevailed, it was exceedingly common to observe crackling flames issue from the shirts of persons who had been previously warming themselves at a stove.

The experiments of Mr Symmer on the electricity of silk stockings that had been worn, which we have already detailed, correspond with the preceding facts; and there are few individuals who have not observed similar electrical phenomena in changing different parts of their dress.

Experiments of Saussure;

That the electrical effects exhibited in the human body are, generally speaking, produced by the friction of the clothes against the skin, has been proved by the experiments of Saussure, Landriani, the Abbé Bertholon, and M. Volta. M. Saussure examined the electricity of his own body by means of Volta's electrometer and a condenser, and he never could discover any electricity in it when he was perfectly naked, when his clothes were cold, or when he was in a state of perspiration. In other states of his body and dress, the electricity which did manifest itself was sometimes positive and at other times negative, without any apparent cause for these variations. When he bent his body forwards, and raised himself suddenly, the balls of the electrometer diverged to a considerable distance, and then collapsed; but if he drew away his hand when the balls were thus divergent, they continued in this state of divergency, and exhibited positive electricity. Saussure observed also that the motion produced by respiration is of itself sufficient to produce a small quantity of electricity; for when he remained on the insulating stool in a state of the most perfect repose that a living being could observe, distinct indications of electricity were manifested when he laid his hand for some time on one of Volta's condensers.

of Hemmer.

The most complete series of experiments on the electricity of the human body were made by M. J. J. Hemmer of Manheim. He insulated himself upon a board supported by glass feet, and then touched for about half a minute a condenser. The condenser was then applied to Saussure's improved electrometer, and, by means of a glass tube excited by woollen cloth, he examined the nature of the electricity. The following are the results of experiments which he made upon himself on the 21st of February 1786, and which he has repeated upon persons in every state of body and mind, and under every variety of dress and temperature.

1. The electricity of the human body is common to all men. It was found in thirty persons of all ages and sexes; but it varied in strength in different individuals, and was positive in some and negative in others.

2. The intensity and character of the electricity often varies in the same person. In 2422 experiments M. Hemmer found it 1252 times positive, 771 times negative, and 399 times imperceptible. Out of 94 experiments made upon his maid-servant, it was 17 times positive, 33 times negative, and 44 times imperceptible.

3. The electricity of the body is naturally positive; for when it is subject to no violent exertion this is always its character. Out of 356 experiments made upon himself when sitting at rest, and when the natural heat of his body was not disturbed, his electricity was 322 times positive, 14 times negative, and 10 times imperceptible.

4. The natural positive electricity of the body is changed into negative by cold, or is greatly diminished. Out of 62 experiments made upon himself when he came from a temperature of 32° of Fahrenheit, his electricity was 38 times negative, 15 times positive, and 7 times imperceptible.

5. The natural positive electricity of the body is changed into negative by lassitude. Out of 16 times that he walked backwards and forwards in his apartment, or was otherwise employed, he found the electricity only

Phenomena and Laws.

once weakly positive, 10 times negative, and 5 times imperceptible. In 32 experiments made when he was standing at rest, the electricity was 2 times weakly positive and 30 times imperceptible.

6. The natural positive electricity of the body is changed into negative by sudden, speedy, and violent motion.

It is obvious from these experiments, that the human body possesses no electrical organs over which the will exercises any control, and that its electricity depends on the chemical and physical changes which are taking place either in its interior or upon its surface.

It has been supposed that the remarkable phenomena of spontaneous combustion in the human body are somehow or other connected with its electrical state; but we possess no accurate data by which the truth of this opinion can be tried.

Art. 2. *On the Electricity of the Raia Torpedo.*

Electricity of the torpedo.

The remarkable property of giving an electrical shock possessed by this fish was known in the time of Aristotle and Pliny, and has been distinctly described by Appian. Redi, Reaumur, Kæmpfer, and Bancroft, successively described the phenomena which it exhibited; and Lorenzini, so early as 1678, published good engravings of the electrical organs of the torpedo.

Experiments of Walsh.

The first person, however, who made accurate experiments on the torpedo was Mr Walsh. He confirmed the remarkable observation of Kæmpfer, that the shock could be evaded if the person who touched the animal held in his breath at the time. Mr Walsh made two series of experiments on this fish, one when it was placed in the air, and the other in the water. In the first series he placed a living torpedo upon a table covered with a wet napkin, round which stood five persons who were insulated. Having suspended from the ceiling by strings two brass wires, each thirteen feet long, one of them was made to communicate by one extremity with the wet napkin, while its other extremity was plunged in a basin of water placed upon a second table, on which other four basins of water stood. The first of the five insulated persons plunged a finger of one hand in the basin in which the above-mentioned wire was placed, and a finger of the other hand into the second basin. The second person put a finger of one hand in this second basin, and a finger of the other in a third basin, and so on till the five persons formed a communication with each other by the water in the basins. The end of the second wire was plunged in the last basin, and Mr Walsh having taken the other end of this wire in his hand, touched the back of the torpedo, when all the five persons experienced a shock which differed only in force from that of the Leyden jar. The shock seldom extended beyond the touching finger, and out of 200 only one reached above the elbow. When the torpedo was insulated, it gave forty or fifty shocks to insulated persons, without any diminution of its force. Mr Walsh found that the shock was communicable through iron wires and other conductors, but not through air, glass, and other electrics; and he was never able either to produce a shock, or move the pith balls of an electrometer. In the series of experiments in water, Mr Walsh held a large and powerful torpedo in both hands by its electric organs, and after plunging it about a foot under water, he raised it suddenly to the same height in air. The instant the lower surface of the fish touched the water in descending, he received a violent shock, and the instant the same surface quitted the water in ascending, he experienced a still more violent shock. A writhing of the fish accompanied both these shocks, particularly the last. The intensity of the shock under water was scarcely one fourth of that at the surface, and not much more than one fourth of those given in the air. The number of shocks in a minute was about twenty, generally two and always one when he was wholly in the air, and sometimes two when he was below water. When the finger of one hand touched the upper part, and the thumb of the same hand the lower part, of a single organ, the shock was twice as great as when it passed through the arms, and Mr Walsh concluded that the two sides of the fish are in opposite electrical states.

Phenor na an Laws

Experi- ments o Ingen- housz;

Dr Ingenhousz, who repeated and confirmed these experiments, says that the sensation of the shocks is the same as if a great number of very small electrical bottles were discharged very quickly through his hand. M. Spallanzani found the shocks strongest when the fish was laid upon a plate of glass. When the animal was dying the shocks were not given at intervals, but resembled a continual battery of small shocks. The battery continued seven minutes, and in this time he experienced 316 shocks. Spallanzani also found that the fœtus gave perceptible shocks like the full-grown fish.

of Hum boldt an Gay Lu sac.

In the year 1805, MM. Humboldt and Gay Lussac examined the properties of the torpedo at Naples, but they do not seem to have added much to the observations made by Mr Walsh. They found that a person accustomed to electric shocks could with some difficulty support the shock of a vigorous torpedo fourteen inches long; that before each shock there is a convulsive movement of the pectoral fins; that the animal must be irritated previous to the shock; that the shock may be felt when a single finger is applied to a single surface of the electric organ; that an insulated person will not receive a shock if he touches the fish with a key or any other conducting body; and that the least injury done to the brain of the fish prevents its electrical action.

Electri organs.

At the request of Mr Walsh, the celebrated anatomist Dr Hunter examined the electrical organs of a torpedo about eighteen inches long, twelve broad, and two thick. These organs are placed on each side of the cranium and gills, reaching from thence to the semicircular cartilages of each great fin, and extending in length from the anterior extremity of the animal to the transverse cartilage which divides the thorax from the abdomen. Within these limits the organs occupy all the space between the skin of the upper and outer surfaces. This description will be understood from fig. 1 of Plate CCXIII., which represents a female torpedo, the skin B having been flayed from the under surface of the fish, to show the electric organs A. The nostrils, in the form of a crescent, are shown at *c*, and the mouth, having a crescent form, opposite to the nostrils, at *d*. The mouth is furnished with several rows of small hooked teeth. The bronchial apertures are shown at E, five being on each side; F is the place of the heart, *gggg* the place of the anterior transverse cartilages, *hh* the exterior margin of the great lateral fin, *i* its inner margin on the confines of the electrical organ, *l* the abdomen, *mmm* the place of the posterior transverse cartilage, which is single, united with the spine, and sustains the smaller lateral fins *nnnn* on each side; O is the anus, and P the fin of the tail.

Plate CCXII fig. 1.

Each organ is about five inches long, and about three inches broad at the anterior end, and half an inch at the posterior extremity. Each organ consists wholly of perpendicular columns reaching from the upper to the under surface of the body, and varying in their lengths according to the thickness of the parts of the body where they are placed. The longest column is about one and a half inch, the shortest about one fourth of an inch, and their diameter about two tenths of an inch. The figures of the columns are irregular hexagons or pentagons, and some-

Ph ome- and ws.

times have the appearance of being quadrangular or cylindrical. The number of columns in the fish examined by Dr Hunter was 470 in each organ; but in a very large fish four and a half feet long, and weighing seventy-three pounds, the number was 1182 in each organ. The number of partitions in a column one inch long was 150. The nerves inserted into each electric organ arise by three very large trunks from the lateral and posterior part of the brain; and when they have entered the organs they ramify in every direction between the columns, and send in small branches on each partition, where they are lost. Dr Hunter remarks that there is no part of any animal with which he is acquainted, however strong and constant its natural action, which has so great a proportion of nerves; and he hence concludes that, if it be probable that these nerves are not necessary for the purposes of sensation or action, they are subservient to the formation, collection, or management of the electric fluid.

M. Geoffroy de St Hilaire has more recently examined the torpedo. He analysed the fluid in the cells of the hexagonal columns, and found it to consist of albumen and gelatine; and, what is very curious, he discovered organs analogous to those of the torpedo in other species of the same genus Raia, which do not possess any electrical power.

erva- ti and eri- nts of Todd.

Some useful observations were made upon the torpedo of the Cape of Good Hope in 1812 by Mr John T. Todd. The torpedos of this locality are never more than eight, nor less than five inches in length, and never more than five, nor less than three and a half inches in breadth. The columns of their electrical organs were larger and less numerous in proportion than those described by Hunter, and they appeared to be of a cylindrical form. The shocks of these torpedos were never sensible above the shoulder, and seldom above the elbow joint. The electrical discharge was generally accompanied by an evident muscular action, as shown by an apparent swelling of the superior surface of the electrical organs. From a great variety of experiments, which we have not room to enumerate, Mr Todd drew the following conclusions:

1. That the electrical discharge is a vital action dependent on the life of the animal.
2. That the action of the electrical organ is entirely voluntary.
3. That frequent action of them is injurious to its life, and, if continued, deprives the animal of it.
4. That when the nerves and the organs are cut, the torpedo loses the power of giving a shock, though it appears more vivacious, and lives longer, than those in which this change has not been produced, and in which the electrical power is exerted.
5. That the possession of one organ only is sufficient to produce the shock.
6. That the perfect state of all the nerves of the electrical organs is not necessary to the production of the shock.
7. That (as was shown by Dr Hunter) a more intimate relation exists between the nervous system and electrical organs of the torpedo, both as to structure and functions, than between the same and any organs of any animal with which we are acquainted.

In 1816 Mr Todd made another series of experiments at La Rochelle, principally with the view of determining whether the torpedo possessed any voluntary power over the electrical organs, either in exciting or interrupting their action, except through the nerves of these organs. Shocks were given by the torpedo even when one half of each electrical organ was removed; and also when an incision was made extending round the circumference of both organs, so as to leave no attachment between these organs and the animal except the nerves. When the large lateral cartilages were removed, and a large portion of the surfaces of the electrical organs denuded, two distinct shocks were received; but the fish being much injured, soon died. During these experiments, Mr Todd observed how powerfully the action of the electrical organs was excited by the cutting of the scalpel; and on one occasion, when he pressed on the electrical organ with his left hand, and held the scalpel wet in the other while cutting the electrical organ, he received a distinct shock in the right hand through the scalpel. He observed also that all the nerves of the electrical organs arise from the medulla oblongata, notwithstanding the long course which three of them are obliged to follow.

Phenomena and Laws.

Mr Todd informs us that the torpedo called *la tremble*, which occurs on the coast between the Loire and the Garonne, is eaten by the poorer inhabitants, who carefully avoid the electrical organs, which are supposed to possess some disagreeable properties.

Observations and experiments of Sir H. Davy;

In 1814 and 1815, when Sir H. Davy was on the shores of the Mediterranean, he was desirous of ascertaining whether or not the electricity of the torpedo possessed the chemical and magnetic powers of that agent. In both these trials he could neither decompose water, nor influence a highly delicate magnetic electrometer; and he seems disposed to infer that there is a stronger analogy between the common and animal electricity than between common and Voltaic electricity, and that it is probable that animal electricity will be found to be of a distinctive and peculiar kind.

of Dr John Davy.

This eminent chemist intended to pursue these inquiries, but his ill health prevented him; and in his latest illness he requested his brother, Dr John Davy, to carry on the investigation. Dr Davy accordingly pursued the inquiry at Malta, and succeeded in obtaining several important results. He placed a needle perfectly free from magnetism within a fine copper spiral wire one and a half inch long and one tenth of an inch in diameter, containing about 180 convolutions, and weighing about four and a half grains. By the electricity of a torpedo about six inches long, he succeeded in communicating distinct magnetism to this needle; and he repeated the experiment with the same success with fishes of different sizes. Dr Davy likewise succeeded in throwing into violent motion the needle of a magnetic multiplier. With every fish he tried he obtained decisive results, and he met with no instance of a fish which had the power of magnetising a needle in the spiral wire failing to move the needle in the multiplier, though he met with more than one example of a fish whose electricity was equal to the latter effect and not to the former. Dr Davy, however, failed in obtaining any igniting power, or the faintest spark, by means of the torpedo. He also found that air was not impermeable to the electricity of the torpedo; but he never could exhibit any influence on the electrometer, or any indications of attraction and repulsion in air.

Chemical and magnetical effects.

Dr Davy's experiments on the chemical agency of this species of electricity were highly satisfactory. He decomposed strong solutions of common salt, nitrate of silver, and superacetate of lead, and he inferred that the *under* surface of the organ corresponds to the zinc, and the upper surface to the copper extremity of the Voltaic battery. In the deviation of the needle in the multiplier produced by the torpedo, the action of its under surface corresponded with the zinc plate, and that of the upper surface with the action of the copper plate. In like manner, the extremity of a needle that received polarity from a torpedo when placed in a spiral wire, had *southern* polarity when it was nearest the *under* surface of the fish, and the other extremity of course northern. In one experiment Dr Davy connected the spiral with the multiplier, and having charged the former with eight needles, a single discharge from an active fish moved the needle in the multiplier powerfully, and converted all the needles into magnets, each of them as strong as if one only had been used.

Substance of its organs.

Dr Davy's next object was to ascertain "the exact nature of the substance of the electrical organs, or the peculiar structure of which they are composed." The electrical organs when wet weighed 302 grains; and when completely dried by sixteen hours exposure to the boiling heat of water, they weighed only twenty-two grains. They appeared to him to consist of 7·28 of matter not evaporable at 212°, and of 92·72 water. When the electrical organs are immersed in boiling water, they suddenly contract in all their dimensions, and the columns, from pentagonal, which they generally are, become circular. The electricity of a small Voltaic trough, the shock of which was just perceptible, distinctly affected the voluntary muscles of the live torpedo, but did not in the least affect the electrical organs. Their substances appeared to be neither sensitive nor contractile by the application of other stimulants; and hence he infers that these organs "are not muscular, but columns formed of tendinous and nervous fibres, distended by a thin gelatinous fluid." Dr Davy never could observe satisfactorily in the fresh fish the horizontal partitions which Dr Hunter had counted. After describing more fully and accurately than Dr Hunter the distribution of the three great trunks of the nervous system, Dr Davy describes the mucous system, which forms a conspicuous part of the anatomical structure of the fish. It consists of several clusters and chains of glands, distributed chiefly around the electrical organs, at different depths beneath the cutis, and of strong transparent vessels of various lengths and sizes opening externally in the skin for the purpose of pouring out the thick mucus secreted by the glands, and destined for lubricating the surface. This system, which was not noticed by Dr Hunter, was described, but imperfectly, by Lorenzini. Dr Davy thinks that this system may not only be aided by, but also aid the secretion of the mucus. In comparing the phenomena of the torpedo with those of other kinds of electricity, Dr Davy notices the following points of difference: "Compared with Voltaic electricity, its effect on the multiplier is feeble; its power of decomposing water and metallic solutions is inconsiderable; but its power of giving a shock is great, and so also is its power of magnetising iron. Compared with common electricity, it has a power of affecting the multiplier, which, under ordinary circumstances, common electricity does not exhibit; its chemical effects are more distinct; its power of magnetising iron and giving a shock appears very similar; its power of passing through air is infinitely less, as is also (if it possess it at all) its power of producing heat and light."

These differences have been explained in different ways by different authors. Mr Cavendish endeavoured to account for them on the principles of common electricity. Mr Nicholson did the same with much ingenuity. Volta at first supposed that the superposition of the different cells in the columns, formed of substances some of which excite electricity by contact, while others transmit it, corresponds to that of the metallic and moist conductors of which the pile is composed; but he afterwards showed to Sir H. Davy another form of the pile, which he thought fulfilled the conditions of the organs of the torpedo; a pile of which the fluid substance was a very imperfect conductor, such as honey, or a strong saccharine extract, which required a certain time to be charged, and which, though it did not decompose water, communicated nevertheless weak shocks when charged. MM. Humboldt and Gay Lussac were more inclined to compare the action of the torpedo to a chain of small Leyden phials, like Cavendish, than to the Voltaic pile. In order to explain why no spark is given by the torpedo, Mr Cavendish proved by experiment that the distance through which the spark flies is inversely, or rather in a greater proportion than the square root of the number of jars; and hence the torpedo may contain sufficient electricity to give a shock, without being able to make it pass through such a space of air as is requisite for the production of the spark. He accounted also for the absence of every appearance of attraction and repulsion, from the known fact that the shock of a battery so weakly electrified as to be incapable of passing through a chain, which is the case with the electricity of the torpedo, is not capable of producing any divergency in the pith balls of an electrometer. Mr Cavendish corroborated these views by constructing an artificial torpedo of thick leather, connected with glass tubes and wires, and covered with a piece of sheep-skin leather, which was an exact imitation of the real torpedo. The battery was composed of forty-nine jars of very thin glass, and contained about seventy-six feet of coated surface.

Humboldt has enumerated the following species of the torpedo which are electrical: Torpedo narke, *Risso;* torpedo unimaculata; torpedo marmorata; torpedo Galvanii.

Art. 3. *On the Electricity of the Gymnotus Electricus.*

Electric of the gy notus.

The electrical eel of Surinam, or *gymnotus electricus*, possesses electrical organs different from those of the torpedo, and exhibits different electrical properties. Its common size is about *three* feet in length; though Dr Bancroft was told that some have been seen in the Surinam river upwards of twenty feet long, and whose shock proved immediately fatal.

Richer was the first person who made known in Europe the electrical properties of this fish; and experiments have been since made upon it by various naturalists. It is from the observations, however, of Dr Williamson of Philadelphia, Dr Garden of Charlestown, and Mr Walsh, that our knowledge of its properties is derived; and these may be summed up in the following manner:

1. When the gymnotus is touched by the hand, a shock is felt in the fingers, and often as far up as the wrist and elbow; and when it is touched with an iron rod twelve inches long, the shock is felt in the finger and thumb.

2. If the eel is provoked by one person, the hand of another person held in the water will experience a small shock.

3. When the eel was touched and provoked with one hand, and the other held in the water at a small distance, a shock passed through both arms; and the same effect was produced when the hand held a wet stick in the water; and when the same experiment was made by eight or ten persons who joined hands, a shock was also experienced.

4. When the first of eight persons pinched the tail, while the last touched the head, they all experienced a severe shock.

5. The shock of the eel was found to pass through those substances which are conductors, and to be stopped by those which are non-conductors, of common electricity.

6. An insulated person electrified, exhibited no marks of electricity; and pith balls refused to diverge either when suspended over the eel's back, or touched by an insulated person when he received the shock.

7. Dr Williamson succeeded in making the electricity of the eel pass through a small space of air, and exhibit the electric spark when the fish was in the open air; but the spark is not visible when the fish is placed in water.

In the preceding experiments the gymnotus was in a enome- and aws.

large vessel, supported by pieces of dry timber about three feet above the floor. A small hole having been bored in the vessel, a person who held his finger in the stream of water which flowed from it experienced a shock when the eel was irritated.

Dr Williamson threw a cat fish into the same vessel with the gymnotus, and in a short time it gave the cat fish a shock, and caused it to turn up its belly and remain motionless.

erva- s of lberg.

Experiments on the gymnotus have more recently been made by M. Fahlberg of Stockholm, and by MM. Humboldt and Bonpland. The Swedish philosopher succeeded in obtaining an electric spark from the eel when placed in the air, by interrupting the conducting chain by two gold leaves pasted upon glass, and a line distant from each other; but he never could discover any phenomenon of attraction or repulsion, though he employed very delicate electrometers, and caused very strong shocks to pass through them.

Hum- lt and pland.

While MM. Humboldt and Bonpland were in South America, where the little streams, and even the basins of stagnant water, are filled with electrical eels, they enjoyed the finest opportunities of studying the phenomena of their electrical action. Having imprudently placed both his feet on a fresh gymnotus, Humboldt experienced a more dreadful shock than he ever received from a Leyden phial, and which left a violent pain in his knees, and in almost every joint, during the rest of the day. When both he and M. Bonpland held a fish, the one by the head or by the middle of the body, and the other by the tail, and, standing on the ground, did not join hands, one of them received shocks which the other did not feel; and hence they concluded that the eel could direct its strokes where it chose, or towards the point where it was most strongly irritated, sometimes discharging them from the whole surface of its body, and sometimes from one point only.

The gymnoti that had been rendered extremely tame during their voyage from Surinam to Stockholm were made to fast a long time, and when fishes were put into the tub they killed them at a distance, the electrical stroke passing through a very thick stratum of water. A fresh-caught gymnotus was placed by Humboldt beside little tortoises and frogs, which, ignorant of their danger, placed themselves upon its back. The frogs did not receive the shock till they touched the body of the eel. When they recovered they leapt out of the tub. Humboldt remarks that this gymnotus was not yet sufficiently tamed to attack and devour frogs.

Upon cutting a very vigorous fish through the middle of the body, Humboldt observed that the fore part alone gave shocks. The shocks, however, are equally strong in whatever part of the body the fish is touched, though it is most disposed to dart them forth when the pectoral fins, the electrical organ, the lips, the eyes, or the gills are pinched. Humboldt remarks that no person has ever perceived a spark issue from the body of the fish itself. He irritated it for a long time during the night, at Calabozo, in perfect darkness, without observing any luminous appearance.

thod of ing the mnoti h ses.

The method of fishing the electrical eels by horses, as described by Humboldt, is too interesting to be omitted in a popular article. The Indians having brought about thirty wild horses, forced them to enter a pool of muddy water surrounded with fir trees. "The extraordinary noise caused by the horses' hoofs makes the fish issue from the mud, and excites them to combat. These yellowish and livid eels, resembling large aquatic serpents, swim on the surface of the water, and crowd under the bellies of the horses and mules. A contest between animals of so different an organization furnishes a very striking spectacle. The Indians, provided with harpoons and long slender reeds, surround the pool closely; and some climb upon the trees, the branches of which extend horizontally over the surface of the water. By their wild cries, and the length of their reeds, they prevent the horses from running away, and reaching the banks of the pool. The eels, stunned by the noise, defend themselves by the repeated discharge of their electric batteries. During a long time they seem to prove victorious. Several horses sink beneath the violence of the invisible strokes which they receive from all sides in organs the most essential to life, and, stunned by the force and frequency of the shocks, disappear under the water. Others, panting, with mane erect, and haggard eyes expressing anguish, raise themselves, and endeavour to flee from the storm by which they are overtaken. They are driven back by the Indians into the middle of the water; but a small number succeed in eluding the active vigilance of the fishermen. These regain the shore, stumbling at every step, and stretch themselves on the sand exhausted with fatigue, and their limbs benumbed by the electric shocks of the gymnoti.

"In less than five minutes two horses were drowned. The eel being five feet long, and pressing itself against the belly of the horses, makes a discharge along the whole extent of its electric organ. It attacks at once the heart, the intestines, and the *plexus cœliacus* of the abdominal nerves. It is natural that the effect felt by the horses should be more powerful than that produced upon man by the touch of the same fish at only one of its extremities. The horses are probably not killed, but only stunned. They are drowned from the impossibility of rising amid the prolonged struggle between the other horses and the eels.

"We had little doubt that the fishing would terminate by killing successively all the animals engaged; but by degrees the impetuosity of this unequal combat diminished, and the wearied gymnoti dispersed. They require a long rest and abundant nourishment to repair what they have lost of galvanic force. The mules and horses appear less frightened; their manes are no longer bristled, and their eyes express less dread. The gymnoti approach timidly the edge of the marsh, where they are taken by means of small harpoons fastened to long cords. When the cords are very dry the Indians feel no shock in raising the fish into the air. In a few minutes we obtained five large eels, the greater part of which were but slightly wounded. Some were taken by the same means towards the evening."

The gymnotus is the largest of the electrical fishes. A fish of three feet ten inches long, obtained by Humboldt, weighed twelve pounds. The transverse diameter of the body was three inches five lines. The gymnoti of the *Cano de Bera* are of a fine olive-green colour. The under part of the head is yellow mingled with red. Two rows of small yellow spots are placed symmetrically along the back, from the head to the end of the tail. Every spot contains an excretory aperture, which keeps the skin of the animal covered with a mucous matter, which, as Volta has proved, conducts electricity twenty or thirty times better than pure water.[1]

Electrical organs of the gymnotus. Plate CCXIII. Fig. 2.

Dr Hunter examined, with his usual skill, the electrical organs of this fish; and in fig. 2 we have copied his engraving of it, in which the skin is removed to show the structure. In this figure A represents the lower surface

Phenomena and Laws.

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[1] Humboldt notices it as remarkable that no electrical fish is covered with scales.

of the head; C, the cavity of the belly; B, the anus; E, the back, where the skin remains; GG, the fin along the lower edge of the fish; EE, the lateral muscles of this fin, removed and laid back with the skin to expose the small organs; L, part of the muscle left in its place; FF, the large electrical organ; HHH, the small electrical organs; *mmm*, the substance which separates the two organs; and *n*, the place where this substance is removed. These organs occupy nearly one half of the part of the flesh in which they are placed, and form more than one third of the whole fish. There are two pair of electrical organs of different sizes, and placed on different sides; the large one F occupies the whole of the lower and lateral part of the fish, constituting the thickness of its fore part, and extending from the abdomen to near one end of the tail, where it terminates nearly in a point. The two organs are separated at the upper part by the muscles of the back, at the lower part by the middle partition, and by the air bag at the middle part. The lesser organ stretches along the lower edge of the fish, and nearly as far as the other, terminating almost insensibly near the end of the tail. The two small organs are separated from each other by the middle muscle, and by the bones in which the fins are articulated. The large organ may be seen by merely removing the skin, which adheres to it by a loose cellular membrane; but in order to see the small organ, the long row of small muscles which move the fin must be removed. The electrical organs consist of two parts, viz. flat partitions or septa, and thin plates or membranes intersecting them transversely. The septa are thin parallel membranes stretching in the direction of the fish's length, and as broad as the semidiameter of the animal's body. The septa vary in length, some of them being as long as the whole body. In a fish two feet four inches long, the distance of the septa was nearly half an inch; and in the broadest part of the organ, which was one and a quarter inch, there were thirty-four septa. In the small organ the septa have a somewhat serpentine direction. They are only the fiftieth of an inch distant, and there are fourteen septa in the breadth of the organ, which is half an inch. The very thin plates which intersect the septa have their breadth equal to the distance between any two septa. There is a regular series of these plates from one end of any two septa to the other end, 240 of them occupying a single inch.

ART. 4. *On the Electricity of the Silurus Electricus.*

Silurus electricus. Fig. 3.

The silurus electricus, of which we have given a drawing in fig. 3, is a fish about twenty inches long, which is found in the Senegal, the Niger, and the Nile. It is eaten by the Egyptians, who dress its flesh, and salt its skin as an aphrodisiac medicine. The shock of this fish is distinctly felt when it is laid on one hand, and touched by an iron rod six feet long held in the other. Its electrical organs, according to M. Geoffroy, are much less complicated than those of other electrical fishes. They lie immediately below the skin, and stretch all round the body of the animal. Their substance is a reticulated mass, the meshes of which are clearly visible, and these cells are filled, like those of other electrical fishes, with an albuminous gelatinous matter. The nerves distributed over the electric organs proceed from the brain, and the two nerves of the eighth pair have a direction and nature peculiar to this species.

ART. 5. *On the Electricity of the Tetraodon Electricus.*

Tetraodon electricus.

In the cavities of the coral rocks in Johanna, one of the Canary islands, Lieutenant Paterson discovered the tetraodon electricus, which he found to possess the properties of other electrical fishes. It has a long projecting mouth, and is seven inches long and two and a half broad. The colour of its back is brown, of its belly sea-green, of its sides yellow, of its fins and tail sandy-green. Its body is covered with red, green, and bright white spots. It has large eyes, and its iris is red, tinged with yellow on its outer edges. It is found also in the American seas.

Lieutenant Paterson found this fish in water whose temperature was 56° or 60° Fahrenheit; and having caught two of them in a linen bag, he had no sooner taken one of them in his hand than he received so severe a shock that he was obliged to let it go. He carried the two fishes to the camp, and though one of them died, and the other was in a state of great debility, he was able to obtain the evidence of the surgeon and the adjutant in favour of his discovery. The former having held it between his hands, received a distinct electrical shock, and the latter received a shock by merely touching the fish on its back with his finger.

ART. 6. *On the Electricity of the Trichiurus Electricus.*

Trichiuru electricus

This fish, which we believe is the *Trichiurus Indicus* of Shaw, inhabits the Indian seas, and has been found to possess the power of giving an electrical shock. It has a pointed snout, and belongs to the family tænioides, of the order acanthopterygii.

Other ele trical fishe

Other electrical fishes have been met with, but the descriptions given of them do not enable us to determine whether or not they are the same as those which we have described in this section. Mr Maxwell, in his observations on Congo and Loango, mentions his having found at sea an electrical fish, which made the sailors who took it exclaim "that the devil was in the fish." When examining it attentively, Mr Maxwell found that his astonishment arose from his having received an electrical shock. Before each shock the skin upon its back and sides became very tense. It was like a cod, and weighed *thirty pounds*. He gave it to the natives to eat, and they praised it much. No electrical fish of such a size has, so far as we know, been found, and it is highly probable that it is a new species.

SECT. VI.—*On the Electricity of the Atmosphere.*

Electricit of the atmosphere

There is perhaps no branch of electricity so highly interesting as that which treats of the electricity of the atmosphere, whether we consider it in reference to ourselves as beings exposed to its tranquil as well as to its disturbed influence, or in reference to the grandeur and beauty of the phenomena which it exhibits.

The methods which have been adopted for examining the electricity of the atmosphere consist in elevating long vertical rods, the summits of which collect the electricity, or in extending insulated wires in a horizontal direction, or in sending up kites into the higher regions.

M. le Monnier, the Abbé Mazeas, Mr Kinnersley, Beccaria, Saussure, Ronayne, Cavallo, Read, Crosse, Ronalds, Schubler, &c. have made numerous experiments on the electricity of the atmosphere in its ordinary state. Le Monnier discovered that there was always more or less electricity in the atmosphere; that there was a regular diurnal period in which the electricity increased from sunrise, when it was scarcely perceptible, till three or four o'clock in the afternoon, when it reached its maximum; and that it again diminished till the fall of the dew, when it again increased, and subsequently diminished, till midnight, when it became insensible.

M. Beccaria found that the electricity of the air was always perceptible in a clear sky and calm weather. In rainy weather, without lightning, it always appeared a short time before the rain fell, and during its actual fall, but disappeared soon after the rain had ceased.

E eri- m s of Sa sure;

Saussure made many important observations on this subject. He found that the electricity of the air was very strong at nine o'clock in the morning; that it gradually diminished till six o'clock P. M., when the first minimum took place; that it afterwards increased to eight o'clock P. M., when the second maximum took place. It then diminished again with some irregularities till six A. M., when it reached its second minimum. It then increased again till eleven o'clock in the evening, when it again became a maximum. The electricity of the atmosphere has therefore a daily period, like the sea, increasing and decreasing twice in twenty-four hours. It, generally speaking, reaches its maximum intensity a few hours after sunrise and sunset, and descends again to its minimum before the rising and setting of that luminary. Saussure also observed that the electricity of the air is strongest during fogs, unless when they change into rain. Saussure likewise found that the electricity of clear weather is always positive; and the opinion of Volta is therefore highly probable, that the electricity of the atmosphere is essentially *positive*, and that the negative electricity which appears in rain, snow, and storms, is derived from more elevated clouds, which are electrified negatively by the discharge of a portion of their electricity into the earth or other clouds, in the same manner as an electrometer acquires negative electricity when it is touched at the instant that the air is electrified positively.

of rosse;

These results were confirmed by subsequent observers, whose observations we have not room more particularly to notice; but we shall make no apology for giving some account of the more recent and valuable observations of Mr Crosse and Mr Ronalds. Mr Crosse's experiments were made with an insulated copper wire, extending originally a mile and a quarter in length, and supported upon two masts from 100 to 110 feet high. The wire was one sixteenth of an inch thick. It was subsequently shortened to 1800 feet in consequence of its being exposed to depredations. From the observations made with this apparatus, which was in use eighteen months, Mr Crosse deduced the following conclusions.

1. The electricity of the atmosphere in its ordinary state is invariably *positive*. It is always fullest during the night. It increases at sunrise, diminishes towards noon, increases again towards sunset, and again diminishes to its nocturnal minimum.

2. The electrical state of the wire is disturbed by fogs, rain, hail, snow, and sleet. It becomes negative when they first come on. It frequently changes to positive, increasing gradually in strength, and then decreasing, a change from positive to negative occurring every three or four minutes.

3. The approach of a charged cloud at first sometimes produces positive and sometimes negative electricity. Its intensity increases and then diminishes and vanishes, being succeeded by the opposite electricity, which increases to a higher maximum, and then diminishes and disappears, and is again followed by the electricity which first appeared. In general the electricity increases at every repetition, till sparks issue in a copious stream from the conductor to the receiving ball, sometimes with interruptions, and again returning with fresh energy. When this happens, a powerful stream of air issues from the wire and the connecting apparatus. An explosive stream of electricity rushes from the one ball to the other at every flash of lightning, and a brilliant light is thrown upon surrounding objects. When the lightning increases, it is wise to let it pass into the ground.

4. The wire is almost as strongly electrified during a driving fog and a smart rain as during a thunder storm, and the electricity passes into opposite states in a similar manner.

5. A very feeble degree of positive electricity occurs in cloudy weather. When rain falls it changes to negative, and again becomes positive when the shower is over.

The following table contains a list of the different states of the air in which its electricity appears, those at the top of the list being those in which it is most powerful.

1. Regular thunder clouds.
2. Driving fog with small rain.
3. A fall of snow, or a brisk hail storm.
4. A smart shower in a hot day.
5. A smart shower in a cold day.
6. Hot weather after some wet days.
7. Wet weather after some dry days.
8. Clear frosty weather.
9. Clear warm summer weather.
10. A sky obscured by clouds.
11. Mackerel or mottled sky.
12. Sultry weather with light hazy clouds.
13. A cold damp night.
14. Weather during north-east winds, with a sensation of dryness and cold not shown by the thermometer.

Experiments of Ronalds,

By means of an electrical apparatus, founded on a new method of electrical insulation, Mr Ronalds made some interesting observations on Vesuvius at the time of moderate eruptions, and another series at Palermo during the prevalence of a sirocco. The rod of the electrometer was placed perpendicularly on the highest pinnacle of Mount Vesuvius, on the north side of the great crater, and about five hundred yards distant from it, a ravine being interposed. The following were the results:

on Vesuvius;

1. The electricity was *always* positive.

2. The intensity of it increased as the sun rose, unless when it was affected by the explosions of the volcano. Very frequent variations took place in the intensity, sometimes accompanying changes of the wind, sometimes following explosions from the crater, sometimes attending the approach of vapour from an aqueous fumerole, when the intensity of the electricity was always increased, and sometimes occurring without any apparent cause.

3. The black fumes from the old crater diminished the intensity more frequently than the white fumes, and very rarely increased it. Mr Ronalds supposes that the black fumes may be in a negative state; and that the white fumes, consisting principally of aqueous vapour, sulphuric and muriatic acids, and sulphur, may, when these vapours are condensed, and when the sulphur sublimes in the air, be brought into a positive state; and that these two states of the two fumes may sometimes act separately on the electrometer, or sometimes wholly and sometimes partially neutralize each other, either by induction or position, or by a discharge from the one to the other.

at Palermo.

The observations of Mr Ronalds on the electricity of the atmosphere during a dry sirocco, were made on the roof of Page's hotel, in Palermo. The electricity was always *positive*, the straw electrometer of Volta varying from five to twenty-one degrees. The electrical phenomena were diametrically opposite to those of the ordinary state of the atmosphere in serene weather, as the electric tension increases almost progressively from sunrise till the hottest part of the day, viz. about three o'clock P. M., when it gradually declined until sunset.

In the arctic regions in 1819–20, there were no sensible indications of electricity "in the summer months, when the clouds become more dense and frequent, and even when a slight shower of rain falls."

Observations of Schubler.

A series of most interesting observations have been recently made by Professor Schubler of Tubingen, on the electricity accompanying the condensation of aqueous vapours in the atmosphere, as affected by the direction of the winds. They were carried on during thirty months, between January 1805 and August 1811. The *first* series was made at Ellvanguen, during sixteen months, from January 1805 to April 1806; and the *second* at Stuttgard, during fourteen months, from June 1810 to August 1811. Ellvanguen is situated 1331 feet above the sea, in 48° 57′ 25″ of N. lat., and Stuttgard at 847 feet, in N. lat. 48° 46′ 32″. Professor Schubler observed no fewer than four hundred and twelve atmospherical precipitations. He used the straw electrometer of Volta, and a simple condenser; and in storms he never pushed his observations beyond the 600th degree of the instrument.

The following table contains the results of these observations.

Direction of the Winds corresponding to the Observations.	Number of observed Precipitations, classed according to the Nature of their Electricity.		Ratio of the Number of Positive and Negative Precipitations.	Mean Intensity of each of the two Electricities.		Mean Intensity of the Electricity, without considering its Nature.	Total Number of Precipitations observed.
	Positive.	Negative.		Positive.	Negative.		
North........................	12	11	100 : 91	131	99	116	23
North-east....................	11	12	100 : 109	105	132	120	23
East..........................	3	5	100 : 166	15	13	13	8
South-east....................	4	7	100 : 175	19	10	13	11
South.........................	5	13	100 : 260	26	23	24	18
South-west....................	28	65	100 : 232	66	33	44	93
West..........................	73	106	100 : 145	75	39	53	179
North-west....................	25	32	100 : 128	31	46	40	57
The three north winds, N.W.—N.—N.E....	48	55	100 : 114	74	75	75	103
The three south winds, S.E.—S.—S.W......	37	85	100 : 230	57	26	39	122
The three west winds, S.W.—W.—N.W....	126	203	100 : 161	57	38	48	329
The three east winds, N.E.—E.—S.E.......	18	24	100 : 133	71	72	72	42
All the winds..............	161	251	100 : 155	69	43	53	412

From these observations Professor Schubler draws the following conclusions:

1. The ratio of the *positive* to the *negative* precipitations follows a regular variation, setting out from the north or south wind, and proceeding either by the *east* or *west* winds.

2. By a *north* wind, the positive precipitations are a little more frequent than the negative ones; by a *south* wind, the *negative* precipitations are more than *double* the *positive* ones.

3. The negative precipitations, by the three south winds, viz. south-east, south, and south-west, are double those by the three *north* winds, viz. north-west, north, and north-east, the ratio being 114 to 230.

4. The *east* and *west* winds hold a mean in this respect. The *former*, however, approach more to those of the *north*, and the *latter* to those of the *south*, the electricity being oftener *negative* by the three *west* winds than by the three *east* winds in the ratio of 161 to 133.

5. The electricity of all the observed precipitations is oftener negative than positive in the ratio of 155 to 100.

6. The mean intensity of the *positive* electricity is, on the contrary, more considerable than that of the *negative*, in the ratio of 69 to 43.[1]

7. The intensity of the electricity, abstraction being made of its nature, is the *strongest* by the three north winds, particularly the north-east and north.

8. The electricity is at an average the weakest by the three south winds. Its intensity is by these three winds in the ratio of 39 to 75 weaker than by the three *north* winds.

9. By the three *east* winds the electricity is in the ratio of 72 to 48 stronger than by the three west winds.

10. The mean intensity of the electricity of all the precipitations, whether positive or negative, observed *in all directions of the winds*, is almost the same as that of the electricity of the precipitations observed *during the west winds alone*.

11. During the *north* and *east* winds the opposite electricities appear most distinctly, and almost with equal intensities. The *west* winds, and particularly the *south*, exhibit, on the contrary, a more feeble electricity, but a greater number of negative precipitations.

12. The *greatest* number of electrical precipitations takes place during *west* winds, and the *least* during *east* winds. The mean direction of the wind during the whole of the precipitations is 86°·9, making use of the formula of Lambert, in which the south is marked by 0°, the west by 90°, the north by 180°, and the east by 270°. The number 86°·9 corresponds with the WEST with four degrees of declination to the south-west.

With respect to the cause of the phenomena now described, Professor Schubler is of opinion, that at the moment of the precipitation of the vapours in our atmosphere, *positive* electricity is at first developed, and the *negative* appears to arise most frequently from the influence of the former. The precipitations which first take place during storms, or passing rains and snows, are commonly *positive*, and are soon followed with *negative* ones of nearly equal intensity. This alternation often happens several times, during which the drops of rain, hailstones, sleet, and snow, continually vary in their size, density, and continuity. At last the electricity growing weaker and weaker, ends by remaining negative; and sometimes after the storm a rain falls with negative electricity.

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[1] Considering the quantity of the two electricities as made up of their intensity, and the number of times that either of them is observed, the ratio of the quantities of positive and negative electricity observed will be 690 to 666, nearly that of equality.

It is however not uncommon to see regular and continuous rains *negative* from their commencement, and during whole days. This fact, together with the feeble intensity of this kind of electricity, seems to favour the opinion that it is often owing to the partial evaporation experienced by the drops of rain during their fall.[1] In confirmation of this he adduces the fact of the negative electricity of the fine aqueous dust at the foot of cascades, which is sometimes so strong in large waterfalls as to make the electrometer diverge more than 100 degrees.

This explanation, Professor Schubler alleges, agrees also with the great frequency of *negative* rains in *south* winds, and of *positive* ones in *north* winds. A current of warmer air, and consequently more light and more elevated, in the first case ought to facilitate the evaporation of drops of rain during their fall; whilst, by the colder north wind, and consequently more heavy and nearer the surface of the earth, the clouds have in general a lower position, and the evaporation of the drops of rain is less easy, and almost nothing.

From these observations it also follows that we must not infer the negative state of the cloud from the negative electricity of the rain which falls from it; for it may happen that rain coming from clouds slightly positive, may become negative by the partial evaporation of the falling drops.

M. Schubler also remarks, that the great intensity of the electricity, and the distinct manner in which the two electrical principles alternately predominate during *north* and *east* winds, seem to arise chiefly from the dryness of the air during their continuance; to which we must add the situation of the clouds brought by these winds near the surface of the earth, the electricity of which may then naturally exert a more sensible influence upon our instruments.

The positive electricity of the atmosphere was found by Saussure to increase in intensity in proportion to the height at which it was collected. When MM. Gay Lussac and Biot ascended in a balloon, they collected atmospheric electricity from the clouds below them, by suspending a wire about 160 feet long from the balloon, and stretching it with a ball of metal. The electricity collected at the upper end of this thread was very perceptible in their electroscope; and when it was examined with a stick of sealing-wax, it was found to be *resinous* or *negative*, although the weather was perfectly serene. This result, though apparently inconsistent with the observations of Saussure and others, has been shown by M. Biot to be perfectly reconcilable with them. In fig. 4, Plate CCXIII. let WW′ be the wire, let us call A the stratum of atmosphere through which the wire passes, B the stratum above this, and C the stratum below it; and let us suppose, what is true, that the atmosphere has positive electricity, which increases with the height. The *positive* electricity in the superior stratum A will attract the *negative* electricity of the wire WW′ with a force equal to + P, and will repel the positive electricity of WW′ with a force equal to + N. The positive electricity in the lower stratum C will do the very same, but in an opposite direction, and with an inferior degree of force, viz. + p and + n, since the electricity increases with the altitude. Hence it follows that the negative electricity of the wire will be attracted towards its upper end by an excess of force equal to $P - p$, and the positive electricity will be repelled to its lower end with an excess of force $N - n$. To MM. Gay Lussac and Biot, therefore, who observed the electricity of the wire at its upper end, the electricity should be *negative;* and to M. Saussure and others, who observed it at its lower end, it should be *positive*.

te XIII. 4.

Upon the same principle, M. Biot explains a very interesting experiment made by M. Hermann. A very sensible electroscope with gold leaves is fixed at a certain height in the atmosphere when the weather is clear, and it there gives no perceptible indications of electricity. A metallic wire, or any other conductor, placed horizontally at the end of an insulating rod, is then placed and kept a short time in a stratum of air a few feet only above the electroscope. It is afterwards quickly brought down so as to touch the electroscope, and the gold leaves diverge with *vitreous* or *positive* electricity; but if, on the contrary, the insulated wire is placed and kept a short time in a stratum of air below the electroscope, and is then quickly raised and made to touch the electroscope, the leaves will diverge with negative electricity. In order to explain these opposite results, we must consider that the insulated conductor is charged at each time with the degree of electricity which belongs to the stratum in which it is placed. When it is carried rapidly, therefore, so that its state is not quite destroyed by the contact of the molecules of air among which it is placed, it will communicate this state to the electroscope. If it comes from *above*, it will carry to it an excess of *positive* electricity; if it comes from *below*, it will carry to it a defect of the same electricity, or an excess of *negative* electricity. "In general," says M. Biot, "let + E be the quantity of free vitreous electricity which the insulated conductor ought to possess, in order to be in a state of electrical equilibrium in the stratum of air where the electroscope is placed, so that whilst it has + E, the molecules of air of this stratum neither give nor take any thing from it. Let it now be carried to a superior stratum, where it takes $E + \delta E$, δE indicating the small excess of vitreous electricity which it has there taken. If we then bring it back quickly into the stratum of the electroscope, it will have $+ \delta E$ too much, and it will communicate this excess to all bodies that touch it. It will communicate it also to the electroscope if it touches it promptly, and, until the latter has lost by the contact of the air this excess which it has imparted, its leaves will diverge vitreously. On the contrary, when the insulated conductor returns from the lower region, it has $E - \delta E$ of vitreous electricity. If we make it touch the electroscope, the latter will partake of its state. Then the quantity of vitreous electricity which it will possess can no longer be in equilibrium with the influence of the mass of the surrounding air, and its natural fluid will be decomposed. But the excess of vitreous fluid which will result from this cannot cause the gold leaves to diverge, because its repulsive force will be wholly employed in compensating that of the exterior electricity E. The repulsive force, then, of the resinous will alone be exerted, because nothing compensates it;

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[1] M. Delarive is of opinion, not only that the evaporation thus occasioned must be very feeble, considering that the air is charged and almost always saturated with humidity; but that if it did take place, it could not generate electricity, as M. Pouillet has shown that the conversion of pure water into vapour produces no electricity. He is disposed to seek for the cause of the negative electricity of rain either in the mechanical action of the air on the falling drops, or in the sudden change of temperature which they experience.

and the gold leaves will diverge in virtue of this electricity, until it has been carried away and neutralized by the immediate and successive contact of the molecules of air. Experiments of this kind present the unique case of an indefinite medium, which is air, of which all the molecules are individually charged with an excess of electricity of the same kind, adhering to their surface; so that the entire mass of the medium is found penetrated with it in a proportion which varies with the altitude. Consequently the different particles of this medium can only be at rest from the mutual compensation of their repulsive forces combined with their gravity; and the same condition is also applicable to conducting bodies which are immersed in it. Thus, for all these bodies the electrical equilibrium cannot take place when their natural electricities are completely neutralized, but only when they possess an excess of either electricity which corresponds to the stratum where they are found, an excess which is vitreous in the atmosphere when it is pure. If they possess a greater excess of this same electricity, they will act only in virtue of this excess upon each other, and upon all the molecules of the surrounding air. They ought, therefore, to repel one another mutually. If, on the contrary, the excess of electricity which they possess is less than that which they would naturally take in the stratum where we place them, the mass of the medium will act upon each of them in virtue of this difference, and their natural electricities will be decomposed as far as is necessary to supply what they want of the electricity of the medium. In virtue of this addition they will repel the medium as much as the medium repels them, and will experience no more action from it. But they will act upon each other with the excess of opposite electricity which they have acquired; and if the medium is an indefinite fluid composed of particles susceptible of electrifying itself by contact, this excess will gradually dissipate in space. Many curious experiments would be necessary to establish the laws of electrical equilibrium, under circumstances sufficiently different from those which we have been generally accustomed to consider."

Electricity of clouds.

The electricity of clouds was noticed by some of the earliest writers on the electricity of the atmosphere. Canton observed that certain clouds were charged with positive and others with negative electricity; and he noticed that the electricity indicated by his apparatus often changed five or six times in half an hour. This fact was confirmed, as we have seen, by the observations of Mr Crosse. These irregularities, however, remained unexplained till Mr Luke Howard distinctly proved that the electricity at the circumference of a nimbus is *negative*, while that of the centre is *positive;* and he suggested it as an interesting subject of inquiry to ascertain if the *negative* electricity was *descending* and the *positive ascending*. Mr J. Foggo undertook this inquiry, and in 1823 he erected a conductor armed with a smoking match, and erected from a south window. On the 12th of March 1824 there was a brisk wind from the north-west, with frequent showers all around. About three P. M. large dense clouds, which discharged heavy showers of hail, passed over the zenith. Between the showers the electricity was always positive, and the leaves of the electrometer showed their maximum divergency. So powerful indeed was the electrical state of the air, that by rubbing the outside of the glass of a detached electrometer with soft leather, the leaves opened more than forty degrees. During the showers, or when the clouds were over head, though no precipitation took place, the electricity was invariably positive, and so strong that sparks could at any time be drawn by the finger from the conducting wire. Mr Foggo likewise ascertained that by taking hold of the wire he could at pleasure intercept the electric fluid from reaching the instrument, so that the charge must have been received from the atmosphere or cloud. When the edge or the circumference of the cloud was nearly over the conductor, the electricity became negative, and appeared to be fully as strong as when it was positive. Mr Foggo, however, now found that it could not be intercepted as formerly by taking hold of the wire, or by touching it with a pointed steel rod. Hence he concluded that the electricity was not proceeding from the cloud as before, but was given off by the earth to the cloud. When the steel point was presented to the instrument, the divergence was so much increased as to endanger the gold leaf, and sparks were heard to pass rapidly between the point and the electrometer, while sharp pricks were experienced when the finger was brought near the brass cap.

Identity of electr- city and lightnin

Such are the general electrical phenomena of the atmosphere during its ordinary changes; but they appear with new splendour, and at once rouse the interest of the philosopher and the dread of the vulgar, when they are exhibited in the terrific grandeur of thunder and lightning. We have already seen that various writers had pointed out the identity of lightning and the electric spark; and though Franklin has obtained the special honour of having been the first who brought down fire from heaven,

> Arripuit fulmen cœlo, sceptrumque tyrannis,

yet he was no more the first who snatched the thunderbolt from heaven, than he was the first who wrested the sceptre from kings.

When Franklin called the attention of philosophers to the various points of resemblance between lightning and the electric spark, he conceived the idea of collecting the electricity of the atmosphere by means of pointed conductors, and of thus preserving buildings from its explosions. One of the first philosophers who endeavoured to verify these views was M. Dalibard, who, at the instigation of Buffon, erected an atmospherical conductor at Marly le Ville, about six leagues from Paris. An iron rod, forty feet long, an inch in diameter, and pointed at its upper end, was erected in a garden upon three large poles, and insulated by silken strings, and a stool with glass feet. In M. Dalibard's absence a thunder-storm appeared on the 10th May 1752, between two and three P. M., and M. Coiffier, who had the charge of the apparatus, drew sparks with a crackling noise from the lower end of it. Having called M. Raulet, the curate of the parish, this gentleman continued for some time, and in the presence of many of his parishioners, to draw large sparks of bluish fire from the conductor. A few days afterwards, on the 18th May, M. Delors drew similar sparks from a rod ninety-nine feet high, erected in Paris. The strongest of them were drawn at the distance of nine lines, and the conductor afforded sparks even when the cloud had moved at least two leagues from above the place of observation. On the 19th day Buffon obtained, at Montbar, similar evidence of the identity of electricity and lightning.

Observ- tions o Romas

In our history of electricity we have already given an account of the observations of the apparatus by which Franklin, in the month of June 1752, obtained sparks of electricity from the atmosphere during a thunder-storm. Attempts were everywhere made to repeat this remarkable observation; and the most successful of these was that of M. Romas, who, according to a decision of the Academy of Sciences, had invented the electrical kite more than a year before it was employed by Dr Franklin. The kite constructed by M. Romas was seven feet five inches high, three feet in its greatest width, and with a surface of eighteen square feet. The string was a cord wrapped round with copper wire. On the 7th June 1753 this kite was elevated to the height of 550 feet, by means of a string 700 feet long, and inclined 45° nearly. A silk cord three feet and a half long was fixed to its extremity, and suspended a large stone to govern the motion of the kite. A tube of white iron, about a foot long and an inch in diameter, was placed near the junction of the string and the silk cord, as a conductor, from which the sparks were to be drawn. From this conductor the spectators drew sparks with their fingers, keys, canes, and swords; and M. Romas having presented his knuckle, received a shock which struck him in the elbows, shoulders, breast, knees, and ankles. Seven or eight persons joined hands, and the shock struck the feet even of the fifth person. The storm now increased, and black clouds gathered in the zenith. At the distance of six inches sparks two inches long were obtained by a discharging rod. The electricity continuing to increase, flashes of fire about a foot long, three inches wide, and three lines in diameter, were frequently received, and the noise of them was audible at the distance of 500 feet. At this time he felt the sensation of a spider's web on his face when he was five feet from the string. The kite was now 650 feet high, and the wind blowing strong from the east, when M. Romas saw on the ground, about three feet from the white-iron tube, three straws dancing up and down below it. One straw was twelve, another five, and the third four inches long. The electricity having increased still more, the longest straw was attracted by the tube, accompanied with three loud sounds, which some compared to the crack of a postilion's whip, and others to that of a large pot of earthenware dashed in pieces on a pavement. This crash was heard even in the centre of the town, and the accompanying flash had the form of a spindle eight inches long and four or five lines in diameter. The long straw followed the string of the kite, and was seen moving with great rapidity even at the distance of ninety or a hundred yards, now attracted and now repelled by the string, each attraction being attended with long plates of fire and constant explosions. A phosphoric smell was distinctly felt. A permanent cylinder of light, about three or four inches in diameter, surrounded the string.

M. Romas again raised his kite on the 16th August, and though the storm was not severe, yet in an hour he obtained thirty beams of fire, nine or ten feet long, and about an inch thick, each accompanied by a noise like that of a pistol. When the glass of his discharging-rod was two feet long, he was able to conduct beams of fire six or seven feet long as easily as he had done those of seven or eight inches, without feeling the slightest shock. On this occasion the string of the kite was above a thousand feet long, and the metallic wire which was coiled round it was continuous throughout.

use of rolling thunder.

It is obvious, from the preceding facts, that the well-known phenomenon of thunder and lightning is entirely an electrical one, the lightning being the electric spark, and the thunder the sound which accompanies it prolonged by successive echoes from among the clouds. That the clouds are capable of reflecting sound was determined by direct observation on the sound of cannon, made by Messrs Arago, Matthieu, and Prony. They observed that in a perfectly serene sky the explosions of their guns were always single and sharp, whereas when the sky was overcast, or when a cloud came in sight and covered any considerable portion of the horizon, the sound of the gun was attended by a long-continued roll like thunder; and sometimes a double sound was heard from a single shot. Sir John Herschel, however, has pointed out another cause for the rolling of thunder, as well as for its sudden and capricious bursts and variations of intensity. "To understand this cause," says he, "we must premise that, *cæteris paribus*, the estimated intensity of a sound will be proportional to the quantity of it (if we may so express ourselves) which reaches the ear in a given time. Two blows, equally loud, at precisely the same distance from the ear, will sound as one of double the intensity; an hundred struck in an instant of time will sound as one blow a hundred times more intense than if they followed in such slow succession that the ear could appreciate them singly."

Now let us conceive two equal flashes of lightning, each four miles long, both beginning at points equi-distant from the auditor, but the one running out in a straight line directly away from him, the other describing an arc of a circle having him in its centre. Since the velocity of electricity is incomparably greater than that of sound, the thunder may be regarded as *originating* at one and the same instant in every point of the course of either flash. But it will reach the ear under very different circumstances in the two cases. In that of the circular flash, the sound from every point will arrive at the same instant, and affect the ear as a single explosion of stunning loudness. In that of the rectilinear flash, on the other hand, the sound from the nearest point will arrive sooner than from those at a greater distance; and those from different points will arrive in succession, occupying altogether a time equal to that required by sound to run over four miles, or about twenty seconds. Thus the same *amount* of sound is in the latter case distributed uniformly over twenty seconds of time, which in the former arrives at a single burst; of course it will have the effect of a long roar, diminishing in intensity as it comes from a greater and greater distance. If the flash be inclined in direction, the sound will reach the ear *more compactly* (i. e. in shorter time from its commencement), and proportionally more intense. If (as is almost always the case) the flash be zigzag, and composed of broken rectilinear and curvilinear portions, some concave, some convex to the ear; and if, especially, the principal trunk separates into many branches, each breaking its own way through the air, and each becoming a separate source of thunder, all the varieties of that awful sound are easily accounted for.

Distance of thunder.

The distance of the point in the atmosphere where the lightning is generated, may be readily computed by multiplying 109° by the number of seconds which elapse between the flash and the first stroke of thunder. The product will give in feet the distance required.

The general phenomenon of thunder and lightning occurs during the passage of electricity between two clouds oppositely electrified, or one of which has an inferior charge of the same kind of electricity; but it appears in its most appalling form when the accumulated electricity of the clouds descends to the earth, shivering the strongest oak in its passage, rending the thickest walls, setting fire to houses, or stacks, or forests, and instantly destroying animal life, when the frail tenement of man or of beast happens to obstruct its path, or afford to it a more easy transit. Sometimes, however, the thunderbolt passes from the earth to the clouds, and in this case it is called the *ascending thunderbolt*. The Marquis Maffei was the first who observed this curious phenomenon. He distinctly saw during a storm the lightning issue from the ground with a loud noise. The Abbe Lioni and M. Seguier of Nismes saw the lightning rise in the form of a flame six feet high, followed by a loud noise.

Ascending thunderbolt.

One of the most interesting cases of the ascending bolt has been recorded by John Williams, Esq. It took place upon the hills above the village of Great Malvern, on the 1st of July 1826. A party had taken refuge from the storm in a circular building roofed with sheet iron, and one of the ladies on entering the hut expressed her alarm lest the lightning should be attracted by the iron roof. They had scarcely entered their retreat, and were about to partake of some refreshment, when a violent storm of thunder and lightning came on from the west. About forty-five minutes past two, a gentleman who stood at the eastern entrance saw a ball of fire which seemed to him moving on the surface of the ground. It instantly entered the hut, forcing him several paces forwards from the doorway. On his recovering from the shock, he found his sisters on the floor of the hut, fainting, as he imagined, from terror. Two of the ladies had died instantly; another lady, and the rest of the party, were much injured. The explosion which followed the flash of lightning was said by the inhabitants of the village to have been terrific. Mr Williams, who immediately examined the hut, found a large crack in the west side of the building, which passed upwards from near the ground to the frame of a small window, above which the iron roof was a little indented. Mr Williams conceived it to be quite clear, from the place of the fragments of stone and other appearances, that the clouds were negatively electrified during this storm.

Electrical phenomena on mountains; on Mount Breven;

Various electrical phenomena of a very interesting kind have been observed by travellers when ascending lofty mountains. In 1767, MM. Saussure, Pictet, and Jallabert, when on the top of Mount Breven, received small electric shocks at their finger ends by stretching out their arms, and a whistling noise even accompanied them. The gold button on M. Saussure's hat yielded distinct sparks.

on Mount Ætna;

In 1814, a party of Englishmen experienced similar effects on Mount Ætna during a storm of thunder and lightning accompanied by a heavy fall of snow. One of the party felt his hair moving, and upon raising his hand to his head a buzzing sound issued from his fingers. The rest of the party experienced the same sensations, and by moving their hands and fingers they produced a variety of musical sounds, audible at the distance of forty feet.

on Ben-Nevis.

On the 27th of June 1825, Dr Hooker and a party of botanists witnessed effects like those described, during a fall of snow on Ben-Nevis when there was no thunder-storm. The snow fell very heavily for nearly two hours. Soon after it began, a hissing sound was heard everywhere around them, and continued about an hour and a half. It seemed to proceed from every point in the vicinity; and on arriving at the cairn on the summit of the mountain, they could almost determine the stones from which the electricity issued. The hair of several of the party exhibited, when touched, the usual electrical phenomena.

On the transport of ponderable substances by lightning.

Before quitting the subject of lightning, we must submit to our readers a brief account of the remarkable observations made by M. Fusinieri on the ponderable substances transported by lightning in its passage, and which it deposits in a permanent state on the bodies which obstruct its passage. When we consider the magnitude of the scale on which the great electrical machine of our atmosphere enables us to study its effects, it appears strange that so little attention has been paid to those interesting phenomena which accompany the electric stroke. M. Fusinieri is the only person who has made this an object of special investigation; and the results to which he has been led possess, as might have been expected, a very peculiar interest. The following are the general results which he obtained: Lightning contains, like the common electric spark, matter in a state of extreme division, and in a state of ignition and combustion. In the matter deposited by lightning on houses and on trees which have been struck by it, he has found *iron*, *sulphur*, and *carbon*. Lightning divides and subdivides itself indefinitely into sparks, which end in being not much larger than those of ordinary machines; and each of these sparks contains ponderable substances in the state of extreme division already mentioned. The lightning deposits the substances with which it is charged while it passes through them, and while it breaks hard bodies; and it deposits them on the surface by which it enters the body, as well as on that by which it escapes, and also on the surfaces of fracture. When the resistance to its passage is not great, it leaves no perceptible deposit; and the quantity of matter deposited increases, and is proportional to the difficulty with which the lightning traverses the body. At the same time that lightning deposits the matter which it contains, it takes up new matter from the combustible bodies, such as iron, charcoal, &c. through which it passes. The deposited matter tends always to expand itself in thin films on the surface which receives it, and it does this most readily on surfaces that are smooth and free from all asperities.

In examining the traces left by lightning when it fell at Vicenza in 1829, and at Padua in 1831, M. Fusinieri made the following observations: It deposited on the surface of a wall by which it entered the house, a thin layer of pulverulent matter, of a brown colour at its centre, and yellowish and much less deep at its margin. When this matter was collected and carefully examined, it proved to be *iron* in different degrees of oxidation. Upon some stones which the lightning had detached from the wall there was found a stratum the fiftieth of an inch thick, and of a brownish colour, which seemed to have undergone a species of fusion. This stratum was *sulphuret of iron*, which gradually changed into a sulphate of the same metal. M. Fusinieri indeed had previously found small crystals of sulphuret of iron upon an iron rod which the lightning had struck, and also upon a stone to which it had passed from the iron. The position of these crystals indicated that they had been formed in the middle of the passage of the lightning; a fact which he considered as proving that the electric matter could transport sulphur across metal itself. When the lightning escaped from the wall, it deposited upon the wood a dust composed of small aggregated grains, which had all the qualities of ferruginous matter. In pursuing the passage of the lightning, it was found to have divided itself into a great number of sparks more or less voluminous upon the windows, formed of pieces of rectangular glass united in a leaden frame. The traces left on the glass and on the lead were very slight, and there were only a few marks on the glass very near its contact with the lead. The traces on the lead were small cavities, round which there had been a fusion of the metal. Some of these cavities passed through the whole thickness of the lead, and their diameters varied with the size of the sparks that had produced them. In general, each cavity of any size was surrounded with several smaller cavities, which seemed to prove that each discharge was accompanied by smaller electric sparks disseminated around it. Besides these cavities, the lightning had spread on the surface of the metal a stratum of pulverulent matter, which adhered so strongly to the lead that none of it could be detached without removing at the same time a portion of the metal. Each large cavity was the centre of one of these strata, which appeared to be composed of globules of lead in the central part, and ferruginous dust on the margin. The glass, though an insulating body, was, as we have mentioned, marked also by the lightning. The origin of the thin strata formed on its surface was at those points where it had been in contact with the lead; but they extended much beyond this, and were composed at first of a powdery matter, sometimes blackish and sometimes whitish; and beyond this they terminated in continuous and diaphanous laminæ, which reflected the colours of thin plates. The central and pulve-

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rulent portion was lead; the exterior portion, and the thinnest, appeared to be iron more or less oxidated. On one occasion one of these thin plates was formed of an extremely thin stratum of metallic iron not oxidated. M. Fusinieri had formerly succeeded in diffusing metals in thin plates upon mercury by the common electric spark; and he considers the fact, that the same phenomenon takes place on glass as on mercury, as demonstrating that the effect is not owing to a molecular attraction of the surfaces, but solely by the property of expansion which is possessed in a state of fusion by those substances which are transported by the lightning. This property belongs in an especial manner to combustible bodies, particularly to metals, though these last do not all enjoy it in the same degree. Iron, for example, is more expansible than lead, as is demonstrated by the thin films which are deposited by electrical discharges.

M. Fusinieri next proceeds to describe the traces of iron, &c. which lightning deposits upon trees. By means of chemical re-agents and the magnetic needle he had previously determined that traces of iron had been left by lightning on two poplars and a pear-tree which it had struck; and he also found traces of sulphur at the extremity of the roots of a poplar tree, at which the lightning had escaped. These observations were confirmed subsequently by many others. A poplar having been struck at Casale, near Vicenza, on the 14th May 1829, M. Fusinieri found that the part of the trunk deprived of its bark was covered with small black spots, which he regarded as produced by the sparks already mentioned which had been disseminated by the electric current at the instant its bark was carried away. The bark itself must have been reduced into extremely small parts, and immediately consumed, for not a vestige of it could be found. It would appear also that the lightning had carried away a part of the wood which it decomposed, such as the carbon, while the rest was volatilized. Traces of sulphur were found at the foot of the tree; and the lightning having insinuated itself between the bark and alburnum of the roots, there was felt, by removing the former, a strong odour of sulphuretted hydrogen, similar to, though more powerful than, that which the traces of sulphur had left upon the ground. The roots torn asunder by the lightning were impregnated with a moist and brownish matter, which was extraneous, but which had penetrated into their organic tissue with the lightning which conveyed it. This matter exhaled the same fetid odour as the surrounding earth, especially that portion of the earth which, from being in contact with the roots, was impregnated with the same brownish matter. In penetrating farther into the earth, it was found traversed by serpentine furrows, covered with a cinereous matter, the odour of which was the same as that which was exhaled by the other traces of lightning. The serpentine form of these furrows clearly indicated the tendency of the lightning to disseminate itself. All these substances and deposits were carefully collected and examined by M. Fusinieri.

In a pear-tree which had been struck with lightning in 1827, M. Fusinieri discovered very remarkable effects. Though its trunk, three feet in diameter, was torn into four parts throughout its whole length, no foreign matter nor odour could be perceived either in its roots or in the earth. At the places where the branches joined the trunk, *the substance of the pear-tree* was altered to the depth of several lines. It had acquired an acid taste and a reddish colour. It exhaled while burning a penetrating and peculiar odour, and it continued to burn without flame till it was completely consumed. The matter of the lightning had therefore penetrated the tissue of the wood, and there presented traces of iron.

M. Fusinieri has collected and detailed many interesting observations respecting the substances deposited by lightning upon the various parts of houses which have been struck by it; but we regret that our limits will not permit us to pursue any farther this most important subject.

These and many other facts seem to prove that iron exists in the air and in clouds; and it is well known that the same metal mixed with manganese, nitrous salts, and organic substances, is found in rain water. M. Fusinieri is of opinion that the iron has been drawn from the earth, and chiefly from mountains, where the mines are most frequented, and where storms commonly begin to form.[1] The colouring matter of snow and rain, and the existence of meteoric stones, prove the existence in our atmosphere of dry and ferruginous vapours, the molecules of which are more or less rarefied or condensed according to the causes which may generate them. The fact that meteoric stones fall during the prevalence of storms and other electric phenomena, and especially the fact that hailstones have sometimes a nucleus of small pieces of sulphuret of iron, appear to M. Fusinieri to afford the true origin of these remarkable bodies. It has been already proved also, that electricity does transport matter; and when we consider, as Ampere has shown, that magnetic currents surround our globe, that matter in an extreme state of subdivision spontaneously expands itself, that radiating heat, like electricity, transports ponderable substances, we may obtain a very simple explanation of the origin of meteoric stones. As the temperature of the surface of the globe is not high enough to detach from it the material bodies which exist in the atmosphere, M. Fusinieri concludes that we ought to attribute this action to other causes, which are yet to be discovered, rather than deny a fact so completely demonstrated.

Fulminary tubes.

Among the remarkable effects of atmospherical electricity may be numbered the production of what are called *fulminary tubes*. These tubes are of different lengths, and are produced by the passage of lightning through beds of sand, the particles of sand being agglutinated by the action of the electric fluid. Dr Fidler has collected and described many of these tubes from different localities; and their electrical origin has been placed beyond a doubt. M. Hachette conceived the idea of imitating these tubes by using a strong electrical battery; and he and M. Savart and M. Beudant having placed a quantity of pounded glass in a hole made in a brick, and having caused the electrical discharge of the battery to pass through the pounded glass, they succeeded in forming tubes exactly similar to those formed by atmospherical electricity. One of those which they made was an inch long, its external diameter varying from one sixteenth to one eighth of an inch, and its internal diameter being the fiftieth of an inch. In another experiment, where a little chloride of sodium was mixed with the pounded glass, the length of the tube was an inch and a fifth, and of uniform diameter. Its mean external diameter was one fifth of an inch, and its internal diameter one twentieth of an inch. When they used powder of felspar or pounded quartz, they could not succeed in making the tubes.

Hail.

Among the phenomena of atmospherical electricity, one of the most interesting is the production of hailstones, particularly those of an enormous size. The connection

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[1] The returning stroke of lightning, when it passes from mountains or places containing iron and other metals, must necessarily carry along with it these substances in a state of extreme subdivision. See p. 620.

Volta's theory.

Matteucci's theory.

between the formation of hail and an atmosphere highly charged with electricity has been long ago recognised; but our almost total ignorance of the subject may be inferred from the character of the hypotheses which have been framed to account for the production of hail. Volta supposes that a small globule of snow becomes a hailstone, gradually increasing in size by being kept in a state of reciprocating motion between two clouds charged with opposite kinds of electricity, until the gravity of the constantly increasing mass overpowers the electrical force, or till the electricity of the clouds is spent by their mutual re-action. M. Matteucci has justly objected to this strange hypothesis, that it is difficult to conceive how a hailstone nearly two pounds in weight could be formed by such a process. He denies that the clouds possess an electric force sufficient to produce such an effect; and, admitting that such a force does exist, he maintains that the electricity would be directly discharged from the one to the other. M. Matteucci conceives that the hailstones are produced instantaneously, and that they fall completely formed. He considers that there can be only two epochs in their formation, viz. the production of the snowy nucleus; and, secondly, that of the icy crust which covers it. When a cloud has its temperature greatly reduced, it is easy to conceive its surface covered with small flocks of snow; and if an electrical discharge should in this case pass through it, it would give rise to hail, by obliging the cooled vesicles to condense round each snowy nucleus. It is this shock, he observes, which is necessary to destroy the inertia of the particles, which ought to unite to each other, as is seen in the experiment of the congelation of water with the cryophorus of Wollaston. M. Matteucci was led to these views by studying the hail-storm which took place at Tussi on the 24th July 1832. About six o'clock A. M., after a brilliant sun, the whitish and scattered clouds were seen suddenly to unite, and to form a thick mass scarcely detached from the horizon, and which covered the country with a thick darkness, that continued uninterrupted by the effects of strong electrical discharges. An impetuous north-west wind soon rose, and was followed by copious rain mixed with hail. This storm, which lasted about fifteen minutes, was followed by a lucid interval, after which there fell a thick snow, which ceased and began again several times. "I do not wish," says M. Matteucci, "to cite any facts which might appear fabulous; but it appears certain that a hailstone was found which weighed *fourteen pounds*, and that another in falling upon a house forced its way through the roof; that trees from three to six centimeters in diameter were destroyed; that oxen were wounded, and that several walls were overthrown or rent by the force of the hail. I state as certain, the fact that hailstones collected a few instants after their fall, still weighed a pound and a half. M. Pouillet assures us that he can himself certify that hailstones have fallen half a pound in weight. I can certify that they have fallen three times that weight."

Paragreles.

In consequence of the demonstrated connection between hailstones and a certain electrical state of our atmosphere, M. Lapostolle, professor of physic at Amiens, proposed to protect vineyards and other cultivated grounds from the destructive effects of hail, by erecting wooden poles twenty-five feet high, for the purpose of carrying off the atmospherical electricity. The use of these hail-rods has extended itself over France, Switzerland, Germany, and Italy; and it is not easy to resist the evidence that has been collected of their efficacy, notwithstanding the opposition that they have met with from many scientific individuals. Each pole is supposed to protect a circle of a hundred or a hundred and thirty feet, in the centre of which they are placed. Rods of metal being too expensive, they are made of wood, in a way which will be described in a subsequent part of this article. Each rod does not cost more than a few shillings, and the practice is to take them up after having put them under cover with the other rural implements, and replace them at the vernal equinox.

Water-spouts.

Another phenomenon, which is either formed by atmospherical electricity or connected with it, is the water-spout, a meteor of rare occurrence, and often most destructive in its effects. That distinct electrical phenomena are developed during the continuance of certain water-spouts cannot be doubted; but the electricity has in these cases been supposed to be a secondary phenomenon, produced by the motion of the air. This view of the subject has received some support from the researches of M. le Comte Xavier de Maistre, who has succeeded in imitating the principal phenomena of water-spouts, and even the co-existing ascending and descending currents, by the mechanical circular motion of a liquid; and it is to this mechanism of the water-spout that the electrical phenomena are ascribed. The lower parts of the atmosphere, and those above the clouds, are brought to the same point by the two interior and opposite currents of the spout, and strata of air charged with vapour, and often with different electricities, are thus brought into union, and produce the electrical phenomena in question.

Sheet o summer lightnin

Matteu ci's the of sheet lightnin

The well-known phenomenon called *sheet or summer lightning* has recently been examined by M. Matteucci of Bologna. This ingenious author considers it to be proved that there is an accumulation of one of the two electricities at the surface of the earth; and he ascribes this electricity either to evaporation or to the analogous causes which M. Pouillet has substituted for it, or to chemical actions which are constantly going on in the interior of the earth. In order that this electricity may not escape and pass immediately into the mass of the globe, as soon as it is developed it is necessary that the ground in which it is accumulated may not be a conductor, either from its own nature, or in consequence of the evaporation which dries it. It is also chiefly in high and insulated places rather than in the plains, above rocks rather than above forests, in summer rather than in winter, in the middle of the day rather than in the night, that these stormy clouds show themselves, whose formation cannot be well accounted for but by the influence of the electricity which the ground retains. To what other cause, he asks, can we attribute those clouds which are sometimes suddenly formed on the flanks of mountains, and afterwards rise into the air, without any variation of temperature, any change of barometrical pressure, or any other apparent modification in the state of the atmosphere? In applying these principles to the explanation of summer lightning, he considers the electricity of the earth's surface to be detained there by the desiccation of the ground, which renders it an insulator. At the moment of sunset, and during the night, the vapours which are thus condensed by cooling near the ground form a conducting stratum which serves to re-establish by degrees the electrical equilibrium between the atmosphere and the earth, which are charged with opposite electricities. It is chiefly in the plains, he conceives, that we ought to observe sheet lightning; and it ought to last a much longer time, because on elevated and insulated places the flow of electricity accumulated during the day will be much more rapid, on account of their form and position in the middle of an atmosphere more rare, more cold, and consequently more highly charged with vapours. These electrical discharges between the ground and the atmosphere may, according to our author, take place with much force, and produce even violent effects, especially if the ground and the atmosphere are too much dried;

and he supposes that some earthquakes, and particularly those which take place after great droughts, may be owing to this cause. This supposition explains, in a satisfactory manner, the process employed by the ancients, and often with success, to protect from earthquakes those places which are subject to them, and which are particularly those where the nature of the ground renders the accumulation of electricity easy, and its escape difficult. This process consisted in sinking into the ground, even to a considerable depth, long bars of iron, which, according to the explanation given above, ought to facilitate the establishment of the electric equilibrium, by establishing a metallic communication between the interior of the ground and the surface, which, by its insulating faculty, retains its electricity.

urora bo-
lis.

Among the atmospheric meteors generated by electricity the aurora borealis holds a distinguished place. The phenomena which it exhibits have already been fully described under another article (the AURORA BOREALIS), but it belongs to our present subject to treat briefly of its electrical origin. The crackling and hissing noise of electricity passing from one place to another has been distinctly heard in this country by Mr Nairne and M. Cavallo, and we can ourselves bear testimony to the same fact. In the north of Europe the sound accompanying the northern lights is an universally admitted fact, and proves beyond a doubt that, in certain auroras at least, the atmosphere is highly charged with electricity. Mr Trevelyan learned when he was in Faroe that the peculiar smell which accompanies electrical discharges was distinctly felt during a brilliant aurora; and in the year 1821 Sir David Brewster had the good fortune to observe, at Belleville in Inverness-shire, an aurora the phenomena of which were actually combined with those of a thunder-storm. This case is so remarkable, and so instructive, that we shall give the description of it in his own words: "On the evening of the 29th August, about half past nine o'clock, P. M., when there was not a breath of wind, and when the thermometer stood at 63°, the noise of very distant thunder was heard towards the south; sheets of very brilliant lightning illuminated the sky, issuing in general from a small black cloud near the horizon. I was surprised, however, to observe, that, with the exception of a few thin black clouds, which were rendered visible by the lightning, the greater part of the sky was covered with shining masses, like those which form the aurora borealis. The stars were easily seen through this luminous matter, which was arranged in irregular masses separated by clear intervals, but having a tendency to assume the appearance of irradiations diverging from the cloud whence the lightning appeared to issue. When the lightning flashed, it was propagated in a particular manner along these masses of light; but, what was very singular, the luminous patches were constantly in a tremulous or undulating motion during the intervals of the flashes of lightning. They shifted their place and changed their form exactly like the light which appears in many of the varieties of the aurora borealis. As the luminous clouds now described did not appear in the northern part of the horizon, and were distinctly related in their position and form to the thunder-cloud from which the lightning emanated, we are entitled to refer the two classes of phenomena to the peculiar electrical condition of the atmosphere, and to suppose that the phenomena of the aurora borealis may have an analogous origin." It seems now to be clearly proved that auroræ exist not only at great heights in our atmosphere, such as from 62 and 105 miles, the lowest as given by Cavendish and Dalton, to 500 and even 1000 miles, as measured by other observers; but that they appear even close to the earth, in the lowest region of the atmosphere, is clearly established by a decisive observation of Captain Parry's.[1] In the first of these cases it would be in vain to look for electrical indications, when the meteor is so far beyond the sphere of our electroscopes and the reach of hearing; but, in the latter case, we may reasonably expect not only to observe the peculiar electric state of the atmosphere, but also to hear the sound which invariably accompanies the passage of the fluid. This view of the subject reconciles the apparently contradictory observations which have been made on the aurora; and the connection of the phenomenon with the magnetic meridian, as well as its influence in certain cases on the magnetic needle, present no difficulty since the recent discoveries respecting the connection between electricity and magnetism.

Fire-balls.

That the other luminous phenomena of the atmosphere have their origin in its electricity cannot be doubted. Fire-balls or globes of fire have been observed at altitudes from 30 to 100 miles, and moving with velocities varying from 5 to 33 miles in a second. These balls of light sometimes leave behind them a luminous track after they have vanished. Sometimes they explode into globes of a smaller size, sometimes they are dispersed into divided sparks, and at other times they are accompanied with showers of meteoric stones. Falling or shooting stars are only the same phenomena on a smaller scale; they appear at all seasons, but most frequently during the prevalence of the northern lights, and generally in the lower regions of the atmosphere. The prismatic columns of light which were observed by Mr Fisher and others in the arctic regions have obviously an electrical origin. "On the afternoon of the 25th October Mr Fisher observed at Winter Harbour two vertical columns of prismatic colours, about 15° on each side of the sun, which was below the horizon; they were about 5° long, and their lower end touched the horizon: they continued for about an hour, from noon to one o'clock. Similar columns were observed two or three times, and about the same time the aurora appeared.

Columns of light.

Fire of St Elmo.

The fire of St Elmo, or Castor and Pollux, is a brilliant light which frequently appears on the summits of ships' masts, on the points of bayonets, on the tops of spears, and on the tips of the ears of horses. It is obviously nothing more than the electricity discharging itself either from or into pointed bodies. Its connection with the electrical state of the atmosphere is obvious from the following account of the phenomenon as given by Lord Napier, who saw it in the Mediterranean in June 1818. "About nine, when the ship was becalmed, the darkness became intense, and was rendered still more sensible by the yellow fire that gleamed upon the horizon to the south, and associated by the deep-toned thunder which rolled at intervals in the mountains, accompanied by repeated flashes of that forked lightning whose eccentric course and dire effects set all description at defiance. By half past nine the hands were got aloft to furl the top-gallant sails and reef the top-sails, in preparation for the threatening storm. When retiring to rest, a sudden cry of St Elme and St Ann was heard from those aloft and fore and aft the deck. On observing the appearance of the masts, the main top-gallant-mast head, from the truck, for three feet downwards, was completely enveloped in a blaze of pale phosphoric light flitting and creeping round the surface of the mast. The fore and mizen top-

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[1] Mr W. C. Trevelyan observed that the aurora borealis in Faroe and Shetland was often seen very low, not more than 40 or 60 feet above the sea, and he learned that in both countries it is distinctly heard.

Phenomena and Laws.

gallant-mast heads exhibited a similar appearance. This lambent flame preserved its intensity for the space of eight or ten minutes, and then it gradually became fainter, till it diminished at the end of half an hour."

An interesting case of the fire of St Elmo, in which the electricity first settled on the most prominent metallic body, and then on the bodies next in conducting power, is described in the memoirs of the Count de Forbin. "In the night," says he, "it became extremely dark, and it thundered and lightned fearfully. As we were threatened with the ship being torn to pieces, I ordered the sails to be taken in. We saw upon different parts of the ship above thirty St Helmo's fires; amongst the rest was one upon the top of the vane of the mainmast, *more than a foot and a half in height.* I ordered one of the sailors to take the vane down; but scarcely had he taken the vane from its place, when the fire fixed itself upon the top of the mainmast, from which it was impossible to remove it."

Sometimes the electricity of the atmosphere shows itself at the yard arms and mast heads of vessels, in the form of balls of fire. Captain Clavering of the Griper experienced a severe gale, which lasted three days without intermission, when about 100 miles to the west of the Fiord of Drontheim. This gale was remarkable for the small amount of the effect produced on the barometer, on its approach, during its continuance, or after its cessation; and Captain Clavering was induced, from this and other causes, to ascribe it to a disturbed state of electricity in the atmosphere. It was accompanied with very vivid lightning, which is particularly unusual in high latitudes during winter, and by the frequent appearance and continuance for several minutes of balls of fire at the yard arms and mast heads. Of these no fewer than *eight* were counted at one time. This phenomenon is obviously an interesting variety of the fire of St Elmo.

The observations which have been detailed in the preceding section place it beyond a doubt that the electricity generated in our atmosphere is identical with that which is developed by friction. Philosophers, however, have sought to establish their similarity as chemical agents. M. Bonjol, for example, has decomposed water by means of the electricity of the air collected by an insulated pointed rod, in stormy states of the atmosphere; and the late unfortunate Mr Alexander Barry, who lost his life in the cause of science, succeeded in August 1824 in decomposing a solution of sulphate of soda coloured with syrup of violets. Bubbles of hydrogen appeared in the tube connected with the string of the electrical kite, while bubbles of oxygen appeared in the tube connected with the ground. In about ten minutes the blue liquid in the first tube became green from the separation of the soda, while the sulphuric acid, by passing to the pole in the other tube, changed its contents, as usual, red. See page 632.

CHAP. III.—ON THE CHANGES PRODUCED BY ELECTRICITY ON ORGANIC AND INORGANIC BODIES.

Changes produced by electricity.

That electricity is a powerful agent in the material world, has long been the opinion of those who have studied its effects. We have clearly seen that it performs a distinguished part in the economy of our atmosphere; but there is reason to believe that its agency is still more general, and that it exercises an influence almost universal over the laws of inorganic matter, as well as over the functions of organic life. Our knowledge, however, on these subjects is but in its infancy; and though the following sections will present to the reader many interesting and important phenomena, he will not fail to deduce from them the conclusion, that a wide field of discovery is yet unexplored, and that there is no branch of science more likely to reward the diligence of the young philosopher than that which treats of the agency of the electric fluid in animal and vegetable life, its effects upon inorganic matter, and its connection with the imponderable agents of light and heat. The general effects of electrical action may be comprehended under the following heads:

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1. On the mechanical changes produced by electricity on inorganic bodies.
2. On the chemical changes produced by electricity on inorganic bodies.
3. On the changes produced by electricity on phosphorescent bodies.
4. On the changes produced by electricity on odoriferous bodies.
5. On the magnetic effects of electricity.
6. On the effects of electricity on animal bodies.
7. On the effects of electricity on vegetable bodies.

SECT. I.—*On the Mechanical Changes produced by Electricity on Inorganic Bodies.*

Mechan cal effe of electr city.

Although we know nothing of the real nature of the electric principle, yet, from its properties and effects, it has been found convenient to speak of it as a fluid. Its action upon bodies which either obstruct its motion, or afford it a ready passage, renders its analogy with a fluid still more striking, and we are thus enabled to comprehend phenomena which it would otherwise be more difficult to understand. A canal with a smooth bottom and sides may be considered as a good conductor of the aqueous fluid, and a river with a rocky bed and a tortuous course may be regarded as a bad conductor. Small quantities of water turned into each of these conductors will find its way by a slow movement, without injuring the surfaces over which it flows, just as a small or a large wire will carry off small quantities of electricity without suffering any mechanical change. But when the current of water is deep and strong, it will overcome its obstructions, burst its barriers, and destroy the channel which at first confined it; while the same current running with the same velocity in a smoother bed will make its way without producing any change upon the materials over which it runs; in the same manner as a small metallic wire will sometimes be expanded and sometimes burst in pieces when it transmits with difficulty an electric discharge, whereas the same discharge will find an unobstructed passage through a wire of still greater diameter.

Expans

The influence of electricity in expanding solid bodies was discovered by Dr Priestley during his experiments on the effects of explosion through metallic substances, when he found that a chain *was actually shortened* after the charge of a battery had been sent through it. A length of chain of exactly twenty-eight inches, after having transmitted a charge of sixty-four square feet of coated glass, was shortened one fourth of an inch, or $\frac{1}{256}$th part of the whole.

Mr Nairne found that a piece of hard drawn iron wire, ten inches long and $\frac{1}{100}$th of an inch in diameter, after receiving many times in succession a discharge of twenty-six feet of coated glass (or nine jars), was shortened $\frac{5}{40}$ths of an inch, or $\frac{1}{133}$d of an inch, by such discharge. Its length was examined after the sixth, ninth, and fifteenth discharges. The total contraction of the wire was fully one inch and one tenth, or *one ninth of the whole length.*

Mr Brooke obtained a contraction still higher than this, by passing a charge of nine bottles or sixteen feet of coated surface nine times in succession through a steel wire twelve inches long and $\frac{1}{100}$th of an inch in diameter. The wire was shortened *one inch and a half,* or *one eighth of its whole length.*

If the wire, however, through which the shock is passed nome- and aws ansion.

has suspended to it a weight so as to stretch it considerably, the wire will be increased in length, in place of being diminished. This effect is by no means inconsistent with those already described. The heat, which, as we shall afterwards see, is always evolved during the transmission of an electric charge, produces a softness short of fluidity, which allows the extending force to overcome the absolute tenacity of the wire.

It is very obvious that the contraction of the wire in one dimension in these experiments was owing to its expansion in a direction at right angles to the length, in the same manner as a piece of caoutchoue extended in one direction is shortened in the other. Mr Nairne indeed observed that the wire had increased in thickness; but though he used a pair of scales which turned with one eighth of a grain, he could not observe any change in the weight of the wire.

The same phenomenon takes place in fluid metals. If, for example, we fill a capillary or thermometer tube with mercury, and transmit through the mercurial column an electrical charge, the metal will suffer such a degree of expansion as to burst the tube to pieces.

When the body which transmits the shock has a less conducting power than metals, the tendency to expand will of course be still greater. If a little water, for example, is placed in a glass tube, and a shock passed through the water, the tube will burst by the expansion of the fluid; and the experiment will succeed even if a common drinking glass is filled with water and substituted for the tube. Beccaria placed a drop of water in the centre of a solid glass-ball, and burst the ball by transmitting a shock through the fluid drop. This experiment was beautifully varied by the Italian philosopher, who constructed a small mortar, and having put a ball into it, he placed behind the ball a drop of water, so as to lie between the two wires which passed through the side of the mortar. When an electric charge was sent through the two wires, the expansion sustained by the water drove out the ball with great velocity. M. Lullin gave the ball a still greater impulsion by substituting a drop of oil for the drop of water.

Even when the conductor is air, a violent expansive effect is created during the transmission of the electric shock. This effect is well shown by fitting a cork cap into an ivory mortar having a cavity an inch deep and half an inch wide. When a shock is sent through the wire in this cavity, it is expanded so suddenly as to drive out the cork with great violence.

When the electric shock is made to pass through solid bodies which are imperfect conductors, such as wood, stone, sugar, and glass, they will be broken by the expansion which is produced. In the case of glass not very thick, it will be broken into innumerable pieces. When the glass is so thick as to resist the shock, it is marked with vivid prismatic colours, which Mr Henley supposes to be thin laminæ of the glass separated from one another by the shock.

The expansive effect created by the shock is finely exhibited by dipping a clean brass chain in melted rosin, and laying it upon paper. If the charge of thirty-two square feet of coated glass is sent through it, the resinous coating will be driven off from every part of the chain, which will be entirely cleared of it.

When a clean uncoated brass chain is laid upon a plate of glass, and a charge of thirty-two square feet passed through it, the glass will be marked in every part of its surface where it was touched by the chain, every marking having the width and colour of the link. The metal could be scraped off the glass at the outside of the mark, but it was actually driven in other places into the pores of the glass. Dr Priestley, who made this interesting experiment, produced a similar effect upon glass with a silver chain, and small pieces of other metals.

Phenomena and Laws.

Diffusion of metals into vapour.

The reader who has perused with attention our chapter on Electric Light, will recognise in these experiments the origin of those beautiful results which have been obtained by Fusinieri, by passing the electric shock from a metallic ball to a polished metallic surface; and the diffusion of solid bodies into metallic vapour, as it may be called, is finely illustrated in the following experiments. Take three strips of window glass, each about three inches long and one wide, and having placed two narrow strips of gold leaf or leaf brass between them, so that the ends of the gold leaf project a little beyond the glass, transmit the charge of a large Leyden jar through the gold leaf. The gold leaf will be found to be melted by the shock, and driven into the surface of the glass. The outer plates of glass are generally broken in this experiment, and the middle one, which frequently remains entire, has an indelible metallic stain upon each of its surfaces. This stain is obviously the metallic vapour of the gold driven into the pores of the glass.

The dispersion of gold or silver into a metallic vapour may be exhibited in another manner. Let a strip of gold or silver leaf, or Dutch metal, be fixed with gum to the surface of a piece of paper, and be placed in such a manner between the forceps of an universal discharger, that a strong electrical charge may be passed through it. The metallic strip will entirely disappear, in consequence of having been dispersed into a vapour or powder, part of which remains in a state of oxidation on the paper, which, from this cause, receives a greenish-brown tinge.

The metallic colours thus obtained have been employed for impressing ornamental figures upon paper or silk. In order to do this, trace the outline of the figures on thick drawing paper, and having cut it out as in stincil plates, place it on the silk or paper intended to be ornamented. When a gold leaf is laid upon it, and a card above the gold leaf, the whole is placed in a press or beneath a weight, and an electrical charge sent through it; the metallic stain is limited to the portion of the drawing paper that is cut away, and consequently any outline figure may be readily impressed upon the ground employed to receive it.

Dr Franklin was the first person who impressed metallic stains upon glass by electrical discharges. Fine gold communicated a reddish stain and silver a greenish one, and the metallic vapour, when driven into the pores of glass, was able to resist the action of the strongest aqua regia.

Sect. II.—*On the Chemical Changes produced by Electricity on Inorganic Bodies.*

Chemical changes produced by electricity.

The effects of electricity as a chemical agent are strikingly displayed in its power of evolving heat, and consequently of inflaming and fusing bodies, and its power of promoting chemical composition and decomposition. The influence of electricity in producing combustion may be shown by several beautiful experiments.

Evolution of heat.

Exp. 1. *To light a candle by electricity.* Having wrapped some loose cotton wool round the extremity of a long brass pin or wire, roll the cotton in the powder of white or yellow rosin. Bring the naked end of the wire into contact with the external coating, while the cotton end is applied to the brass knob of a charged jar, and the rosin and cotton will be instantly inflamed.

By dipping the cotton in oil of turpentine, and using a large jar, the cotton may be inflamed in a similar manner; and its inflammation will be promoted by strewing upon it some fine brass dust.

Exp. 2. *To light a candle in another way.* Thrust a wire up through the middle of the candle to within a short distance of the wick, and having connected the outside coating of a charged jar, by means of a chain, with the lower end of the wire, touch the wick with the knob of the jar, and the candle will be lighted.

Inflammation of bodies.

Exp. 3. *To inflame phosphorus, &c.* Having placed powdered phosphorus, rosin, or camphor, on some cotton wool, and wrapped it round one of the knobs of a discharging rod, apply the knob thus covered to the ball of a charged jar, and the naked knob to the external coating of the jar, and the powder will be set on fire.

Powdered rosin floating on water may be set on fire by transmitting a charge over the surface of the water between two points.

Exp. 4. *To inflame alcohol or ether.* The alcohol or ether being placed in an insulated metallic cup, electrify the cup, and upon taking a spark from the cup either with the knuckle or any other conductor, the fluid will be set on fire.

If ether is placed in a thin stratum upon the surface of water, in a clean wine glass, a spark taken from the surface will inflame the ether when the water is connected with the prime conductor.

Exp. 5. *To inflame gunpowder.* Upon the end of an insulated metallic wire fix a small cartridge, and when the cartridge is presented to the knob of a charged jar, the powder which it contains will be exploded.

Exp. 6. *To exhibit the heat evolved by electricity.* Take a wooden rod, for example one of red fir, about one inch thick and ten inches long, and place it between the ball of the conductor and the conducting wire; put the ball of a thermometer in a hole bored in the wood, and in a few minutes the mercury will rise to about 112°. Van Marum, who made this experiment, found that in three minutes the mercury rose from 61° to 88°, and in five minutes to 112°.

Mr Snow Harris's instrument for measuring the evolution of heat.

Plate CCXIV. Fig. 1, 2.

The evolution of heat by electricity is finely shown by means of a beautiful and delicate instrument constructed by Mr Snow Harris. Mr Children and other philosophers had deduced from a variety of facts that the heat evolved by a metallic wire while transmitting an electric charge, is in some inverse ratio of its conducting power; and hence Mr Harris was desirous of measuring the relative degrees of heat so evolved by various metals and alloys in a gaseous medium such as air, and thus to discover their precise relations as conductors of electricity. The instrument which he used for this purpose is represented in Plate CCXIV. fig 1, and is little more than an air thermometer, the metallic wire to be examined being made to pass air-tight through the ball. A glass tube CDA, whose bore is regular, and somewhat less than one tenth of an inch, has one of its extremities DA bent upwards and outwards for about two inches, and is united by welding to a spherical reservoir A, containing a coloured fluid.[1] This tube is fixed to a correctly divided scale E, supported by a suitable base; and the *zero* of the scale is at *o*, on a level with the coloured fluid in the reservoir A. Above the reservoir A is screwed air-tight, by means of brass caps closely cemented, a glass ball B, three inches in diameter; and through this ball a metallic wire *m*, *n*, varying from $\frac{1}{100}$th to $\frac{1}{5}$th of an inch in diameter, may be passed air-tight by means of small flanges of brass *m*, *n*, fig 2, cemented in and round two holes drilled through the ends, each flanch having a small projecting shoulder to receive the wire, and upon which are screwed two brass balls *a*, *b*, so as to render the whole air-tight. In order to fix the wire, the brass parts are made quite clean internally, and the wire being passed directly through them, is gently stretched, and then compressed in the holes by small pegs of tough wood, so as to insure a good contact. The pegs and the wire are allowed to project a little, to enable the observer to substitute different wires expeditiously. When an electrical explosion of sufficient force is now made to traverse the wire *m*, *n* in the ball B, the heat which it evolves will be made evident by the ascent of the coloured fluid along the scale E.

Mr Harris now submitted to examination equal wires of different metals; and in order to insure the transmission of equal and similar explosions through each of them, he adopted the following contrivance. Two equal brass balls were fixed at a given distance, as in Lane's discharging electrometer. One of them, which was insulated, was placed in immediate connection with the positive side of the battery, while the other was connected with the negative side; the metallic wire to be examined forming part of the circuit. This last connection was made by means of two fixed copper wires inserted into the balls on each side of the glass, and made perfect at the points of junction. When the charge therefore of the battery was sufficiently intense to pass the given interval, the discharge took place through the wire in the ball. Mr Harris used a battery of *five* jars, each containing *five* square feet of coated surface. They were placed on a metallic base communicating with the negative conductor, and were charged by means of long copper rods projecting immediately from the bottom of each jar. The machine employed was a plate one, with a disc of glass three feet in diameter.

Mr Sn Harris' experi- ments the evo tion of h by elec city.

The results which Mr Harris obtained from an extensive series of experiments are given in the following table.

	Metals.	Effects.		Metals.	Effects.
	Copper	6	Alloys.	Copper 1 part, silver 1 part	6
	Silver	6		Copper 1 part, silver 3 parts	6
	Gold	9		Copper 3 parts, silver 1 part	6
	Zinc	18	Alloys.	Gold 1 part, silver 1 part	20
	Platinum	30		Gold 1 part, silver 3 parts	15
	Iron	30		Gold 3 parts, silver 1 part	25
	Tin	36	Alloys.	Tin 1 part, lead 1 part	54
	Lead	72		Tin 3 parts, lead 1 part	45
	Brass	18		Tin 1 part, lead 3 parts	63
Alloys.	Gold 1 part, copper 1 part	20	Alloys.	Tin 1 part, zinc 1 part	27
	Gold 3 parts, copper 1 part	25		Tin 3 parts, zinc 1 part	32
	Gold 1 part, copper 3 parts	15		Copper 8 parts, tin 1 part	18

Considering the heat to be in the inverse ratio of the conducting power, it appears from this table, 1*st*, That the heats evolved from silver and copper are alike, and also those from iron and platinum, and from zinc and brass,

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[1] This fluid may consist of rectified alcohol, *one* part distilled water, *three* parts coloured tincture of cochineal, with a little sulphuric acid to make the whole sour.

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while the heats evolved from lead and tin are as 2:1; and from zinc and gold, and from brass and gold, as 2:1. 2*dly*, That silver and copper being regarded as the *best* conductors, from being the *least* heated by the explosion, the conducting power of

Gold to copper will be as 2: 3
Zinc or brass to copper or silver.......1: 3
Platinum or iron to copper or silver..1: 5
Tin to copper or silver...................1: 6
Lead to copper or silver.................1: 12

3*dly*, That the conducting power of an alloy of *gold* and *copper*, or gold and silver, is less than either metal separately; and that the difference in the conducting power increases with the quantity of the inferior conductor alloyed; and that tin and lead in alloy have a conducting power equal to the mean of their two separate conducting powers. And, 4*thly*, that copper alloyed with an eighth part of its weight of tin becomes as much heated by an electrical explosion as iron.

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Many beautiful experiments have been made by different philosophers, on the fusion of metallic wires. Mr Kinnersley, in the presence of Dr Franklin, transmitted the charge of a case of bottles through a fine iron wire. After first appearing red hot, the wire was melted into spherical drops like small shot. With a battery of thirty-two square feet, Dr Priestley melted into globules wires even so large as the seventieth of an inch in diameter, sometimes placing them in tubes of glass, and sometimes in paper. The most complete experiments, however, on the fusion of wires were made by Mr Brooke, Van Marum, Baron Kienmayer, Mr Cuthbertson, and Mr Singer. The following are a selection from their most successful experiments.

No. of Bottles.	Square Feet of Coated Surface.	Grains of Repulsion in Brooke's Electrometer.	Length of Wire.	Diameter of Wire.	Effect produced.
9	16	32	12	$\frac{1}{170}$	Steel wire melted.
9	16	32	12	$\frac{1}{170}$	Brass ditto ditto.
4		30	3	$\frac{1}{170}$	Steel ditto ditto.
2		45	1	$\frac{1}{170}$	Steel wire not ditto.
	48	4	3	$\frac{1}{170}$	Steel wire melted.
	48	15	6	$\frac{1}{150}$	Lead ditto ditto.
	40		18	$\frac{1}{250}$	Iron ditto ditto.
15 jars			60	$\frac{1}{150}$	Iron ditto ditto.

The last of these experiments was made by Mr Cuthbertson, and the last but one by Mr Singer. Mr Singer found that the power of any coated surface to melt wires varies with the thickness of the jars; which confirms the conclusion of Mr Cavendish, that the quantity of electricity necessary to charge different jars of the same extent of coated surface is inversely as the thickness of the jars.

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"The effects of gradually increasing the power of the charge," says Mr Singer, "when wires of the same length and diameter are employed, are very remarkable. If the wire be iron or steel, its colour is first changed to *yellow*, then (by an increased charge) *blue*, by a further increase it becomes *red hot*, then red hot and *fused into balls;* if we continue to increase the charge, it becomes red hot and *drops into balls*, then *disperses in a shower of balls*, and lastly disappears with a bright flash, producing an apparent smoke, which, if collected, is a very fine powder, weighing more than the metal employed, and consisting of it and a portion of the oxygen of the atmosphere, with which it has combined."

The experiments of Van Marum were made with a much greater extent of coated surface, and the effects produced were consequently much more intense. The following are a few of his results:

Phenomena and Laws.

Van Marum's experiments.

Square Feet of Coated Surface.	Length of the Wire.	Diameter in parts of an inch.	Effect produced.
130	180 inches	$\frac{1}{151}$	Iron wire melted.
130	300	$\frac{1}{240}$	Iron ditto ditto.
225	120	$\frac{1}{38}$	Lead ditto ditto.
225	120	$\frac{1}{38}$	Tin ditto ditto.
225	5	$\frac{1}{38}$	Iron ditto ditto.
225	3·5	$\frac{1}{38}$	Gold ditto ditto.
225	0·25	$\frac{1}{38}$	Silver ditto ditto.
225	0·25	$\frac{1}{38}$	Copper ditto ditto.
225	0·25	$\frac{1}{38}$	Brass ditto ditto.

In the course of these experiments Van Marum observed the curious fact, that when a charge of 225 square feet of coated surface was transmitted through fifty feet of iron wire, *the jars were not entirely discharged*, and the residual charge was capable of melting two feet of the same wire.

With the view of determining the relative fusibility of different metals, Van Marum applied the same electrical charge to wires of different metals drawn to the same diameter. The following were the results with wires the 32d of an inch in diameter.

Metals.	Length of Wire Fused.
Lead	120 inches.
Tin	120
Iron	5
Gold	$3\frac{1}{2}$
Silver	$\frac{1}{4}$
Brass	$\frac{1}{4}$
Copper	$\frac{1}{4}$

Hence he concludes that lead and tin are the worst metals for conductors, and copper, brass, and silver, the best.

Cavallo's experiments.

M. Cavallo made some interesting experiments on the fusion of grains of native platinum by means of electricity. He placed the grains in a groove one tenth of an inch deep, cut in the surface of a cake of wax. A battery was discharged through a line of metallic grains thus arranged, and in this way they were partially but decidedly fused. He found the whiter grains to be more easily fused than those of a dark-grey colour.

Oxidation of metals.

Another of the chemical effects of electricity is its power of promoting the combination of metals with oxygen, or, what is the same thing, of oxidating them. Beccaria and others had observed this property of electrical action, but it is to Mr Cuthbertson and Mr Singer that we owe the most complete series of experiments on this subject. The apparatus used by Mr Cuthbertson is represented in Plate CCXIII. fig. 5, where AB is a cylinder of glass two inches and a half in diameter and eight inches high. A brass cap is screwed on the lower brass cap B, and in the interior of the vessel is fixed a small roller CD, on which is coiled a quantity of wire attached to a pack-thread at intervals of four inches. Into the centre of the upper cap A is screwed a brass tube F, about three inches long; the end of the pack-thread and wire is pushed through it by means of a long needle, and hog's lard is placed in the tube so that the thread and wire may move through it air-tight. By this means the wire is stretched along the axis of the glass cylinder, and when one length of it is exploded, another is drawn forward by the contiguous pack-thread, without opening the cylinder. The quantity of air absorbed in the process is indicated by a gage. It consists of a glass tube, about ten inches long, screwed into the lower end of the stop-cock, and plunged in a vessel of

Mr Cuthbertson's apparatus. Plate CCXIII. Fig. 5.

Phenomena and Laws.

quicksilver, the rise of which, when the stop-cock is opened, will be a measure of the air absorbed. Mr Cuthbertson found that the air was always deprived of a portion of its oxygen. When hydrogen or nitrogen was used in place of atmospheric air, no oxidation took place in the wire, and the wire was melted and minutely divided. The results obtained by Mr Cuthbertson are given in the following table, each wire being ten inches long.

Mr Cuthbertson's experiments.

Metals.	Diameter of Wire.	Charge in Grains of Cuthbertson's Electrometer.	Colour of the Oxide when collected.
Lead	$\frac{1}{90}$	20	Light grey.
Tin	$\frac{1}{90}$	20	Nearly white.
Zinc	$\frac{1}{90}$	45	Nearly white.
Iron	$\frac{1}{150}$	35	Reddish brown.
Copper	$\frac{1}{150}$	35	Purple brown.
Platina	$\frac{1}{150}$	35	Black.
Silver	$\frac{1}{150}$	40	Black.
Gold	$\frac{1}{150}$	40	Brownish purple.

Mr Singer's experiments.

Mr Singer repeated these experiments with shorter and finer wires, and with a moderate electrical charge. The wires were not placed in receivers, but stretched parallel to the surface of a sheet of paper, at the distance of one eighth of an inch. The following were his results with wires five inches long.

Metals.	Diameters of Wire.	Charge in Grains of Cuthbertson's Electrometer.	Colours of the Figures on Paper.
Lead	$\frac{1}{180}$	12	Brown and blue grey.
Tin	$\frac{1}{180}$	11	Yellow and grey.
Zinc	$\frac{1}{180}$	17	Dark brown.
Iron	$\frac{1}{180}$	12	Light brown.
Copper	$\frac{1}{160}$	12	Green, yellow, and brown.
Platina	$\frac{1}{180}$	13	Grey and light brown.
Silver	$\frac{1}{160}$	18	Grey, brown, and green.
Gold	$\frac{1}{180}$	18	Purple and brown.

When Mr Singer made the explosion over glass, he found that a portion of the metal appeared immediately under the wire in an unoxidated state, while the oxidated portion produced round the other a figure of some width. The figures are in this way more beautiful, though less permanent, than when they are produced upon paper.

Dr Wollaston's experiments.

The oxidating power of common electricity is finely exhibited in the following experiment, given by Dr Wollaston. Having coloured a card in a strong infusion of litmus, a current of electric sparks was passed along it by means of two fine gold points, which touched the card at the distance of an inch from each other. After a very few turns of the machine, and when the card was nearly dry, a *redness* at the place of the positive wire was distinctly manifest to the naked eye; and when the experiment was repeated with the negative wire on the same spot, it was restored to its original *blue* colour.

Revival of metallic oxides.

The metallic oxides may be revived, or restored to the metallic state, by means of electricity. Beccaria, who discovered this property, revived the oxide of zinc, and produced quicksilver from cinnabar by exploding a jar between two pieces of the calces. The following method of making this interesting experiment is given by Mr Singer. Introduce into a glass tube some oxide of tin, so that the oxide may cover about half an inch of the lower internal surface of the tube when it is laid horizontally. Place the tube on the table of Henley's discharger, and introduce the pointed wires into its opposite ends, that the oxide may lie between them. When several strong charges have been sent through the tube, a part of the tube will soon be stained with metallic tin, which has been revived by the transmitted electricity. The charge of a very moderate-sized jar is sufficient to revive the mercury and sulphur which compose vermilion.

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The deoxidating power of negative electricity is well illustrated by the following elegant experiment of Dr Wollaston's. Having coated with wax about two or three inches of the middle of a fine silver wire, the hundred and twentieth of an inch in diameter, he cut the wire through in the middle of the wax, so as to expose a section of it. The two coated extremities of the divided wire were plunged in a solution of sulphate of copper, placed in an electric circuit between the two conductors, and sparks taken at the distance of one tenth of an inch were passed through the solution. After a hundred turns of the machine, the wire communicating with the negative conductor had a precipitate formed upon its surface, which by burnishing was clearly copper, whereas there was no such coating upon the other wire. The direction of the electric current being reversed, the order of the phenomena was reversed, and the copper was shortly re-dissolved by the aid of the oxidating power of common electricity, and a similar precipitate formed upon the opposite wire. Dr Wollaston obtained similar results from gold wires and a solution of corrosive sublimate.

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The influence of electricity in effecting chemical composition and decomposition forms one of the most interesting departments of electrical and chemical science. The most valuable researches which have been made on this subject were carried on by means of the Voltaic battery, and must necessarily be detailed under another article; but the discoveries which were made through the agency of the electrical machine fall to be recorded in the present section.

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tire.

One of the earliest experiments on the influence of electricity as a powerful chemical agent, was made by Mr Warltire, who fired a mixture of atmospheric air and hydrogen gas by means of electricity in a close copper vessel containing about three pints. Although no air could escape by the explosion, yet a loss of two grains was perceived in every experiment. When the vessel which contained the gases was clean and dry, a dewy moisture was found adhering to the inside of the vessel. Guided by this indication, Dr Priestley entered upon the subject. Having placed a blue solution of water and litmus in a glass tube, he transmitted through it a current of electrical sparks from a brass wire. In two or three minutes the blue liquor became red, particularly at the part where the sparks entered, and the air inclosed in the tube was diminished. The appearance of an acid having been formed at the expense of the air confined in the tube, induced Dr Priestley to place the tube in the receiver of an air-pump, so that by gradually exhausting the air, the part of it inclosed in the tube expanded and pushed out the discoloured liquor. Upon again admitting the air, a new portion of the litmus solution was introduced, while the confined air remained the same as before, and resumed the space which it had occupied after the passage of the electric current. After this the electrical sparks were no longer able to alter the colour of the solution, or to cause any decrease in the volume of the confined air.

Of Dr
Priestle

In passing a current of electric sparks through olive oil, turpentine, oil of mint, and ether, Dr Priestley found that an inflammable gas was evolved.

In his experiments on the gases Dr Priestley was more successful in transmitting the spark through ammoniacal ome- and ws.

gas; he found that two hundred shocks passed through a given quantity of the gas produced an increase of volume equal to one fourth of the whole. Upon subsequently admitting water, the original quantity operated upon was absorbed, and the remaining gas, equivalent to the expansion effected by the electric shocks, was found highly inflammable.

Dr Priestley likewise passed an electrical current, consisting of slight shocks continued for about an hour, through an inch of carbonic acid gas confined in a glass tube one tenth of an inch in diameter, when, upon admitting the water, one fourth part only was absorbed. In a similar manner Dr Priestley succeeded in decomposing carburetted hydrogen, the charcoal being deposited in a pulverulent form on the interior of the tube. When a succession of electric sparks from a moderate-sized conductor during the space of five minutes had failed in effecting this decomposition, he found that two shocks of a jar, each of which might be produced in less than a quarter of a minute with the same machine in the same state, were sufficient to cover the whole of the inside of the tube with the black carbonaceous matter. Dr Priestley remarked in these experiments that no shock, however powerful, would decompose the gas, if the quantity operated upon were great.

eri- ts of Hon. Ca- lish.

The power of electricity as a chemical agent was studied with peculiar success by the Honourable Mr Cavendish. In the year 1781 he fired 500,000 measures of hydrogen with about two and a half times that quantity of atmospheric air, and having by this means obtained a hundred and thirty-five grains of pure water, he was led to the conclusion that water was composed of two gases, viz. oxygen and hydrogen. In pursuing these enquiries Mr Cavendish made use of the apparatus shown in fig. 6 of Plate CCXIII. The air to be examined was confined in a bent glass tube A, filled with mercury, and having its ends immersed each in a vessel of the same fluid. The air to be electrified was introduced by a piece of glass tube ABC, fig. 7. In order to use this apparatus, the tube ABC being filled with mercury, is introduced as in fig. 7, with its bent extremity uppermost, into the vessel containing the gas, and standing in the pneumatic trough. In this part of the process the orifice at C is stopped by a finger, by withdrawing which a little mercury will descend through C, and an equal volume of the gas will enter at the end A. When the gas has been admitted in sufficient quantity into the tube ABC, it is withdrawn and reversed, the end C, which is placed uppermost, remaining carefully closed. The extremity A, which fits the end of the tube in fig. 6, is introduced beneath the mercury in either of the glasses, and by withdrawing the finger from the upper end C of the transferring tube, the mercury will descend, and the gas will be forced into the tube A, fig. 6. The orifice of the transferring tube should not be greater than that of a common thermometer tube.

In order to introduce portions of air successively during the same experiment, Mr Cavendish used a tube AB of a small bore (see fig. 8), a bulb C, and a tube DE, having a bore larger than that of AB. This apparatus having been first filled with mercury, the bulb C and tube AB are filled with the gas, by introducing the end A beneath the inverted jar, upon the shelf of the pneumatic trough, and then drawing the mercury from the leg D by means of a syphon. The aperture A being closed, the apparatus is weighed. The extremity A, fig. 8, is then fitted into the end of the tube A, fig. 6. When it is required to force air out of this apparatus into the tube, a wooden cylinder with a tight fitting is thrust down into the tube ED, an additional quantity of mercury being occasionally poured in at E to supply the place of what is forced into the bulb C. When the experiment is completed the apparatus is again weighed. The increase of weight is due to the mercury introduced, and its volume is equal to that of the air transferred to the tube A, fig. 6. The bore of the tube A was generally one tenth of an inch in diameter, and the aerial column in the bend of the tube from one half to three fourths of an inch.

Phenomena and Laws.

In transmitting the electric spark through this tube, Mr Cavendish, instead of making one end of it communicate with a conductor, placed an insulated ball at such a distance from the conductor as to receive a spark from it, and made a communication between that ball and the mercury in one of the glasses, the mercury in the other glass communicating freely with the ground.

In transmitting the electric spark through common air in contact with a blue aqueous solution of litmus, a red tint was produced in the solution. When lime-water was inclosed in the tube instead of litmus, and sparks transmitted till there was no further diminution in the volume of the included air, no cloudiness appeared in the lime-water, and the diminution of volume, amounting to one third of the original bulk of the air, exceeded the diminution from deoxidation alone, which would have been only one fifth.

When this experiment was repeated with some impure oxygen gas, a considerable diminution of volume was produced, but there was no cloudiness in the lime-water, and none could be perceived by adding to it a little carbonic acid gas; a small portion of caustic ammonia, however, produced a brown precipitate. Hence it is obvious that the lime-water was saturated with some acid formed in the process.

Having inclosed in the tube some of the same impure oxygen in contact with soap leys, the diminution of volume proceeded faster than with the lime-water, the greater strength of the alkaline lixivium acting as a more powerful absorbent of the acid which was generated.

When pure oxygen or pure azote was used no absorption took place; but when five volumes of pure oxygen were mixed with three of common air, the absorption was almost total; and as common air contains about one part of oxygen and four of azote, the mixture of five parts of oxygen and three of common air was equivalent to seven parts of oxygen and three of azote.

Mr Cavendish now supplied the interior of the tube with a little alkaline ley, and having introduced a mixture of seven parts of oxygen and three of azote, he transmitted a current of electric sparks, admitting fresh gas as the volume of air diminished. When the diminution ceased, a little pure oxygen, and afterwards a little common air, were added, in order to see if the absorption ceased from any want of a proper proportion in the two elements. As this was not the case, the soap leys were separated from the mercury, and were found to have become perfectly neutral, from their having no effect on the colour of litmus. When the leys were evaporated a dry *nitrate of potash* was obtained. By repeating this experiment on a more extended scale, Mr Cavendish demonstrated that the soap leys had been converted into a solution of nitre, and therefore established the great truth that nitric acid had been formed during the process, and that nitric acid is a compound of oxygen and azote.

Apparatus and experiments of Van Marum.

By means of the great Teylerian electrical machine at Haerlem, Van Marum, Van Troostwyk, &c. made many experiments on the chemical agency of electricity. The apparatus which they used, shown in Plate CCXIII. fig. 9, consists of a tube of glass DE, twelve inches long and a quarter of an inch in diameter, hermetically sealed, and having a gold or platina wire D*d* an inch and a half long fixed at D. Another platina wire E*e* was carried up from

Apparatus and experiments of Van Marum.

the open end of the tube E to *e*, within one eighth of an inch of the end *d* of the upper wire. The tube DE having been filled with distilled water, the open end of it E was immersed in a vessel V containing quicksilver, and the upper end D of the wire D*d* was brought into contact with the insulated brass ball C, placed at a little distance from AB, the prime conductor of the electrical machine. The lower wire E*e*, immersed in quicksilver, communicated with a chain VG connected with the outer coating of a Leyden jar containing about a hundred and forty-four square inches of coated glass, and having its ball M in contact with the prime conductor AB. When the electrical discharges were sent through the distilled water, the gas was disengaged as long as the ball C was in contact with the conductor; but upon increasing its distance, a position was found where the gas was disengaged, and ascended to the top of the tube. The evolution of the gas continued till it reached nearly the lower extremity of the upper wire, and then a discharge caused the whole gas to disappear, its place being supplied by water. With this apparatus the Dutch philosophers made the following experiments.

Oxygen gas from red precipitate had its original volume diminished one twentieth, and the properties of what remained were not changed.

Nitrous gas had its volume diminished to less than one half. There were no red fumes when it was mixed with atmospheric air, neither was there any condensation. It would not support combustion, and it lost its usual smell. A kind of powder covered the surface of the mercury, consisting of a new combination formed from the mercury.

Hydrogen gas, obtained from sulphuric acid and iron, suffered no diminution. Owing probably to some admixture of common air, it gave a slight redness to tincture of turnsol.

Olefiant gas from sulphuric acid and alcohol had its original volume tripled, and in some degree lost its inflammability.

Sulphurous acid gas, from sulphuric acid and charcoal, had only one eighth of its volume absorbed by water. Black spots were formed on the inside of the glass receiver. It had little smell, and extinguished a candle.

Muriatic acid gas experienced a considerable diminution of volume, but the remainder was readily absorbed by water. The electric sparks would not pass through more than two inches and a quarter of this gas.

Carbonic acid gas from sulphuric acid and chalk had its volume increased a little, and was made less absorbable by water.

Ammoniacal gas had its volume at first almost doubled, and then experienced a slight diminution. It became incapable of being absorbed by water, and exploded by the contact of flame.

Fluoric acid gas experienced no perceptible change.

Atmospheric air gave a slight redness to tincture of turnsol, and at the same time became sensibly deoxygenated. The diminution of volume was $\frac{151}{500}$ths, the mean of three experiments; and of the same air not electrified $\frac{182}{500}$ths, the mean of three experiments.

The Dutch philosophers made many other experiments which we have not space to describe, and in 1789 they succeeded in repeating the experiment of Cavendish on the decomposition of water.

Dr Wollaston's experiments and apparatus.

Hitherto a powerful apparatus was deemed necessary for effecting the decomposition of water, and a succession of discharges from a coated surface was deemed indispensable. Dr Wollaston, however, considering that the decomposition must depend upon a proper proportion between the quantity of water and the decomposing force, conceived the idea of reducing the surface of communication between the air and the metal which conveyed the electricity.

"Having procured," says he, "a small wire of fine gold, and given it as fine a point as I could, I inserted it into a capillary glass tube; and after heating the tube so as to make it adhere to the point, and cover it in every part, I gradually ground it down till, with a pocket lens, I could discern that the point of the gold was exposed.

"The success of this method exceeded my expectations. I coated several wires in the same manner, and found that when sparks from the conductors before mentioned were made to pass through water by means of a point so guarded, a spark passing to the distance of one eighth of an inch would decompose water when the point exposed did not exceed one seven hundredth of an inch in diameter. With another point, which I estimated at $\frac{1}{15000}$th, a succession of sparks one twentieth of an inch in length afforded a current of small bubbles of air.

"I have since found that the same apparatus will decompose water with a wire one fortieth of an inch diameter, coated in the manner before described, if the spark from the prime conductor passes to the distance of four tenths of an inch of air.

"In order to try how far the strength of the electric spark might be reduced by proportional diminution of the extremity of the wire, I passed a solution of gold through a capillary tube, and, by heating the tube, expelled the acid. There remained a thin film of gold lining the inner surface of the tube, which, by melting the tube, was converted into a very fine thread of gold through the substance of the glass.

"When the extremity of this thread was made the medium of communication through water, I found that the mere current of electricity would occasion a stream of very small bubbles to rise from the extremity of the gold, although the wire by which it communicated with the positive or negative conductor was placed in absolute contact with them. Hence it appears that decomposition of water may take place by common electricity as well as by the electric pile, although no discernible sparks are produced. The appearance of two currents of air may also be imitated, by occasioning the electricity to pass by fine points of communication on both sides of the water; but in fact the resemblance is not complete, for in every way in which I have tried it, I observed that each wire gave both oxygen and hydrogen gas, instead of their being formed separately, as by the electric pile.

"I am inclined to attribute the difference in this respect to the greater intensity with which it is necessary to employ common electricity; for, that positive and negative electricity so created have each the same chemical power as they are observed to have in the electric pile, may be ascertained by other means."

The preceding experiment, which is only an elegant repetition of one formerly made by Dr Pearson and the Dutch philosophers, has excited much attention, and cannot be regarded as any proof of the identity of ordinary and Voltaic electricity; Dr Faraday justly remarks that it should never be quoted as establishing true electrochemical decomposition, because the law which regulates the transference and final place of the evolved bodies has no influence here. The water is decomposed at the two poles by an independent action, and the oxygen and hydrogen evolved are the elements of the water existing at the wires the instant before. The substitution of the finger for one of the points will not interfere with the action of the other. But although Dr Wollaston did not decompose water in any way analogous to that of the pile, yet Dr Faraday seems to have succeeded in doing it by the same apparatus; but when he considered that he had obtained the true effect, the gas evolved was so small in quantity that he could not ascertain whether or not oxygen was emitted at the one wire and hydrogen at the other, as ought to have been the case.

D Fara- s appa- s and eri- ts.

The inability of Dr Wollaston's apparatus to exhibit in an unquestionable manner true electro-chemical decomposition being thus obvious, Dr Faraday devised the following ingenious arrangement for effecting chemical decomposition by ordinary electricity, and by means of it he effected true electro-chemical decompositions, perfectly identical with those produced by Voltaic electricity. The plate machine which he used had its glass disc fifty inches in diameter. It had two sets of rubbers. The prime conductor consisted of two brass cylinders, connected by a third, the whole length being twelve feet, and the surface in contact with air was 1422 inches. When well excited, one revolution of the plate gives ten or twelve sparks, each an inch long; and sparks or flashes from ten to fourteen inches long may easily be drawn from the conductors. When moderately worked, each turn of the machine is made in four fifths of a second. The electric battery consists of fifteen equal jars, each twenty-three inches in circumference, and coated eight inches upward from the bottom, so as to contain 184 inches of glass each, coated on both sides, independent of the bottoms, which are thicker glass, and contain each about fifty square inches.

In order to carry off instantaneously electricity of the feeblest tension, Dr Faraday formed what he calls a *discharging train.* This discharging train consisted in connecting a sufficiently thick wire metallically, first with the metallic gas pipes of the house, then with the metal pipes of the public gas works of London, and lastly with the metallic water-pipes of London. This arrangement was so effectual that the electricity even of a single Voltaic trough was instantly carried off; and this was essential to the success of many of his experiments.

e XIV. 3.

The arrangement for applying the apparatus now described to chemical decomposition is shown in Plate CCXIV. fig. 3. Two pieces of tinfoil *a*, *b* are placed upon a glass plate raised above a piece of white paper to prevent the interference of shadows. One of these pieces, *a*, is connected by an insulated wire *c*, or by a wire and wet string, with the electric machine, and the other piece, *b*, by a wire *g*, with the discharging train or the negative conductor. Two pieces of fine platina wire must then be provided, bent as in fig. 4, so that the part *d* shall be nearly upright, whilst the whole rests on the three points *efp*. By this means we can obtain at pleasure surfaces of contact as minute as possible; the connection can be discontinued or removed in a moment, and the substances which are acted upon can be readily examined. With this apparatus Dr Faraday obtained the following results.

4.

1. Having made a coarse line on the glass plate with a solution of sulphate of copper, the ends *p* and *n* of the platina wires were put into it, the foil *a* being connected by a wire and wet string with the positive conductor of the machine, so that no sparks passed. After twenty turns of the machine there was so much copper precipitated on the end *p* that it looked like copper wire, no apparent change having taken place at *n*.

2. A large drop of a mixture of equal parts of muriatic acid and water coloured a deep blue by sulphate of indigo was placed on the glass, so that the ends *p* and *n* were plunged in opposite sides of it; *one* turn of the machine evolved sufficient chlorine to exhibit bleaching effects round *p*. *Twenty* revolutions produced no effect at *n*, but there was so much chlorine got free at *p*, that when the drop was stirred the whole became colourless.

3. Having mingled a solution of iodide of potassium with starch, the ends *p* and *n* were immersed in a drop of it as before; on turning the machine iodine was evolved at *p*, but not at *n*.

Dr Faraday's apparatus and experiments.

Dr Faraday improved his apparatus still further by wetting a piece of filtering paper in the solution to be examined, and placing it on the glass beneath the points *p*, *n*. The paper will retain the substance evolved at the point of evolution; its whiteness will render visible the least change of colour, and will allow the point of contact between it and the wires *p*, *n* to be contracted to the utmost degree. Dr Faraday found a piece of paper moistened in the solution of iodide of potassium and starch, or of the iodide alone, to be with certain precautions a most admirable test of electro-chemical action; and when it is placed and acted upon in the manner already described, it will exhibit the evolution of iodine at *p* by half a turn only of the machine. He found, indeed, that with these adjustments, and the use of iodide of potassium on paper, chemical action is sometimes a more delicate test of electrical currents than the most delicate galvanometer.

A piece of litmus paper wetted in a solution of muriate or sulphate of soda was quickly reddened at *p*, and a similar piece wetted in muriatic acid was soon bleached at *p*, no similar effects taking place at *n*.

A piece of turmeric paper wetted in a solution of sulphate of soda was reddened at *n* by two or three turns of the machine, and by twenty or thirty turns abundance of alkali was evolved at the same place. By turning the paper round so that the spot came under *p*, and working the machine, the alkali soon disappeared, the place became yellow, and a brown alkaline spot appeared in the new part under *n*.

Dr Faraday next combined a piece of turmeric paper with a piece of litmus, wetting both with a solution of sulphate of soda. The paper was placed so that *p* was on the litmus and *n* on the turmeric paper. By a few turns of the machine acid was evolved at *p* and alkali at *n*, as in galvanic decomposition. These various decompositions were equally effected whether the electricity passed to the foil *a* from the machine through water or wire only, by *contact* with the conductor, or by *sparks* there, provided the sparks were not so large as to cause the electricity to pass in sparks from *p* to *n*, or towards *n*.

Plate CCXIV. Fig. 5.

Dr Faraday's final experiment deserves peculiar notice, as affording a case in which there is the most perfect analogy between the effects of ordinary and Voltaic electricity. Three compound pieces of litmus and turmeric paper, when wetted by a solution of sulphate of soda, were disposed on a plate of glass as shown in fig. 5. The wire *m* was connected with the prime conductor, *t* with the discharging train, and the wires *r* and *s* connected the moistened pieces of paper, each wire resting on three points, one of the points, at *r* and *s*, being on the glass, and the others on the papers, the ends *p*, *p*, *p* resting on the litmus and *n*, *n*, *n* on the turmeric paper. When the machine had been worked for a short time, acid was evolved at all the poles *p*, *p*, *p*, by which the electricity entered the solution; and alkali at the other poles *n*, *n*, *n*, by which the electricity left the solution.

The precaution above referred to, in using the iodide of potassium as a test of electro-chemical action, is that no sparks should be passed in any part of the current, and no increase of intensity allowed by which the electricity may be induced to pass between the platina wires and the moistened papers, *otherwise than by conduction;* for if the electricity burst through the air, a different effect is produced. The litmus paper is in this case reddened by the spark, and iodine will be evolved from paper moistened by iodide of potassium. This effect is owing to the formation of nitric acid by the oxygen and nitrogen of the air. The acid thus formed reddens the litmus paper, or prevents the exhibition of alkali in the turmeric paper, or evolves iodine from the iodide of potassium. We have thus a simple and elegant method of illustrating Mr Cavendish's experiment of forming nitric acid from the atmosphere.

M. Bonjol's experiments.

M. Bonjol of Geneva has announced that he has decomposed water by common electricity. The electricity was obtained from an insulated lightning rod; and the decomposition is said to have proceeded continuously and rapidly even when the electricity of the atmosphere was by no means powerful. M. Bonjol is also said to have decomposed potash and chloride of silver, by passing the sparks of an ordinary machine through these substances placed in narrow tubes. Dr Faraday justly regards these as not cases of true electro-chemical decomposition, but as analogous to that of Dr Wollaston's apparatus, arising either from a very high temperature acting upon minute portions of matter, or perhaps connected with the results produced in air by the passage of the spark.

Experiments of Dr Barry.

One of the most remarkable decompositions, however, which has been obtained previous to Dr Faraday's experiments, is that of the late Mr Barry. This experiment is given as a proof of the chemical action of atmospheric electricity; but, as Dr Faraday has shown, it possesses a much greater interest if confirmed. The following is his own account of it:—"In August 1824 I elevated the kite in an atmosphere favourable to the exhibition of its phenomena. It was raised from an apparatus firmly fixed in the earth, and was insulated by a glass pillar. The usual shocks were felt on touching the string, which simple fact I am induced to mention from the circumstance of no electrometer having been employed. The portion of string let out, with a double gilt thread passed through it, was about 500 yards. I then made the connection shown in fig. 6, where the straight glass tubes, A, B, having platina wires passed from above half way down their axes, and standing in their respective glass cups C, D, were filled with a solution of sulphate of soda coloured with syrup of violets, connected also with each other by the bent glass tube E, likewise filled with the above solution in the usual manner. A portion of gilt thread *d* was then brought from the tube at A, and united to the kite-string K, whilst a similar thread *b* was carried from B to the earth. Bubbles of hydrogen in A, and of oxygen in B, soon appeared. In about ten minutes the blue liquid in A became green from the separation of the soda, whilst the sulphuric acid, by passing to the pole in the tube B, changed its contents, as usual, red.[1]

Fig. 6.

Dr Fara day's ob servatio on them

The effect now described as produced by *atmospheric electricity* was never produced by *common electricity.* Dr Wollaston and other philosophers could not obtain the gases in separate vessels, and Dr Faraday kept his powerful machine in action for a quarter of an hour, during which 700 revolutions were made, without producing any sensible effect, although the shocks that it could then have given must have been more numerous and powerful than could have been taken with any chance of safety from the kite-string of Mr Barry. Dr Faraday thinks "it just possible that the air which was passing by the kite and string, being in an electrical state sufficient to produce the 'usual shocks' only, could still, when the electricity was drawn off below, renew the charge, and so continue the current. The string was 1500 feet long, and contained two double threads; but when the enormous quantity which must have been thus collected is considered, the explanation seems very doubtful." Dr Faraday therefore considers Mr Barry's experiment as a very important one to repeat and verify; and he remarks, that if it is confirmed, it will be the first recorded case of the true electro-chemical decomposition of water by common electricity, and will supply a form of electrical current which is exactly intermediate, both in point of quantity and intensity, between those of the common electrical machine and the Voltaic pile.

Effects electric on gase

The effects of electricity on mixed and compound gases are exhibited in the following table, taken chiefly from Mr Singer's work on electricity.

Mixed Gases.	Results.
Atmospheric air and hydrogen,	Water and nitrogen.
100 oxygen and 200 hydrogen,	Water.
160 chlorine, 100 hydrogen,	200 muriatic acid gas.
Muriatic acid gas and oxygen,	Chlorine (and water)?
Carbonic oxide and oxygen,	Carbonic acid.
Nitrogen and oxygen,	Nitric acid.
Sulphurous acid and oxygen,	Sulphuric acid.
Phosphuretted hydrogen and oxygen,	Water and phosphoric acid.
Sulphuretted hydrogen and oxygen,	Water and sulphurous acid.
150 oxygen and 200 ammonia,	Water and 100 nitrogen.
100 olefiant gas and 284 oxygen,	Carbonic acid and water.
100 olefiant gas and 100 oxygen.	Carbonic oxide and hydrogen.
100 carburetted hydrogen and 100 oxygen,	Carbonic oxide and hydrogen.
100 carburetted hydrogen and 200 oxygen,	Carbonic acid (and water?)

Compound Gases.	Results.	
Muriatic acid,	Hydrogen	Messrs Henry and Dalton.
Fluoric acid,	Hydrogen	
Nitrous acid,	Nitric acid and nitrogen.	
Carbonic acid,	Carbonic oxide and oxygen.	
100 sulphuretted hydrogen,	Sulphur and 100 hydrogen.	
100 phosphuretted hydrogen,	Phosphorus and 100 hydrogen.	
100 ammonia,	150 hydrogen and 50 nitrogen.	
100 olefiant gas,	Carbon and 200 hydrogen.	
100 carburetted hydrogen,	Carbon and 200 hydrogen.	

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[1] *Phil. Trans.* 1831, Part I. p. 165, 166.

The effects thus indicated are regarded by Mr Singer as mechanical, and as arising from the momentary agitation into which the various media are thrown by the action of the spark, which tends to promote a new arrangement of parts. This theory, of which Mr Singer himself not only saw, but has stated, the difficulties, cannot now be maintained with any show of reason; and there can be no doubt that the effects in question arise from a molecular polarity related to the two poles of the electric circuit, or to the two kinds of electricity which exist in nature.

fluence electri- y on pu- efaction d fer- entation.

It has been asserted, but not from any extensive series of accurate experiments, that putrefaction and fermentation are promoted by electricity. M. Achard of Berlin, considering that, in animals killed by lightning, the process of putrefaction advances with great rapidity, cut a piece of beef into three parts, and electrified one piece positively for ten hours, another negatively during the same time, while the third was not electrified at all. On the fourth day the electrified pieces had an intolerably fetid smell, while the unelectrified piece had only begun to smell a little. The same result was obtained with a piece of boiled veal. M. Achard also killed several birds by electrical shocks, and having killed others by sticking a needle through their heads, he placed them all under similar circumstances. The birds killed by electricity became putrid much sooner than the rest. The influence of electricity on fermentation was studied also by M. Achard. A handful of rye brought into a state of fermentation for the purpose of being distilled, was separated into two portions, one of which was electrified and the other not. Five hours afterwards the vinous fermentation had ceased in the electrified portion, but did not cease in the other portion till after the lapse of eight hours.

fluence electri- y on co- urs.

The influence of electricity upon colours is a subject of peculiar interest, and cannot fail to prove a rich field of discovery to those who may enter upon it with ardour. That electricity does alter the colour of particular bodies is undoubted; but whether it produces a real chemical change on these bodies, or merely a transient change in their power of absorbing specific rays of the spectrum, remains to be determined. The few experiments made by Cavallo are extremely vague and disparate. He found that vermilion, carmine, verdigris, white and red lead, had their colour altered by the electric shock; and that the colours of orpiment, gamboge, sage-green, red ink, ultramarine, Prussian blue, and of a few other compounds, were not altered. The eye, however, is no judge of a real change of colour. It can judge only of the general result of the change, without indicating the nature of the change or changes that have taken place. A body, too, which may have lost or gained the power of absorbing definite rays of the spectrum, may often appear to have suffered no change at all, provided that the sum of the changes is a colour similar to the original colour of the body.

In producing these effects, namely, putrefaction, fermentation, and change of colour, the electric fluid may act, not by any virtue of its own, but by the intermedium of those ponderable substances which the spark carries along with it, and consequently leaves in bodies.

Sect. III.—*On the Changes produced by Electricity on Phosphorescent Bodies.*

Influence of electricity on phosphorescence.

Although the phenomena of phosphorescence have been lately much studied, yet philosophers are very little acquainted with its cause, whether it is developed by the light of the sun, the action of heat, or the transmission of electricity.

Almost all bodies may be rendered luminous during the transmission of an electric discharge through their substance; but unless this luminosity continues after the discharge is over, the body cannot be said to have been rendered phosphorescent by electricity. In his numerous experiments on this subject, Mr Skrimshire invariably kept his eyes closed till the sound of the discharge had been heard, and therefore the light which he then saw was not the light of the electric spark, modified by its transmission through the body, but was a real phosphorescence, which continued after the original cause of it was withdrawn.

The substances which he submitted to examination were placed on a horizontal brass plate, fixed to the ball of the prime conductor, and he then tried to obtain a spark from the body by means of a common discharger. The body was next placed upon a table, and the charge of a Leyden phial passed *over it*, at the distance of about a quarter or half an inch above its surface; and, as a last trial, the charge of the jar was made to traverse its surface by resting the points of the discharging rod at an inch or more distant from each other, upon the specimens under examination.

The following table contains a general view of the results obtained by Mr Skrimshire:

esults tained Mr rim- ire.

Results obtained by Mr Skrimshire.

Table showing the Phosphorescent Effects of Electricity upon different Bodies, according to the Experiments of Mr Skrimshire junior.

CALCAREOUS GENUS.

Calcareous spar,	Rendered very luminous by the shock.
Common chalk,	Very luminous when the shock passed above it. When passed along its surface a zigzag track of light continued several minutes.
Ketton stone,	Part of the stone shattered, and its luminous grains dispersed in all directions.
Selenite,	Shines for a few seconds with a vivid greenish light.
Fresh nitrate of lime,	Gave small sparks, which were red flame-coloured upon its surface.
Muriate of lime,	More phosphorescent than the nitrate of lime.
Dark purple fluor spar,	Gave no sparks, but the electric fluid passed in a purple stream with a whizzing noise.
Yellowish fluor spar,	Gave very good sparks, while dark purple fluor spar gave none.
Sulphuret of lime, or Canton's phosphorus,	The most luminous of any substance by the electric explosion.
Phosphate of lime,	A minute red spark. It is inflammable by a very small shock.
Calcined oyster shells,	Are rendered beautifully luminous, and give the prismatic colours.
Ditto calcined with sulphur,	Give a durable and bright light, according to Mr Singer.

BARYTIC GENUS.

Carbonate of barytes,	No spark, but very luminous when the shock was passed above it.
Sulphate of barytes,	Good sparks, but slightly luminous. According to Singer, it gives a bright green light, more bright than that of the carbonate.
Sulphuret of barytes,	Was slightly luminous by the electric explosion.

Phenomena and Laws.

Results obtained by Mr Skrimshire.

MURIATIC GENUS.

Magnesia, pure and carbonated,	Were both transiently luminous by the electric explosion.
Sulphate of magnesia,	Very luminous through its whole substance.
Sulphuret of magnesia,	Not more luminous than the carbonate.
Chlorite,	Sparks branching off in minute party-coloured points.
Steatites, talc, and fibrous amianthus,	Gave sparks, and were slightly luminous by the explosion.
Asbestus,	Ramifications on its surface more variegated than in chlorite.
Mica,	Affords sparks, but is not luminous by the explosion.
Micaceous schistus,	Sparks ramified as in chlorite, scarcely phosphorescent.

ARGILLACEOUS GENUS.

Alum,	Spark purple, rather ramified, luminous through its whole surface.
Pipe clay,	Sparks, and luminous, but not luminous when made into pipes.
Slate clay,	Sparks, and luminous, but loses its absorbent power as it becomes bituminous.
Slates,	Sparks, and absorbed electric light from the explosion.
Hone stone,	Good spark, and phosphoric by the explosion.
Fullers' earth,	Good bright sparks, but slightly luminous.
Reddle,	No spark, but a purple stream attended with a very sharp hissing noise.
Armenian bole,	Ramified spark. It is not luminous by the explosion.
Basalt,	Sparks radiated upon its surface, but not ramified.
Bricks and tiles,	Small purple sparks of a bright red colour, slightly luminous.
Queen's ware,	Good spark, flame coloured and radiated upon its surface, but not phosphoric.
Ditto fractured,	The unglazed surface gives a purple spark, and is luminous by the explosion.

SILICEOUS GENUS.

Rock crystals,	Light, first red, and then white (*Singer*); all phosphoric (*Skrimshire*).
Quartz,	Phosphoric, with a dull white light; a purple stream instead of a spark.
Flints,	Small purple spark; not so luminous as quartz.
Lapis lazuli,	Affords very good sparks, and is luminous by the shock.
Agates, felspars, jaspers, Scotch pebbles,	Luminous by the explosion, and gave hissing purple sparks.
Porphyries and granites,	Hissing purple sparks, and luminous by the shock.
Pudding stones,	Similar hissing sparks. Oval pebbles more luminous than the sand.
Mochoas,	Good sparks from the arborescent parts, but only a hissing stream from the stone itself, which is slightly luminous by the shock.
Pumice stone,	Hissing streams in some, and good sparks in others, slightly luminous.
Different kinds of glass,	Neither give a spark, nor are luminous.

STRONTIAN GENUS.

Native carbonate of strontites,	Only a hissing purple stream, but very luminous by the explosion.

COMBUSTIBLES.

Roll brimstone,	Gives no spark, and is scarcely luminous by the shock.
Flowers of sulphur,	Are not phosphoric.
Phosphorus,	Inflames both by the spark and shock.
Charcoal,	Some kinds afford good sparks, and are phosphoric, and some not.
Cannel coal and Sunderland coal,	Give sparks beautifully variegated, in minute spangles, radiated upon their surface; but they are not phosphoric.
Hard and dry peat,	Gives a very good spark, but is scarcely luminous.
Hard and brittle bitumen from Derbyshire,	Gives no sparks, but the fluid spreads uniformly and silently over its whole surface, like the electric light in an exhausted receiver; it is luminous by the shock.
Elastic bitumen from Derbyshire,	Is also luminous by the shock.
Jet and asphaltum,	Give the same phenomena as bitumen, but are not luminous by the explosion.
Amber,	Gives no sparks, but is phosphorescent, particularly fat amber.
Plumbago,	Gives good sparks, and is not phosphoric.

As many bodies possess the property of becoming phosphorescent by heat, the phosphorescence produced in the preceding experiments may in general be ascribed to the heat which accompanies an electrical discharge. But although the heat thus produced may be either the sole or an auxiliary cause of the phosphorescence which is excited in bodies which are known to be phosphorescent by common heat, yet it is obvious from other experiments, that electricity exercises a specific influence upon that peculiar structure or condition of bodies which causes them to give out light when heated.

Experiments of Dessaignes.

M. Dessaignes seems to have been the first person who established a relation between electricity and phosphorescence. He found that the metallic powders, such as those of zinc and antimony, which are the most phosphorescent, lose their luminous qualities in a damp state of the atmosphere. Even in dry weather antimony loses its power of phosphorescing if it be rubbed in a metallic mortar; whereas, in an insulated mortar the light is very much increased. Glass pounded in dry weather becomes much more luminous than when it is pounded in a damp state of the air. It loses this property entirely in wet linen; but being as it were self-insulated, it is not deprived of its phosphorescence, like antimony, by being pounded in a mortar, which is a conductor of electricity. In order to make adularia phosphoresce briskly, it must be pounded in an insulating or insulated mortar; and the handle of the pestle should likewise be insulated. M. Dessaignes also found that *if glass be calcined till its phosphorescence is diminished, it resumes that property by being exposed on an insulated support and subjected to a few electrical discharges, or to a current of electrical matter.* Other substances which have *lost their phosphorescence* by calcination resume it when electrified; but our author remarked *that electricity does not restore the phosphorescence of those substances which have been deprived of it by the light of the sun.*

In pursuing this branch of the subject M. Dessaignes found that those phosphorescent substances which are imperfect conductors of electricity, are susceptible of receiving the luminous property from the action of the sun's rays; that *non-conductors* will not thus phosphoresce at all, or at least very imperfectly; and that most conductors give out no light whatever. Orpiment, and some of the oxides of arsenic, tin, zinc, and lead, are exceptions to this remark, and also the muriate of tin and the sulphate and phosphate of lead. Non-conductors, and conductors which refuse to phosphoresce after feeble electrical discharges, become luminous after strong ones; while imperfect conductors that phosphoresce after weak electrical discharges give no light whatever when the discharges are much increased. In support of the analogy between electricity and phosphorescence, M. Dessaignes remarks that phosphorescence is affected by the presence of points. Fluor spar, which has the asperities produced by fracture, phosphoresces readily, while the entire and smooth crystal remains dark. The same is true of calcareous spar, adularia, apatite, emerald, and common salt. If both sides of the glass be rough, it phosphoresces throughout; but if one side be rough and the other polished, it only shines when the rough surface receives the heat. It is a fact still more curious, that when Iceland crystal with smooth faces is exposed to the solar rays, it acquires very little phosphorescence; whereas, if but one of the faces is roughened and exposed to the sun, it readily becomes luminous. In like manner, Arragonite becomes luminous when a fractured face is exposed to the sun, but acquires very little light when the smooth natural surface is exposed to it. M. Dessaignes likewise maintains that nearly all the bodies that are susceptible of phosphorescence by friction become luminous by heat, by electricity, and by exposure to light. The general view which our author takes of these phenomena is, that phosphorescence is produced by a particular fluid, which is set in motion by light, by heat, by electricity, and by friction, and that it is dissipated by overheating or too long exposure to light.

Experiments of Mr Pearsall.

The influence of electricity upon phosphorescence and the colours of certain bodies has been recently examined by Mr Pearsall of the Royal Institution, who has amply confirmed the general result deduced experimentally by M. Dessaignes, that bodies which have lost their phosphorescent property by calcination acquire it again when an electrical discharge is passed through them. Having submitted a piece of chlorophane to a powerful heat, it gave out a strong phosphorescent light of a *pale violet colour*; but the specimen decrepitated so much during its calcination that a piece of sufficient size to be electrified could not be preserved. He therefore placed the calcined fragments in a glass tube, and sent through them three electrical discharges, the effect of which was the emission of a *deep violet light*. He then heated the fragments upon platinum, and they emitted a phosphoric light of different colours. Some of the fragments appeared *green*, others *yellow*, and all of them finished by emitting a *deep violet light*. These colours were evidently distinct from those of the natural mineral, for a portion of the latter heated at the same time produced only a *feeble violet colour*. Another portion of the same specimen, calcined but not electrified, emitted no light when heated.

A specimen of chlorophane, whose phosphorescence had been destroyed by an intense heat, was exposed to the solar rays for two days without any of its phosphorescent quality being restored. A single electrical discharge, however, restored its phosphorescence, which increased in the ratio of the number and the intensity of the shocks it received. The green light emitted by the action of heat was more deep and of longer continuance after three, six, or even twelve discharges, than after one. Mr Pearsall obtained the same results with apatite and some diamonds; but electricity produced no effect in developing phosphorescence by heat in amethyst, sapphire, ruby, garnets, and other mineral substances which he tried. The following table contains the principal results obtained by our author.

Names of Minerals.	Natural Colours.	Effects of Heat.	Kind of Calcination.	Mode of electrifying them.	Effeets of Heat after being electrified.
Fluor spar.	White crystallized mass.	No light.	Decrepitating strongly.	Small fragments in a tube.	Feeble light.
Ibid.	Ibid. another specimen.	Ibid.	Ibid.	Ibid.	Momentary but distinct light.
Ibid.	Ibid.	Ibid.	Ibid.	Ibid.	Feeble light.
Ibid.	White crystals.	Feeble violet light.	Ibid.	A fragment.	Feeble *violet* light, ending in deep purple.
Ibid.	Green crystals.	Pale violet light.	Ibid.	Ibid.	*Yellowish green*, ending in intense brilliant *purple*.
Ibid.	Ibid. another specimen.	Violet light.	Ibid.	Six discharges through a tube.	*Green*, *violet*, and then *purple*.
Ibid.	Amber coloured crystals.	Strong violet and rose coloured light.	Ibid.	Ibid.	Bright *orange*, but of short duration.
Ibid.	Crystallized violet mass, the least coloured parts used.	Ibid.	Ibid.	Ibid.	*Yellow* or *flame* coloured light.
Ibid.	The most coloured parts of the same specimen.	Ibid. stronger.	Ibid.	Ibid.	*Yellowish green* light.
Ibid.	Another specimen, deep violet throughout.	Ibid.	Ibid.	Ibid.	Very fine bright *yellow* light.
Calcareous spar.	Crystals.	No light.	Heated to redness.	Solid piece, six discharges.	No light.
				Fragments in a tube.	Feeble and *reddish* light.
Ibid.	Ibid.	Ibid.	Ibid.	Small solid piece, six discharges.	Ibid.
Ibid. Dog-tooth spar.	Ibid.	Yellow light, steady and continuing long.	Ibid.	Solid crystal, six discharges.	*Orange* light, but only at a high temperature.
Diamond.		No light.	Ibid.	Single pieces, 12 discharges.	Pale blue light.
Apatite.	Fragment.	Luminous.	Calcined.	Single piece.	Yellow light.

In the course of these interesting experiments Mr Pearsall observed the curious fact, that the specimens of fluor spar, though colourless in their natural state, received a bluish tint when electrified, and the acquired phosphorescence was proportional to the depth of the tint. When a number of fragments were used, the larger fragments were of a blue colour, and emitted a blue light when heated, whereas the smaller fragments emitted only a pale yellow light. Mr Pearsall thinks it probable that the phosphorescent property is communicated by electricity only to the surface, which he considers as explaining the fact that fragments of different dimensions emit differently coloured lights.

In resuming the investigation of this subject, Mr Pearsall found, that bodies not naturally phosphorescent, such as statuary marble in its natural or calcined state, ivory when its carbonaceous part was removed, calcined mother of pearl, calcined oyster shells, calcined petuncles, egg shells, and lime, were not only rendered phosphorescent by heat after being strongly electrified, but acquired this property with a beauty, a variety, and an intensity of colour superior to those which occur in specimens that possess a natural phosphorescence. We regret that our limits will not permit us to give in detail a second series of experiments which Mr Pearsall performed with twelve different varieties of fluor spar, all of which gave distinct phosphorescence previous to their being electrified; but the general result of them may be thus expressed. When the natural spars emit by heat a light of different colours, the electric action produces only one of them; but when the mineral yields only one natural colour by heat, this is replaced, when electricity is applied, by a phosphorescence of various colours, among which the primitive tint does not appear. As the colours change with the number of electrical discharges, Mr Pearsall found the following to be the order of progression. The specimen was a green fluor.

1 discharge,	pale purple light when heated.
2	pale green, changing into purple.
3	the same colours, more intense and durable.
4	purple, with increased intensity.
6	green, brighter and deeper.
10	green bright; fine and more durable purple.
20	deep and more durable colours.
40	very rich colours, the purple at last inclining to red.
100	green colour, highly brilliant, and becoming yellowish. The purple had now a superb tint.
160	an intense light nearly white, followed with a brilliant green light, then with a durable purple, and then with a yellow accompanied with violet tints.

This specimen had been successively heated and electrified nearly fifteen times, and had suffered no deterioration in its phosphorescent property.

Mr Pearsall next shows that the property communicated by electricity was preserved even for *three* months, when the specimen was kept in the dark. Out of twelve fragments, two had completely lost their acquired phosphorescence by exposure to the sun for twenty-one days, five had nearly lost it, and six had experienced a modification in their colours by this exposure.

Mr Pearsall now examined the influence of electricity on the natural phosphorescence of bodies, and he found that an augmentation of intensity was produced, of which it is difficult to give an idea. Specimens of fluor whose pyro-phosphorescence was feeble or uncertain, were raised to the rank of highly phosphorescent bodies, and some of them even rivalled the Siberian fluor. At the end of fifty days some of these specimens still preserved the excess of phosphorescence which had been communicated to them, while others continued to exhibit the same order of colours.

Mr Pearsall has brought forward several experiments to prove that the phosphorescence of bodies, and the modifications it experiences, depend on their structure and mechanical condition. Phosphate of lime, for example, which in the form of *apatite* has an intense natural phosphorescence, has none when aggregated from a precipitation of it in a solution of muriatic acid, nor when obtained from powdered or calcined apatite. A calculus of phosphate of lime, however, gave green, yellow, and orange light when heated after having been calcined and exposed to twenty electrical discharges. Mr Pearsall also several times observed that the power of phosphorescence returned after it had disappeared.

With the view of showing that the phosphorescence was not owing to any radiating matter which was carried along with the sparks, Mr Pearsall inclosed coloured chlorophane in glass tubes hermetically sealed, and found them phosphorescent after 225 discharges. He found Voltaic electricity capable of producing phosphorescence in some cases and not in others; so that it differs greatly from common electricity in this property.

In explaining the preceding phenomena, Mr Pearsall considers the intense electricity of the Leyden jar as altering the structure upon which phosphorescence depends, by the vibratory motion which it communicates, and which allows the particles to take a new arrangement. When the body has had a new structure communicated to it by the vibrations or shocks of each electrical discharge, the action of heat is supposed by our author to permit the body to return to its primitive structure; and he conceives that the vibrations of the atoms during these changes of structure may produce light.

SECT. IV.—*On the Changes produced by Electricity on Odoriferous Bodies.*

Influenc on odori ferous b dies.

It has been recently discovered by M. Libri of Florence that electricity exercises a curious influence over odoriferous bodies. Having caused a continued current of electricity to traverse a piece of camphor, the odour of this substance became more and more feeble, and at last entirely disappeared. When the camphor has suffered this change, and is withdrawn from all electrical influence, and put in communication with the ground, it will remain without odour for some time, but it will afterwards resume its former properties slowly and gradually. M. Libri seems to have obtained a similar result with other odoriferous bodies; but he has not, so far as we know, given any more particular account of his researches.

SECT. V.—*On the Magnetic Effects of Electricity.*

Magne effects electric

During almost every period of the history of electricity, philosophers have pointed out strong resemblances between the phenomena which it exhibits and those of magnetism. Some of the most striking points of resemblance were, that each consisted, as it were, of two powers or directions of powers, of an opposite nature, and subjected to similar laws of attraction and repulsion; that the action of magnetism has a great analogy with that of electricity; that the distribution of the forces in an electrified body differs very little from that of the forces in a magnet; and that the pyro-electrical tourmaline has the strongest resemblance to an artificial magnet.

These views were powerfully confirmed by the fact, often enome- a and Laws.

observed, that magnetism was communicated to bodies by a stroke of lightning, and that the compass needles of ships have had their polarity changed by a similar cause. The ship Dover was struck by lightning in the Atlantic on the 9th January 1749; and in four compasses on board, one of which was in a brass box, and the other three in wooden boxes, *all the needles had lost their virtue.* At first their polarity seemed to have been nearly reversed, but after a little while they moved about in every direction, and were of no use. Mr Gowin Knight, having examined one of these compasses, observed that the outward case was joined together by pieces of iron wire, sixteen of which were found in the sides of the box and ten in the bottom. By applying a small needle to each of these wires, Mr Knight found that they were all strongly magnetical, particularly those which had joined the sides.

Another very remarkable case occurred on board the New York Packet, in its voyage from America to Liverpool in 1827; and as a very accurate description of it was communicated by the Rev. Mr Scoresby to the British Association at York in 1831, we shall lay before our readers his own abstract of it. "Soon after the commencement of the voyage, this vessel encountered a severe thunderstorm, and received a stroke of lightning, which shattered the masts in several parts, and started some of the exterior planks of the bends. This was in the morning before day-light. The weather continuing unsettled, and the air in a highly electric state, with water-spouts in various directions around, the captain, fearing another explosion from the highly charged atmosphere, put up a lightning conductor which he had on board. In the afternoon of the same day the ship was a second time struck, but preserved by the conductor, though the iron of which it was composed was destroyed, and fell in melted globules upon the deck. No lives were lost, though some of the crew received heavy shocks; whilst one person, an invalid passenger, derived essential benefit from the electric discharge. Mr Scoresby had an opportunity of examining the vessel immediately on her arrival in Liverpool, when, on investigating the condition of the iron on board, he found almost every article capable of permanent magnetism, with sensible polarity. Table-knives and forks were capable of lifting needles or small nails, and one knife sustained a travelling-trunk key. Most of the watches on board suffered by the magnetic influence, especially those which were under the pillows of their owners in bed. These were all stopped, and on examination were found so highly magnetic that portions of the steel-work were capable of suspension by each other, in a chain of three or four pieces. Of one of these pieces (the cap-spring) Mr Scoresby made a pocket compass, which was exhibited when his communication to the association was made, and was observed to be in all respects a delicate and perfect instrument."

xperi- ents of ranklin.

In enumerating the points of analogy between lightning and electricity, Dr Franklin remarks that they have both the power, not merely of reversing the poles of magnets, but of completely destroying their magnetism. By discharging four large jars through a common sewing needle, he communicated to it such a degree of magnetism, that it placed itself on the plane of the magnetic meridian when it was made to float on water. If at the time of receiving the discharge the needle lay east and west, the end at which the discharge entered pointed north; but if the needle lay north and south, the end which lay to the north continued to point to the north, at whatever end the discharge entered. He found also that the magnetic intensity developed in a needle was a *maximum* when the needle lay north and south, and a *minimum* when it lay east and west, at the time of receiving the electrical discharge. If the charge of a large jar or battery is transmitted through a steel wire perpendicular to the horizon, it will be permanently magnetised, and the lower end, at the time of the discharge, will afterwards turn to the north when it is made to traverse in a horizontal plane. If we now replace the wire in its vertical position, the end which was formerly the lowest being now the highest, and again transmit the discharge, the polarity of the needle will either be completely destroyed, or the poles will be reversed.

Phenomena and Laws.

It has been found also that the polarity of a natural magnet may be completely destroyed by transmitting through it the charge of a battery.

Experiments of Beccaria.

In repeating the experiments of Franklin, Beccaria discovered that lightning always communicates the magnetic polarity to bodies containing iron, and he observed this phenomenon even in common bricks that had been struck by lightning. Guided by the observations which he made on the polarity of such bodies, he was able to trace the directions which the lightning had taken in passing through them.

Of Van Marum.

A series of elaborate experiments were made by Van Marum, on the magnetic effects of electricity. He employed a battery of 135 jars, containing 130 square-feet of coated surface, and he transmitted the powerful charges which it yielded through watch-spring needles from three to six inches long, and also through steel bars nine inches long, between a quarter and half an inch broad, and nearly a line thick.

In this way he found that when the needle or bar was placed horizontally in the plane of the magnetic meridian, its north end acquired north polarity, and its south end south polarity, in whatever direction it received the discharge. When the bars possessed some degree of polarity before receiving the shock, it was either diminished or reversed after receiving it. When the needle or bar received the shock in a vertical position, its lower end became the north pole whether it had been previously magnetic or not. Generally speaking, the degree of magnetism which was communicated was as strong in a horizontal as in a vertical position. When the needle was placed in the magnetic equator, and received the discharge longitudinally or along its axis, it received no magnetism whatever; but when *the shock was passed through its width, or at right angles to its axis*, the needle received a considerable degree of magnetism, the end which pointed to the west becoming the north pole, and that which pointed to the east the south pole.

When the charge was so powerful as to render the needle hot, no sensible polarity was communicated to it.

Discovery of electro-magnetism by Professor Oersted.

Such was the state of our knowledge respecting the connection between electricity and magnetism, when Professor Oersted of Copenhagen, led by theoretical views, established a most interesting relation between these two powers, and laid the foundation of the new science of *Electro-magnetism*, or *Magneto-electricity*. The fundamental fact which Mr Oersted discovered may be thus expressed.

When a wire conducting electricity is placed parallel to a magnetic needle properly suspended, the needle will deviate from its original or natural direction. This deviation follows a regular law.

1. If the needle is *above* the conducting wire, and the positive electricity goes from right to left, the *north* end of the needle will be moved *from* the observer.

2. If the needle is *below* the wire, and the positive electricity passes as before, the *north* end of the needle will be moved *towards* the observer.

3. If the needle is in the same horizontal plane with the wire, and is between the observer and the wire, the *north* end of it will be *elevated*.

4. If the needle is similarly placed on the opposite side,

Phenomena and Laws.

the *north* end of it will be depressed. In these two experiments the needle must be very near the wire.

From these simple facts Mr Oersted concludes, *that the magnetical action of the electrical current has a circular motion round the wire which conducts it.* This law will be understood by inspecting Plate CCXIII. fig. 10, where, if AB is the conducting wire or the direction of the positive electricity, the circle *c d e f* will be the plane in which the magnetical circulation takes place. The small arrows show the direction of the austral or polar magnetism, the sharp ends or heads of the arrows indicating the direction in which the *austral* magnetism, and consequently the *north end* of the needle, is *repelled*, and the *boreal* or northpolar magnetism is attracted; while the opposite ends of the arrows indicate the direction in which the *boreal* magnetism, and consequently the *south end* of the needle, is *repelled*, and the opposite magnetism attracted.

Plate CCXIII. Fig. 10.

Dr Colladon's experiments with ordinary electricity.

The preceding discovery was made with the electricity of the galvanic battery, but it is equally true when a strong current is obtained from the common electrical machine. An electric spark sent along a conducting wire passes too quickly to move the needle, and a current produced by the electrical machine does not appear to contain a sufficient quantity of electricity to act upon the needle, or rather to show its action. If the electrical effect of the current, however, is multiplied, its action upon the needle becomes apparent. In order to do this we must use, as Dr Colladon first did with success, Schweigger's multiplier, which is shown in fig. 11, where ABCDE is the wire which conducts the electrical current, bent several times, and covered with three folds of silk for the purpose of insulation. The needle NS is then inclosed within the coils of the wire, and the effect of the current upon it is obviously quadrupled by the *four* coils of the wire which surround it. The coils should be as near to each other as possible; and as they can be repeated a great number of times, the multiplication of the effect is almost unlimited. The needle is suspended by a single fibre of silk, and the sensibility of the instrument may be increased by using a magnet for the purpose of diminishing the directive power of the needle. When Dr Colladon brought the two ends of the wire of this apparatus to the two conductors of an electrical battery of 4000 square inches, so as to make the discharge go a little way through the air before it entered the wire, a current of sufficient strength and of some duration was obtained, which produced a considerable deviation in the needle. Dr Colladon also obtained a deviation of several degrees with this multiplier, by means of the electrical current obtained from an electrical machine.

Fig. 11.

Experiments of Dr Faraday.

These interesting experiments of M. Colladon have been amply confirmed and beautifully extended by Dr Faraday. Although MM. Arago, Ampere, and Savary had witnessed a successful repetition of M. Colladon's experiments, yet the conclusions to which they led were doubted by some and denied by others. Dr Faraday was therefore induced to repeat them with great care. He employed for this purpose the electrical machine, battery, and discharging train already described (see page 631).

The galvanometer which he used was sometimes a single one, consisting of sixteen or eighteen convolutions of copper wire covered with silk, and sometimes a double one, consisting of two independent coils, each containing sixteen feet of silked copper wire. The glass jar which covered the galvanometer and supported the needle was coated inside and outside with tinfoil, the upper part (left uncoated for the purpose of examining the motions of the needle) was covered with a frame of wire-work with numerous sharp projecting points. When this frame and the two coatings were connected with the discharging train, an insulated point or ball, connected with the machine in its most active state, could be brought within an inch of any part of the galvanometer, without the inclosed needle being affected by any ordinary electrical attraction or repulsion.

Dr Faraday expected, by means of the retarding power of bad conductors, to obtain from ordinary electricity the powers of Voltaic electricity. After the connections were properly made, a battery charged positively by about forty turns of the machine was discharged through the galvanometer, when the needle immediately moved. By repeating this experiment when the needle was vibrating, its vibrations were extended to above forty degrees on each side of the line of rest: on reversing the galvanometer the needle was equally well deflected in the opposite direction, the deflections being in the same direction as if a Voltaic current had passed through the galvanometer, the positive surface of the battery coinciding with the positive end of the Voltaic apparatus. Similar effects were obtained by taking the electrical current directly from the prime conductor, and dispensing with the battery altogether. When the electricity, too, was passed through an exhausted receiver to imitate the aurora borealis, and then through the galvanometer to the earth, it was equally efficacious in deflecting the needle.

From these and other experiments, Dr Faraday concludes that a current of common electricity, whether transmitted through rarefied air, water, brine, acids, and other imperfect conductors, or through wire, or by means of points in common air, is still able to deflect the needle (the only thing necessary being to allow time for its action), and is just as magnetic as a Voltaic current.

As it is by the galvanic battery, however, that this subject has been studied, we cannot pursue it any farther at present, and must refer our readers to the articles already mentioned, in which a full view of this new science will be given.

Sect. VI.—*On the Effects of Electricity upon Animal Bodies.*

Influenc of electri city on a mal bodi

The influence of electricity on the human frame, whether it is administered in small quantities so as to excite and surprise us, or in the more powerful and awful form of a stroke of lightning, must be well known to the least informed of our readers.

When any part of the body receives an electric shock, a disagreeable sensation is felt in the place; and, according to Dr Robison, it is sharper when taken from a long wire than from a large body. When the human frame forms part of the electric circuit, or when the charge of a Leyden phial is made to enter the body at one hand and pass out of it at the other, a violent concussion or shock is felt along the line of its passage across the breast and through the arms. This electrical shock, and the involuntary motion which accompanies it, arises no doubt from the obstructions which an imperfect conductor like the human body, composed of fluids and solids of different conducting powers, presents to the free passage of the electric fluid. If the charge is increased, the patient through whom it passes falls down under its influence, and suffers a temporary suspension of vital action; and if it is increased to a still greater degree, it will produce instantaneous death. This case is frequently exemplified when persons are killed by lightning; and a very remarkable instance of the laceration of the human body lately occurred, which could have arisen only from an obstruction to the free passage of the fluid. The case to which we refer presents us with a most singular variety of action exhibited by the lightning in passing through animal bodies; and it is so interesting, and so well described by Mr B. Boddington, the father of the gentleman who was struck with the lightning, that we shall present our readers with an abstract of it.

gular ects of htning.

On the 13th of April 1832, Mr and Mrs T. F. Boddington left Tenbury, occupying the hind barouche seat of their post-chariot, the servants being in the inside. About half past three o'clock, with the sun shining, and a serene sky, they observed a dark cloud to arise in the direction of their route. Soon after a clap of distant thunder was heard, but no lightning was seen. A few drops of rain having begun to fall, Mr Boddington put up an umbrella, and, after giving it to his wife, he put up another, and when he was in the act of extending the latter, a flash of lightning struck them both senseless, threw the horses on the ground, and cast the post-boy to a distance. One of the servants, after recovering from his alarm, looked out of the window, and saw the head of Mr Boddington hanging over the seat, and apparently lifeless. Jumping from the carriage, he raised his master's head, and found his clothes on fire, while Mrs Boddington was standing up tearing off her bonnet and shawls. She had neither seen the flash nor heard the thunder, but felt a sense of suffocation, and was putting off her things to obtain air. She and the servant then proceeded to extinguish the fire, which was still consuming her husband's dress. The lightning, passing down through the umbrella, penetrated through the bonnet into Mrs Boddington's neck, and zigzagged along the skin of her neck to the steel busk of her stays, leaving a painful but not a deep wound, and affecting the hearing of the left ear. From the lower end of the busk the lightning pierced through all the garments down to her thighs, where it made wounds on both; but the one on the left was so deep and so near the femoral artery, that the astonishment is she escaped with her life, the hæmorrhage being very great. None of her clothes were burnt, notwithstanding their inflammable nature, nor did any of her wounds present the appearance of burns. Mr Boddington, after remaining insensible for ten minutes, revived, and felt a pain all over him. The main force of the shock passed down the handle of the umbrella to his left arm, though a portion of it made a hole through the brim of his hat, and burnt off all the hair that was below it, along with his eye-brows and eye-lashes. The fragments of the burnt parts falling into the eyes, deprived him nearly of sight for two or three days. The electric stream shattered his left hand, melted his gold shirt-buttons, and tore the clothes in a most extraordinary manner, forcing parts of them, with the buttons, to a distance, and inflicting a deep wound under their position on the wrist. The arm was laid bare to the elbow, a severe wound was made in his body, and every article of his dress torn away as if by gunpowder. It then passed to the iron of the seat, wounding his back, the whole of which was literally flayed. The horse rode by the postilion was killed. A very striking difference was observed in the wounds of Mr and Mrs Boddington. Hers were fractures of the flesh. His, on the contrary, whether deep or shallow, were all burns, and had a white and blistered appearance. No wound was visible on the dead horse excepting an indentation on the head where the fluid entered, discolouring the spine in its passage.

xperiments of an Marum on ls.

For the purpose of determining in what manner death is produced by a powerful electric discharge, Van Marum sent the electric shock through eels one and a half and three and a half feet long. The smaller eels were instantly killed when the shock was sent through their whole body; but when the charge was only sent through individual parts, these parts only lost their irritability, while the rest retained it. When the shock went through the upper and fore part of the head of the large eels, the under jaw, as well as the muscles of the neck and belly, and even the lower part of the body, preserved their irritability, while the parts which conveyed the charge had totally lost it. When smaller shocks were sent through warm-blooded animals, similar effects were observed; and hence it has been inferred that the circulation of the blood cannot take place when such an effect has been produced, and that the suspension or destruction of life must arise from this cause. When the shock does not affect the large arteries the animal may recover, provided that the spinal marrow and the cerebellum are not injured.

Experiments of Morgan.

Various experiments have been made by Mr Morgan and others, with the view of ascertaining the influence of electricity on the animal functions. Mr Morgan found that if the diaphragm forms part of the circuit between the inside and outside coating of a jar containing two square feet, the lungs will make a sudden effort, followed by a loud shout. When a small charge is similarly applied, a violent fit of laughter is always produced, even on the gravest persons. A strong charge transmitted through the diaphragm is frequently accompanied by tears and sighs, and sometimes by fainting. When a strong charge is sent through the spine of a person standing, he will frequently either drop on his knees, or fall prostrate on the floor. A strong charge having been transmitted accidentally through Mr Singer's head, he felt the sensation of a violent but universal blow, which was followed by transient indistinctness of vision and loss of memory, but no permanent injury was received. When the charge of a battery is sent through the head of a bird, its optic nerve is always injured or destroyed; and when a smarter shock is given to a larger animal, a tremor and depression, with a general prostration of strength, is produced.[1]

Mr Cavendish observed that the sensible shock depended more on the quantity than on the intensity of the charge, a double degree of intensity with only half the quantity invariably producing a less powerful shock. According to Volta, only a little more electricity is necessary to produce an equal shock from a larger surface. A surface, for example, sixteen times as large, required only an elevation of the electrometer to one tenth of the number of degrees. Dr Robison informs us that the shock obtained from a small charge given to a large surface, yields a less unpleasant shock than a large charge given to a small surface. As these observations, however, depend upon individual feeling, and as it is known that different persons are affected in very different ways with the same degree of electricity, they may not be generally correct.

Effects of electricity on the pulse.

The influence of electricity on the pulse has been examined by different authors, though with some variety of result. M. Trembley found that the arterial pulse was quickened in persons electrified. M. Boze was of the same opinion; but the Abbé Nollet could not discover any increase in the rapidity of the circulation of various animals which he electrified. Cavallo, on the contrary, informs us that an experienced medical electrician assured him that, "in a diseased state of the body, an obvious acceleration of the pulse was observed to result from the application of electricity."

Experiments of Nollet.

In the experiments made by M. Nollet, his attention was directed to other points beside the state of the pulse.

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[1] Dr Young observes, that a minute tremor communicated to the most elastic parts of the human body, particularly to the chest, occasions a nervous agitation, not unlike the effect of weak electricity.

His experiments were made with birds, cats, and the human subject; and having selected and carefully weighed pairs of the animals, he communicated to them a current of electricity for some hours, when they were again weighed. The loss sustained was ascribed to perspiration. The general result was, that the animal which was electrified was always found to be lighter than the one which was not. The persons who submitted to these experiments suffered no inconvenience from them. They experienced a slight degree of exhaustion, and an increase of appetite, but none of them found themselves sensibly warmer.

Experiments of Van Marum.

In order to settle these questions respecting the influence of electricity on the pulse and on insensible perspiration, Van Marum selected *eleven* persons, and repeated the experiment *four* times upon each, with negative as well as with positive electricity. They were placed in a room so remote from the machine that they could not hear the noise which was made in working it. They were placed on insulating stools, and their pulse was felt and carefully counted both when the machine was in motion and at rest. The general result was, no decided acceleration was observed, a few additional beats having taken place in some cases. In general, however, *there was a great irregularity in the pulse.*

The next experiment of Van Marum was a very interesting one. He placed a boy eight years old in one scale of a delicate balance, which scale was insulated by means of a silk cord. The boy being connected with the conductor, the balance was brought to a state of exact equilibrium. Having determined that the boy, previous to being electrified, lost 280 grains in an hour, he electrified him, and found that the loss was 295. In another experiment the boy lost 330 grains before, and 310 after being electrified. A girl seven and a half years old lost 180 grains before, and 165 after being electrified. A boy eight and a half years old lost 430 grains before, and 290 after being electrified. A boy nine years old lost 170 before, and 240 after being electrified. As this boy had remained very quiet during the experiment, the increase was ascribed to electricity, and the experiment was carefully repeated. He now lost 550 grains before, and 390, 330, 270, 550, and 420 after being electrified. Hence it appeared that the insensible perspiration had rather decreased than augmented.

Medical electricity.

The powerful influence of electricity on the human frame led the more sober part of the medical profession to view it as a valuable auxiliary in the healing art, while those who were more sanguine regarded it as an universal medicine, which might be resorted to in every form of disease. Charlatans of every degree found the electrical machine a lucrative article of trade; and there were not wanting well-meaning enthusiasts who contributed to prolong the reign of medical electricity.

But though electricity has not yet taken up a position in the healing art, there can be no doubt that in various disorders its application has been found advantageous, and that patients have, in a particular class of diseases, experienced instantaneous relief.

Electrical machine for medical purposes. Plate CCXVI. Fig. 16.

The machine used for medical purposes should have sufficient power to yield a continued current of strong sparks. The diameter of the plate in a plate machine should be about twenty inches, and that of a cylinder about ten or twelve inches. The only apparatus necessary is a jar fitted up with Lane's electrometer (see Plate CCXVI. fig. 16), and a pair of directors, each consisting of a glass handle surmounted by a brass cap, with a wire a few inches long, carrying a ball at its extremity. A wooden point is sometimes substituted for this ball. When it is required to pass a shock through any part of the body, the directors are applied at the opposite extremities of the part, one director being connected by a wire with the inside coating, and the other with the outside coating of the jar, or, what is the same thing, with the receiving ball of Lane's electrometer, previously placed at such a distance from the ball of the jar as to yield a charge of the proper magnitude. When sparks are to be administered, it is done with the director and brass ball; but when the organ is very delicate, such as the eye, a stream of electricity is thrown upon it from the wooden point, held at the distance of about half an inch. An insulating stool, capable of holding a chair for the patient, is also necessary. In certain cases a brass plate, communicating with the inside of the jar, is placed in the bottom of the chair, so as to apply itself to the lower part of the body, when the electricity is required to pass through the abdomen or adjacent parts.

In his *Introduction to Electricity and Galvanism*, Mr Carpue has enumerated several diseases in which it seems to be almost certain that electricity will be beneficial. The following is an abridgment of his list:

1. *Contractions.*—In those which are of long duration immediate relief has been obtained, provided they depend on the affection of a nerve.

2. *Rigidity.*—Cases of this kind have been frequently relieved after some perseverance.

3. *Sprains, Relaxation.*—Electricity applied after the subsidence of the inflammation is generally advantageous.

4. *Indolent Tumours.*—Strong sparks and slight shocks are frequently very effectual. Schirrous indurations of the breast have been often successfully dispersed. Ganglions have also been removed from the wrists or feet.

5. *Chilblains.*—Electricity is a good preventive, and in two cases they were removed by electric sparks.

6. *Deafness.*—Sparks thrown upon the mastoid process, and round the *meatus auditorius externus*, and drawn from the same part on the opposite side, generally afford relief, and about one in five have been permanently cured.

7. *Opacity of the Cornea.*—A current of electricity thrown for about ten minutes a day on the eye from a wooden point, sometimes cures this disorder. It is said to yield most readily when originating from the small-pox. In one case the disorder always returned when the electricity was discontinued.

8. *Gutta Serena.*—The method of electrifying the eye for the opacity of the cornea has been occasionally successful in this disorder.

9. *Knee Cases.*—Pains and swellings in the knee have been removed to the extent of one case in ten by sparks.

10. *Chronic Rheumatism.*—Sparks given for ten or fifteen minutes every day have afforded numerous cures. A few days is sometimes sufficient; but in cases of long standing considerable perseverance is necessary.

11. *Acute Rheumatism.*—An electrified current of air applied about a month, effected a cure in one case out of six.

12. *Palsy.*—Moderate shocks, with sparks occasionally, have been successful in about one case in every fourteen.

13. *St Vitus's Dance.*—This has also been frequently relieved by electricity.

A work in two volumes has been written by the Abbé Bertholon, a very respectable and scientific individual, in which electricity is regarded as a power which exercises an extensive influence in the cure of disease; and there is scarcely any class of disorders in which this credulous author has not represented it as having been successful. He considers the electricity of the atmosphere as a principal cause of the number of deaths, particularly sudden deaths, and as having a marked influence on generation, conception, and parturition.

Although several works of rather an empirical character have been more recently written on medical electricity, yet no philosopher of any eminence, with the exception of Professor Marianini, has devoted any attention to the subject. This ingenious author has published more than one memoir entitled "*On some Cases of Palsy treated by means of Electricity produced by a Voltaic Apparatus.*"[1] He has given a minute account of the cases in which electricity proved efficacious, of those which were attended with some amelioration, and of those in which it was wholly unsuccessful. He gives excellent general directions for the application of electricity, and mentions some curious facts which have occurred in his practice. Our author recommends electricity in the strongest manner as a moral remedy in palsy, and advises philosophers to study, more attentively than they have done, the influence of this powerful agent upon the human frame. As M. Marianini did not use ordinary electricity, we cannot with propriety give any further account of his labours here. We shall only remark, that it will be a most interesting study to compare the effects produced with the intense electricity of the machine, with those produced with the more copious quantity yielded in the Voltaic apparatus.

SECT. VII.—*On the Effects of Electricity upon Vegetable Bodies.*

fects of ectricity vege- bles.

It has been distinctly shown by Priestley, Ingenhousz, and Sennebier, but especially by Theodore de Saussure, that the various parts of plants act upon atmospheric air; that they insensibly disengage a large quantity of carbonic acid at the expense of the oxygen; and that, owing to some combination within the plant, they sometimes exhale pure oxygen. Now, as all carbonic acid has vitreous electricity, this exhalation of the acid from plants ought to furnish an abundant supply of it to the atmosphere. M. Pouillet, of whose researches we have already given an abstract, has placed this truth beyond a doubt.

From this fact alone we might reasonably infer that electricity performs an important function in the phenomena of vegetation; but so little attention has been paid to this subject, that we have some hesitation in laying before our readers the very imperfect and unsatisfactory experiments which have been recorded. The best experiments, indeed, have entirely a negative character; and the general result of them is given when we say that electricity appears to have no decided efficacy as a stimulus to vegetable life.

The recent discoveries, however, which have been made on endosmose and exosmose by M. Dutrochet, render it extremely probable that an electrical action is the cause of the ascent of the sap in plants; but as M. Poisson continues to ascribe these curious facts to capillary action, and other philosophers to other causes, we must wait for further experiments before we can treat this subject as a branch of electricity.

PART II.

DESCRIPTION OF ELECTRICAL APPARATUS.

ectrical paratus.

In the preceding part of this treatise we have already had occasion to refer to several pieces of electrical apparatus, and particularly to two or three varieties of the best machines for generating electricity by friction. Notwithstanding this slight anticipation, however, we must resume the subject at some length, on account of its great importance in a popular and practical view of the science.

The various kinds of electrical apparatus may be classed under the four following heads:—

1. Instruments for generating and collecting electricity.
2. Instruments for accumulating electricity.
3. Instruments for indicating the presence of electricity, and measuring its quantity.
4. Instruments for miscellaneous purposes.

CHAP. I.—DESCRIPTION OF INSTRUMENTS FOR GENERATING AND COLLECTING ELECTRICITY.

Instruments for generating electricity.

The instruments which belong to this chapter are, electrical machines, atmospherical conductors, and electrophori.

SECT. I.—*Description of Electrical Machines.*

The simplest of all pieces of apparatus for generating electricity is a tube or rod of glass, which, when rubbed with a piece of woollen cloth, will yield as much electricity as will charge a jar in a short time. In consequence, however, of the labour which attends this operation, it has been usual to turn a sphere or cylinder of glass round an axis by a simple winch, or by a double wheel and band, for the purpose of generating electricity rapidly, and without fatigue to the operator.

We have already exhibited two of these machines in Plate CCIX. fig. 3 and 6, and described their general construction. It is easy to modify this construction in various ways;—and for particular purposes and particular classes of experiments particular forms of the machine may be most convenient: But as the philosopher is best capable of introducing such modifications for his own use, we shall not occupy our pages with the descriptions of electrical machines which have sprung more from the fancy and caprice of individuals than from the wants of the science.

There can be no doubt that the plate-glass machine is the most commodious and the most powerful form of the electrical machine.

We have already described, and given representations of very excellent plate-glass machines in Plate CCIX. fig. 1, 2, and 7, and in Plate CCX. fig. 1–5, of the last of which we shall give a fuller description; but we have reserved to the present chapter the description of the best form of the electrical machine with which we are acquainted, and which we owe to the ingenuity of Mr Snow Harris, F. R. S. Plymouth.

1. *Description of Mr Snow Harris's Electrical Machine.*

Mr Snow Harris's electrical machine. Plate CCXIV. Fig. 7.

This machine, which is shown in perspective in Plate CCXIV. fig. 7, consists of a circular disc of plate glass Z Z, three feet in diameter, mounted on a horizontal axis, resting on two horizontal supporters of mahogany. These supporters are themselves sustained by four vertical mahogany columns, fixed upon a firm frame as a base. To the lower side of this frame are fixed four legs M, N, O, P, upon which the whole machine rests; and these legs again rest upon another steady frame R, S, T, furnished with rollers, so as to move it easily into any required position, and likewise with three levelling screws R, S, T, for placing it horizontally. By these means the machine may be so adjusted and fixed that the axis of the plate of glass, which has a free motion backwards and forwards in the holes in which it turns, may not tend more to one side than to the other, and occasion an equal action on the rubbers. The rubbers, which are four in number, are insulated on pillars of glass A, B, one placed at each extremity of the horizontal diameter A, B of the plate. The positive conductor C, B, D projects in a vertical position in front of the plate Z Z, while the negative conductor passes in a curvilineal direction behind, and connects the rubbers of each side.

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[1] *Ann. dell. Scienz. del Regno Lombardo-Veneto*, Marz. et Avr. 1833.

The plate of glass is turned by an insulated handle, immediately in front of which is placed a short index, which is fixed to the axis, and which moves over a graduated circle L, attached to the horizontal part of the frame, and through the centre of which the axis passes. In this manner the number of revolutions of the plate may be accurately registered.

In order to strengthen the centre of the plate, two smaller plates are cemented to each side by varnish; and a small stop is inserted into the axis, to prevent the pressure from increasing beyond a certain point.

When the machine is used for ordinary purposes, the conductors shown in fig. 7 are employed; but when it is employed to accumulate electricity, the conductors should have the smallest extent possible, and, excepting at the receiving points, where they collect the electricity from the edge of the silk flaps about H, H, they should be covered with sealing-wax. In this case the positive conductor is formed of small straight tubes, as shown in fig. 8, and its extremities terminate in balls of varnished wood, through the substance of which the metallic communications pass.

Fig. 8.

2. *Description of Van Marum's Electrifying Machine.*

Van Marum's electrical machine. Pl. CCX. Fig. 1-5.

This machine, to which we have made a brief reference in Sect. III. Chap. II. Part I., is represented in elevation and in section in fig. 1 and 2 of Plate CCX. The plate of glass AB, which is thirty-one inches in diameter, is sustained by a single pillar E, at the upper extremity of which are two similar brass collars I, I, one of which is shown separately in fig. 4. The horizontal axis MN rests upon these collars, and this axis carries a counterweight L, in order to balance the plate of glass and its appendages, and thus equalize the friction on the collars. The rubbers, which cannot be seen in the section, fig. 2, are shown at *m*, *n*, fig. 1. The pair at *m* is attached to the ball O, and supported by the glass pillar *e;* and in like manner the pair at *n* is attached to the ball P, and supported by the glass pillar *f.* A horizontal section of the rubbers and balls is shown separately in fig. 3. A semicircle of brass CD is attached to an axis *g* that turns on the ball G, resting on the pillar F, so as to give the conductor CGD a motion round that axis. Collectors six inches long and two and a half in diameter are placed at C and D, to collect the electricity from the revolving plate AB. At the outer end of the axis *g* is a copper tube H*h*, terminating at its lower end in a ball H, and its upper end in a smaller ball *h*, two inches in diameter, which, screwing into G, will fix the tube H*h* in any position round *g*. An arch of brass wire *cld*, half an inch in diameter, is fixed to the end of the bearing piece K, and moves round I into any given azimuth, so as to be placed, as in fig. 1, opposite the rubbers *m*, *n*, or at right angles to them. In like manner, the conductor CGD can be placed either horizontally, so that the collectors C and D may be opposite the rubbers *m* and *n*, or vertically, as shown in fig. 1. By this apparatus it is easy to produce either positive or negative electricity. In the position of the conductor shown in fig. 1, where CGD is at right angles to the rubbers, and where the rubbers are connected with the ground by the arch *cld*, and by the wire KK, fig. 2, the conductor G will give *positive* electricity; but when we wish *negative* electricity, the conductor CGD is placed horizontally, with its collectors C, D opposite the rubbers, and the arch *cld* is placed vertically, so as to insulate the rubbers.

A mahogany cap T covers the metallic caps of the supports, in order to insulate them more perfectly. A hollow ring of mahogany, VX, is, for the same reason, made to cover the metallic socket into which the support is inserted. In fig. 3, *a*, *b*, *a*, *b*, are four pieces of gum-lac. In fig. 1 and 2, W is the handle by which the machine is wrought.

3. *Description of Hare's Electrical Machine.*

Hare's electric machin Pl. CCI Fig. 7.

This machine, which we have previously noticed, differs from those generally made, in having its glass plate horizontal; and it is considered by its inventor, Professor Hare of Philadelphia, as giving negative electricity in a way preferable to that in which it is obtained in Van Marum's machine. The glass plate MN, thirty-four inches in diameter, is supported on an upright iron bar PR, about an inch in diameter, and covered by a stout glass cylinder, sixteen inches high and four and a half inches in diameter, open only at the base, through which the bar is introduced so as to form its axis. At the top of the bar PR is a block of wood turned to fit the cavity at the apex of the cylinder, and cemented therein. The external apex of the cylinder is fixed by cement into the brass cap which carries the plate. The glass cylinder, which is liable to no strain, effectually insulates the plate from the iron axis PR. The brass cap seen at P is surmounted by a screw and flange, which, with the aid of a corresponding nut and discs of cork, keeps the plate firm. The wheel W, driven by a handle, communicates by means of a band with another wheel about twenty inches in diameter, placed on the iron axis RS.

"Nearly the same mode of insulation and support," says Dr Hare, "which is used for the plate is used in the case of the conductors. They consist severally of arched tubes of brass (ABC, DEF), of about an inch and a quarter in diameter, which pass over the plate from one side of it to the other, so as to be at right angles to, and at a due distance from, each other. They are terminated by brass balls and caps, which last are cemented on glass cylinders of the same dimensions nearly as that which supports the plate. The glass cylinders are suspended upon wooden axes, surmounted by plugs of cork turned accurately to fit the space which they occupy. The cylinders are kept steady below by bosses of wood which surround them. In this way the conductors are effectually insulated, while the principal strain is borne by the wooden axes."

The collectors are shown at MN in connection with the *positive* conductor ABC, and the rubbers are shown between P and the balls D and F in connection with the *negative* conductor DEF. The advantage of this form of the machine over that of Van Marum is, that the two conductors are permanently fixed in their places, and that positive and negative electricity can be at any time obtained without any change in the machine. Dr Hare considers the band as of advantage in preventing the plate from being cracked by any hasty effort to put it in motion when it adheres to the cushions, as it often does. Dr Hare uses a winch on the other side of the wheel, so that two persons, or one with both hands, may drive it.

The great expense of large cylinders and plates of achines silk bs; glass, and their liability to injury, have induced artists to construct electrical machines of different substances. M. Walckiere de St Amand of Brussels constructed a machine of extraordinary power, which consisted of a web of varnished silk twenty-five feet long and five feet wide, revolving upon two wooden cylinders covered with woollen serge. During the revolutions of the cylinders, the silk moves between two cushions, each seven feet long and two inches in diameter, covered by cat's skin or hare's skin, and moveable so as to vary the friction. The machine was driven by four men, and it had so great power that it gave sparks fifteen inches long, and nobody durst take a spark from it but with the shoulder and elbow.

varnish- paste- ard; Dr Ingenhousz constructed machines with discs of pasteboard four feet in diameter, and soaked in copal or amber varnish dissolved in linseed oil. They were covered with the same varnish, and were mounted upon an axis or flat board, three inches broad, and covered with flannel or hare's skin, being placed between each two discs, so as to act as a rubber. Sparks one and even two feet long were given out by the front disc when the knuckle was presented to it.

wooden scs. Wooden discs, and cylinder discs of gum-lac partly immersed in mercury, which acted on the rubber, and stretched varnished ribbons, have been all used in the construction of electrifying machines, but it would be an unprofitable task to describe them.

4. *General Observations on the Construction and Use of the Electrical Machine.*

bserva- ons on e electri- l ma- ine. Although in fine dry weather, and in a warm and dry place, a good electrical machine may be brought into an excellent state of action, merely by wiping it with a warm linen cloth, and afterwards with a silk handkerchief, yet in a different state of the atmosphere, and in humid apartments, every precaution is necessary to insure the vigorous and steady action of the machine. By turning the machine before a fire, or placing it in a current of heated air, or, as Dr Faraday suggests, by placing it over a sand-bath or a hot iron plate, whose temperature does not exceed 212 degrees, the different parts of the machine will be thoroughly dried and heated without affecting the cements.

lethods heating e ma- ine. We have already described (see page 576) the improvement of Mr Ronalds, who heats the inside of the machine, &c. by a spirit-lamp. Dr Faraday recommends the heating of a cylinder-machine by placing a chemical Argand lamp with a low flame beneath the cylinder, and to support a plate of metal nearly six inches square, about an inch above the chimney of the lamp. This plate, by being heated, varies the air above it, and produces a large moderately heated current, which encircles the cylinder, and thoroughly warms it. Care must be taken not to heat the cylinder in spots, but to bring it, and especially the insulating parts, to an uniform temperature, which shall never be sufficient to melt the cement which is used in any part of it.

The state of the rubbers requires particular attention. They must be carefully freed from dust, and supplied with a soft and uniform coating of amalgam, which should always be rubbed in a mortar with tallow previous to being used. Large spots of amalgam should be removed from the cylinder or plate, either by the nail or a piece of wood. Dr Faraday remarks, that a few spots of amalgam rather increase than diminish the activity of the machine, and that the silk which proceeds from the rubber is better when impregnated with amalgam than when free from it. Dr Faraday adds, that it is often useful to hold a piece of silk, with some amalgam adhering to it, against the revolving plate or cylinder, and also to rub the surface of amalgam on the rubber with the same amalgamated silk. When the machine is thus put into good action, and the prime conductor removed, it should discharge a continued series of brushes from the edge of the silk, and abundance of sparks flying round the glass.

SECT. II.—*Description of the Electrophorus.*

Electro- phorus of Volta. Plate CCXIV. Fig. 9.

This ingenious instrument, which was invented by the celebrated Volta, is shown in Plate CCXIV. fig. 9. It consists of a circular metallic disc A, or a plate of wood covered with tinfoil, having an insulating handle of glass screwed into a nut E, made of wood or brass. The plate A is called the *upper conductor*, or *cover*. The next plate B, called the *resinous plate*, consists of a plate half an inch thick, composed of equal parts of shell-lac, common resin, and Venice turpentine, poured when hot upon a marble or stone table. The next plate is a metallic one C, called the *lower conductor*, or *sole*, which may be either separate or not from the *resinous plate* which rests upon it. The edge of the first plate A must be pretty thick, and made smooth and round. The following is the method of generating electricity with this apparatus.

The *cover* A being held in the left hand, rub the upper surface of the *resinous plate* B with a piece of dry fur, or whip it with a fox's tail or stripe of cat's skin. It will thus be excited *negatively*. Place the upper conductor above the resinous plate, and while it is there touch it with the finger, and then raise it by its glass handle. It will exhibit signs of positive electricity, and will yield a spark either to the knuckle or to the knob of a Leyden phial. If the cover A is again placed upon B, and, after being touched, again raised, it will give another spark, and *twenty* of these sparks will charge a Leyden jar of a moderate size. If the upper conductor A is not touched by the finger when placed upon B, it will exhibit, when raised, very faint, if any, traces of electricity. Now, as the resinous plate B continues, without any new excitation, to charge the upper conductor A, it is manifest that its electric condition is not destroyed by the contact and removal of A; and as it is necessary to connect the upper conductor with the ground, by touching it previous to its being raised, it is obvious that the electricity acquired by A is derived from its contact with B.

Fig. 10.

In order to explain the theory of the electrophorus, let us insulate the *lower conductor* C, by placing it on a glass stand, as in fig. 10, and let this conductor communicate with the pith balls of an electroscope. As soon as the upper surface of the cake B is excited, the pith balls will diverge with negative electricity. The negative electricity developed by the excitation of the upper surface has decomposed the natural electricity of C, by attracting the positive part and repelling the resinous part into the electroscope where it is indicated. If we now touch the conductor C, its negative electricity is carried off, and the positive undergoes no diminution; but, owing to the escape of the negative portion, the balls will collapse. If we now make the upper conductor A approach to B, and rest upon it, touching it at the same time with the finger, so as to connect it with the ground, the positive electricity of the cake B will decompose the natural electricity of A, repelling its negative electricity to the earth through the finger, and attracting its positive portion to its lower surface. This positive electricity of A attracting the negative electricity of the surface of B, and repelling the vitreous electricity of C, thus doubly tends to diminish the force by which this positive electricity is rendered latent or detained. Some of it, therefore, will be set free, and the pith balls will diverge with positive electricity, the divergence increasing as the conductor A comes nearer and nearer to the plate B. But as the positive electricity of the lower conductor has a tendency to repel the positive electricity with which we wish to charge the upper conductor A, we must cause the lower conductor C to communicate with the earth, as in fig. 9. By this means the electricity of C is reduced to its natural state, and the electricity of the upper surface of the cake B renders latent the maximum quantity of positive electricity on the upper conductor B.

Although the air produces a gradual dissipation of the electricities which are not rendered latent in an excited electrophorus, yet a well-constructed electrophorus will remain for months in full energy.

Lichtenberg's electrical figures.

M. Biot has ingeniously applied the principle of the electrophorus to explain what have been called the figures of Lichtenberg. If, when the electrophorus is charged, we raise the conductor A, and replace it on the cake B, by making it rest obliquely and upon its edge, then its positive electricity, accumulating itself wholly in the part which touches B, will become much stronger. It will escape from A, and will completely neutralize the negative electricity of the places towards which it goes, and after some contacts thus repeated upon different parts of the cake B, it will be all discharged. Hence we may deduce the following curious experiment: Instead of bringing back upon the negative electricity the positive which it has developed by its influence, carry it to another resinous cake B′, in its natural state. It will likewise attach itself to the surface of this cake, which will become positively electrified, and be capable in its turn of developing by its influence negative electricity. When the second cake B′ is thus charged, place upon its surface a disc of metal. We shall then have an electrophorus of an opposite kind to the first; and if this last is used to charge a third cake B″, the latter will have negative electricity; and in this way we may have any number of cakes, which will be electrified positively and negatively alternately. By this process we may electrify each surface only in certain parts, by attaching to the conductor A a rod and metallic button. If we then touch the resinous cake with this button, the electricity will be carried wholly to the point of contact. These points may be so chosen as to form the outlines of any regular or picturesque figures. In order to render these forms or pictures visible, we have only to strew on the surface of the resinous cake some light powder formed by a non-conducting substance, such as pounded resin or sulphur. The small particles of the resin, for example, will attach themselves only to the electrified spots; so that, by inverting the plate, all the rest will fall down by their own weight. These small particles affect regular and different arrangements, according to the nature of the electricity which makes them adhere; so that, by forming figures with the two electricities in different parts of the same plate, we obtain at the same time two sorts of figures.

Lichtenberg's method of making these figures visible is exceedingly beautiful. Having triturated sulphur and minium or red lead together in a mortar, so as to have a mixture of a yellow and red powder, he traced his figures on the resinous cake with the knob of a jar charged with vitreous electricity, and repeated them with the knob of a jar charged with resinous electricity. The compound powder being now projected, either with a powder puff or by means of a pair of bellows, upon the cake, the particles of sulphur which are electrified positively by trituration will attach themselves to the negatively electrified spots, while the negatively electrified particles of red lead will adhere to the positively electrified spots, so as to form a series of red and yellow figures when the cake has been inverted, and the rest of the powder has fallen from it. Many beautiful variations of this experiment have been devised; and Mr Bennet has shown how to make the figures permanent, by transferring them to paper.

When this experiment was first made, some German philosophers observed that the powder of rosin had sometimes a progressive motion which was not regular, and a new theory was the consequence of this. It was found, however, that they were very small insects of the genus *acarus* which happened to be in the powder, and which walked over the surface of the plate.

When well made and properly used, the electrophorus is a very powerful and useful instrument. Dr Klincock of Prague has shown, that if we transfer alternately the upper conductor from one resinous cake to another, and touch it after it is placed on the cakes, both cakes continually acquire more and more electricity, so that the upper conductor returns from either plate quite overcharged; and Leyden jars may be so strongly charged by them as to burst by the charge. The conductor returns from one plate charged with positive, and from the other charged with negative electricity.

M. Cavallo informs us that an electrophorus made of sealing-wax spread upon a thick plate of glass six inches in diameter was capable, when once excited, of charging a Leyden jar several times in succession, and so strongly as to perforate a card with the discharge. The upper conductor, when separated from the plate, was sometimes so strongly electrified that it darted strong flashes to the table upon which the electric plate was laid, and even into the air.

2. *Mr J. Phillips's Modification of the Electrophorus.*

Phillips electrophorus. Plate CCXIV Fig. 11.

As the contact of the operator's finger is of no other use than to connect the upper conductor with the earth, Mr John Phillips of York conceived the ingenious idea of producing the same effect by a momentary contact between the upper and under conductors. In effecting this he adopted three methods. The *first* consisted in raising a brass wire and ball from the lower conductor above the edge of the resinous cake, so that the edge of the upper conductor, or a brass ball upon it, may be brought in contact with it. This method answered very well with small instruments, in which the upper conductor can be easily directed to any particular point of the sole. In the *second* mode he fixed a narrow strip of tinfoil across the whole diameter of the resinous surface, so as to join the metallic sole or lower conductor. This construction answers perfectly, and is particularly suitable to large circles, whose upper conductors will infallibly touch some point of the metallic strip. The *third* method is to perforate the resinous disc quite through at the centre, and at any other point, and to insert in these perforations brass wires with their smoothest tops level with the resinous surface.

These three methods are represented in fig. 11, where *a* represents the ball in the *first* method, *b* the slip of tinfoil in the *second*, and *c*, *c*, *c* the conducting wires in the *third* and best method.

"On two of the largest electrophori," says Mr Phillips, "which I have made, both the second and third methods have been tried with equal success, but I much prefer the latter construction. The largest instrument has a cast-iron basis 20·5 inches diameter, resinous surface 19·75 inches, cover 16·25 inches. The resinous composition was made according to the directions in Mr Faraday's work on Chemical Manipulation. The cover is made of a plate of thin copper, strengthened at the edge by a thick brass wire, from which three radial brass wires pass to ectrical paratus.

the upper part of a central brass tube. In consequence of the angle they thus form with the plane of the plate, they act as pretty strong braces to maintain its figure, and the whole is very light. This central brass tube receives a cylindrical piece of wood, into which the insulating glass handle covered with sealing-wax is screwed by its wooden foot.

"With ordinary excitation this instrument will yield loud flashing sparks two inches long or more, and speedily charge considerable jars. The cover can be easily charged and discharged fifty or a hundred times in a minute, by merely setting it down and lifting it up as fast as the operator chooses, or the hand can work. In charging a jar or plate, I placed one knob of the connecting rod near the insulated surface of the jar or plate, and the other some inches above the cover; then the cover being alternately lifted up and set down, the jar is very quickly charged.

"One instrument nine inches in diameter, which I have made from the second plan above described, has very often surprised me by its remarkable power of retaining electrical excitation.

"The following example is worthy of notice. Early in September 1832 this instrument was removed from a house in York, where it had been for some time laid by, and brought to my present residence, distant one third of a mile. It was placed on a shelf on my book-cases, where it remained untouched until the 23d March 1833, and was then taken down *covered with dust.* It was found to be in a state of feeble excitement, so as to give sparks, visible in the day light, nearly one fourth of an inch long."

3. *Dr Faraday's Improvements on the Construction of the Electrophorus.*

nprovement on ne electrophorus.

As the electrophorus is an excellent substitute for an electrical machine in the laboratory of the chemist, from its being capable, when in good order, of inflaming the greater number of explosive mixtures operated upon in eudiometers, Dr Faraday has published his simple and ingenious methods of constructing this instrument.

He recommends the *cover* to be made of a piece of flat deal board one third or one half of an inch thick. This board is to be covered with pasted tinfoil laid on smoothly, particularly at the edges, and having all asperities rubbed down. The smoothest and flattest side being reserved for the lowest, a piece of glass tube seven or eight inches long is to be fixed on the centre of the other side for a handle; and towards the edge, on the same side, there should be fixed a piece of thick wire, about two inches long, bent outwards, and carrying a smooth metal ball at its upper end.

In order to make the resinous plate, a sheet of tinfoil one or one and a half inch wider than the cover is laid smoothly in the bottom of a flat dish, so that its edges may rise up all round, or in the inside of a hoop. Shelllac, common resin, and Venice turpentine, in equal proportions, are then to be melted together in a metallic vessel, and kept in a state of fusion from 230 to 240 degrees of Fahrenheit, till the vapour has ceased to evolve, and the fluid is quiet. When it has thickened by cooling, it must then be poured quickly, to avoid the formation of bubbles, upon the tinfoil, so as to form above it a cake one third or one half of an inch thick. The tinfoil should then be trimmed round its edge, and the cake should rest upon or be attached, by its tinfoiled side, to a board, to serve as a base and prevent it from injury. Dr Faraday observes that the *cover,* instead of a board, may be a plate of tin turned up round a thick wire, so that no sharp edge or angle may be presented outwards; and that for the resinous plate may be substituted a sheet of thin crown glass, having for its metallic base a sheet of tinfoil pasted to it. He adds also, that a large plate of mica without fissures, and coated in the same manner with tinfoil on one side, makes an excellent electrophorus. When glass, however, is employed, it must be well warmed at first, and kept warm during the experiments. The glass should be excited by being *rubbed* with a piece of silk with some amalgam spread upon it. It should be passed briskly over its surface backward and forward, and finally slid quickly off at its edge, so as not to rest upon any one point of the glass, lest it should discharge that portion of its surface.

Electrical Apparatus.

To return, however, to the use of the electrophorus first described. The resinous plate, when warm and dry, should be placed horizontally on its board, with the tinfoil below, and connected by a wire or chain with the ground, or with a discharging train when it can be obtained. See page 631. A piece of warm flannel, doubled up loosely into a roll about ten inches long, is to be held in the hand by one end; and the other end, being swung round in an inclined direction with a quick motion of the wrist, should strike the surface of the plate obliquely each time it passes, so as to produce an effect between that of a rub and a blow. When the whole surface of the warm resinous cake has been thus struck, it will be excited to a considerable degree. The *cover* of the electrophorus, being previously warmed, must now be lifted by its glass handle and placed on the middle of the resinous cake; and if the knob or metallic ball of the cover be now touched, a spark will pass from it to the finger. The cover is next to be lifted by its handle in a horizontal direction; and when it is two or three inches above the plate, the knob upon it is again to be touched by the finger or a ball, when a spark stronger than the first will be obtained. The cover being again put down on the plate, a third spark will pass between the knob and the knuckle. The cover being again lifted as formerly, a spark as strong as the second may be taken from it. By repeating this process, similar effects may be obtained for a long time. The sparks which are taken by the knuckle after putting the cover down are negative, and those which are taken after lifting it up are positive. Hence we charge a jar either positively or negatively, according as we take the spark when the cover is up or down. In order to obtain strong positive sparks, the cover, when on the resinous plate, must be touched with the finger, which must be removed before the cover is lifted up; and to obtain the strongest negative sparks, the cover when raised should have all its electricity carried off by the hand or some other conducting body before it is again placed on the plate. As the cover ought to be in a state of good insulation, the handle should be made of sealing-wax and gum-lac, or if made of glass, it should be varnished with sealing-wax dissolved in alcohol.

Sect. III.—*Description of Conductors for bringing down Electricity from the Atmosphere.*

Conductors.

Various means have been adopted for collecting the free electricity of the atmosphere, either for the purposes of experimental investigation, or in order to defend buildings and ships from lightning. The apparatus for the first of these purposes is essentially different from that which is used for the last.

1. *Electrical Kites.*

When the lower atmosphere is charged with electricity, Electrical kites.

it is not difficult to collect it for the purposes of experiment; but in ordinary states of the air, or when the free electricity exists at some height above the earth, it is necessary to bring it down by means of a kite. For this purpose a schoolboy's kite is sufficient. It is only necessary to twist a copper wire round the hempen string. Dr Franklin covered the frame of his kite with a thin silk handkerchief, in order that it might the better sustain the violence of a thunder-storm. In order to compensate for this additional weight, he made the framework of two strips of cedar wood in the form of a cross. The string of the kite terminates towards the observer in a silk string or cord, which insulates the kite and its conducting string; and in order to protect the observer still farther, a safety chain has been sometimes suspended from the extremity of the conducting string, so as to reach the ground and carry off the electricity in case of its becoming too powerful.

Mr Cuthbertson sometimes found it necessary to use three kites all connected together. On one occasion when he could collect no electricity from the atmosphere with a kite having a string 500 feet long, he succeeded in obtaining it by adding other two kites, each of which had strings of the same length. Mr Cuthbertson likewise employed an apparatus for raising his kites, in which the strings were lengthened or shortened by coiling them round a drum.

2. *Exploring Conductors.*

Exploring conductors. Read's hand-exploring rod.

One of the simplest instruments for collecting atmospherical electricity is the *hand-exploring* rod used by Mr Read. It was of the same material, length, and thickness as a common fishing-rod, and had small wire twisted round it from one end to another. Standing on an insulating stool, he raised the rod in a vertical position, and after a minute or two he touched with his other hand an electrometer, which indicated the nature and intensity of the electricity brought down. When the electricity thus obtained was very weak, he placed on the rod a lighted torch, keeping it as far up the rod as the strength of his arm would permit; and he always found that the flame attracted the electricity more powerfully than the end of the rod.

Read's fixed thunder rod. Plate CCXIV. Fig. 12.

Mr Read, however, found it necessary to use a fixed conductor or thunder-rod; and we have shown in Plate CCXIV. fig. 12, the apparatus which he used in his experiments on the electricity of the atmosphere, of which we have already given some account. The principal part of it is a wooden rod AA, twenty feet long, one inch in diameter at the top, and two at the bottom. Into the lower end of it is cemented a solid glass pillar B, coated with wax, and twenty-two inches long. This pillar rests on a wooden pedestal C, carried by a bracket D. At thirteen inches above D, the rod passes through a glass tube F, coated with wax, and supported by a strong arm of wood E. A lining of cork lies between the rod A and the tube F, to prevent the latter from being broken when the rod is bent by the wind. Several sharp pointed wires G stand out from the top of the tube. Two of them are of copper, about one eighth of an inch thick, one of them being twisted round the rod to the right, and the other to the left, as shown in the figure, so as to reach the brass collar at the top of the lower funnel H, to which they are soldered. The use of the two funnels HH is to defend the glass rods B, F from the weather. Through a hole in the wall at I passes a glass tube coated with sealing-wax, through which a strong brass wire passes from the rod at M into the room. At the end of the tube this wire passes through a brass ball L, two inches in diameter; and, after proceeding a little farther, it suspends from its extremity a pith-ball electrometer K, about twelve inches from the wall. A bell N, carried by a strong wire, is placed two inches from the brass ball L, three tenths of an inch in diameter, suspended from the nail O. The bell N, which has a metallic communication R with the moist ground, is rung by the ball L. Jars and other pieces of apparatus are placed when wanted upon the small shelf P; and all this part of the apparatus is protected from the weather by being inclosed in a wooden box.

Cavallo's atmosphe rical colle tor. Fig. 13.

M. Cavallo's apparatus, called an atmospherical collector, merits a description here, on account of its simplicity and ingenuity. A common jointed fishing rod AB, fig. 13, has its smallest joint replaced by a slender glass tube C, coated with sealing-wax. From a cork D at its outer end is suspended a pith-ball electrometer. A piece of string AHGI, is fixed to the end A of the rod, and supported at the point G by a piece of twine FG. When a pin at the end I of the cord is pushed into the cork D, the electrometer is uninsulated; but it is insulated for the purposes of observation in the following manner. The pin being fixed in the cork D, and the rod held by the hand at A, it is held out of one of the highest windows, at an angle of about 50° or 60° to the horizon, and kept there for a few seconds. The cord is then pulled at H, so as to disengage the pin from the cork D, and the string drops into the dotted position KL, leaving the electrometer insulated and electrified in a state opposite to that of the atmosphere.

3. *On Lightning Conductors.*

Lightnin conductors.

We have already seen that electricity is from various causes generated and set free in our atmosphere, and that individual clouds and masses of clouds are often highly charged with electricity, and insulated by the surrounding air. The earth and the sea are good conductors of electricity; and, generally speaking, their natural electricity is undisturbed. The attraction, therefore, of the electricity of the clouds for the opposite electricity in the earth or the sea, may become so powerful as to break through the resisting medium which intervenes. If the clouds are above a mountain or rising ground, this discharge of electric matter into the earth is attended with no danger. The effects have sometimes been traced in the fusion of portions of the rocks which crown these exposed summits. If a tree stands in the stratum of air through which the cloud discharges itself, the lightning passes through it, cleaving and bursting and damaging it in its passage. If a house obstructs its path, the electricity descends through its walls, seeking the quickest and easiest passage to the earth. It will follow bell-wires, iron rods, damp walls, and gilded pictures, and find out any matter, whether organised or unorganised, living or dead, which is placed near its path, and is capable of advancing it on its rapid and breathless errand to the earth. If a living animal grazing, or a human being walking, in an open field, intervenes between the overcharged cloud and the ground, the one or the other will become the chosen path of this irresistible foe. If a ship floats under an electrified canopy of vapour, it has less chance of escape than the tree, the house, or the living being.

The only terms upon which we can meet this relentless enemy, is a humble admission of its supreme and irresistible power, and a resolution to give it the freest and the fullest passport through our territory. We must supply it, in short, with a railway of metal, the only species of road upon which it can travel with a suitable speed and a harmless intention. The moment it ceases to find a conducting body, it begins its devastation among imperfect or non-conducting substances, till it again gets into a safe and easy path.

use con- tors.

In order to protect houses or buildings from injury by lightning, iron or copper cylindrical rods, about half an inch or three quarters in diameter, are generally fixed to the highest or most exposed parts of them. They are made sharp at the point, rise five or six feet above the most elevated part, and pass down into the ground. The iron staples which fasten them to the walls should be considerably larger than the rod, and should be covered with two or three folds of woollen cloth steeped in and covered with melted pitch. Every piece of metal on the roof should have a metallic connection with the conductor; and continuous strips of lead should be built into every wall, and connected to one another by horizontal strips communicating with the conductor.

ip con- ctors.

Although ships are especially exposed to danger, particularly in tropical climates, yet no adequate means of protection have yet been adopted, either in the royal or merchant navy. The conductors hitherto used consist of long flexible chains or links of metal about the size of a goose quill. They are sometimes made of iron, but those in the king's service are of copper. They are generally packed in a box, and when required, they are set up so as to extend from the mast-head into the sea; but it is well known that in many ships furnished with such conductors, they are kept packed up in the ship's hold during long and hazardous voyages. For this reason Mr Singer recommended that fixed conductors should be employed; that they should be attached to the mast; and that where motion is required, there should be an interruption in the inflexible conductor, and its parts should be connected "by a spiral wire, which would be at once perfectly continuous, and sufficiently flexible to yield to every necessary movement."

r Snow arris's ip con- ctors.

This important suggestion excited no attention, and it was reserved for Mr Snow Harris, F. R. S. Plymouth, to devise a new method of constructing ships' conductors, and to exhibit their utility and efficacy on board some of his majesty's frigates. In order to afford a ship effectual protection from lightning, Mr Harris conceived it to be essential that the conductor be as continuous and direct as possible from the highest points to the sea; that they be permanently fixed in the masts throughout their whole extent, so as to allow one part of the mast to move upon another; and, if any part of the mast should be accidentally or wilfully removed along with the conductor attached to it, that the remaining portion of the conductor should still be perfect, and capable of transmitting an electrical discharge into the sea. To accomplish these objects, a sort of double conductor should be formed, consisting of two laminæ of sheet copper, placed one above the other, so that the extremities of the laminæ of one layer should be opposite the middle of the laminæ of the other layer. These laminæ are each about four feet long, from six inches to one and a half broad, the thickness of the under layer being one eighth, and of the upper layer one sixteenth, of an inch. The copper bands thus formed are fixed in a fine dove-tailed groove in the aft sides of the different masts, and are secured in their place by wrought copper nails, so as to form a smooth surface, the nails being driven at each side, so as to be about four inches apart. Before inserting the conductor, the groove should be painted over with white lead, and must be deep enough to allow the copper to lie a little beneath the surface of the wood. "The metallic line," says Mr Harris, "thus constructed, will then pass downward from the copper spindle at the mast-head, along the aft sides of the royal-mast and top-gallant-mast, being connected in its course with the copper about the sheeve holes. A copper lining in the aft side of the cap through which the top-mast slides now takes up the connection, and continues it over the cap to the aft side of the top-mast, and so on as before, to the step of the mast; here it meets a thick wide copper lining, turned round the step, under the heel of the mast, and resting on a similar layer of copper fixed to the keelson; this last is connected with some of the keelson bolts, and with three perpendicular bolts of copper, of two inches diameter, which are driven into the main keel upon three transverse or horizontal bolts, brought into immediate contact with the copper expanded over the bottom. The laminæ of copper are turned over the respective mast-heads, and secured about an inch or more down on the opposite side; the cap which corresponds is prepared in a somewhat similar way, the copper being continued from the lining in the aft part of the round hole over the cap, into the fore part of the square one, when it is turned down and secured as before, so that when the cap is in its place the contact is complete. In this way we have, under all circumstances, a continuous metallic line from the highest points to the sea, which will transmit the electric matter directly through the keel, being the line of least resistance."[1]

Plate CCXIV. Fig. 14, 15, 16.

This metallic line is shown in Plate CCXIV. fig. 14, 15, 16, by the dotted line A, B, C, D; and it will be seen that any elongation or contraction of the masts, as in fig. 14 and 15, or the removal of either of them, as in fig. 16, which brings them into a new position, will in no way disturb the continuity of the line A, B, C, D, which evidently remains the same, and is therefore, under these different circumstances, the shortest and best conducting line between the mast-head at D and the sea at S. When the sliding masts are struck, a part of the conducting line necessarily remains below the cap and top; but as this is quite out of the circuit, it will not at all influence the passage of the electric fluid along the shorter line. Mr Harris has put this beyond a doubt by direct experiment.

Size of conductors.

Mr Harris has exhibited in the following table the mean proportion of a conductor thus constructed on one mast of a fifty-gun frigate, in comparison with the copper links usually furnished to the British navy, together with the equivalent of copper or of iron rod which will be necessary in order to have a conductor of the same mass. The numbers at the bottom of the table represent, with the exception of the proposed conductors, the masses, surfaces, and diameters of cylindrical metallic rods, supposed to extend the whole length of the mast. Thus, in column 2 we have 1·2 inches as the diameter, and 8064 as the surface of the copper rod, containing 2423 cubic inches of metal, and having the same quantity of matter as the proposed conductors, and from which it is calculated. The sums, therefore, are not the result of the addition of the numbers for the successive masts. The same observation is applicable to column 3, which gives the equivalent in iron. In column 4 Mr Harris has given the cubical contents and surface of a copper rod half an inch in diameter, which is supposed capable of conducting any stroke of lightning that has yet been felt; and in column 5

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[1] "Since the mizen-mast does not step on the keelson, it will be necessary to have a metallic communication at the step of the mast, with the perpendicular stancheon immediately under, and so on to the keelson as before, or otherwise carry the conductor out at the sides of the vessel."

Electrical Apparatus.

he has given the mass and surface of the conductors now used in the British navy, which are to those proposed by Mr Harris, in reference to their cubical contents, as 94·4 to 2423, or as 1 to 257.

	1		2		3			4		5	
Succession of Masts.	Proposed Conductors.		Equivalent in a Copper Rod.		Equivalent in an Iron Rod, taking Conducting Powers only as four to one.			Mass and Surface in a Copper Rod of half an inch Diameter.		Mass and Surface in present Conductors.	
	Mass.	Surface.	Diameter.	Surface.	Mass.	Surface.	Diameter.	Mass.	Surface.	Mass.	Surface.
	Cub. Inch.	Sq. Inches.	Inches.	Sq. Inches.	Cub. Inch.	Sq. Inches.	Inches.	Cub. Inch.	Sq. Inches.	Cub. Inch.	Sq. Inches.
ROYAL POLE. Conductor eighteen feet three inches long, two inches wide; two laminæ, each $\frac{1}{16}$th of an inch thick.	54	1752	·56	385	216	770	1·12	42	343	10·5	171
TOP-GALLANT-MAST. Conductor seventeen feet long, two and a half inches wide; two laminæ, one $\frac{1}{8}$th of an inch thick, the other $\frac{1}{16}$th.	95	2040	·77	493	380	986	1·54	40	320	10	160
TOP-MAST. Conductor fifty feet long; copper four inches wide; two laminæ, each $\frac{1}{8}$th of an inch thick.	600	9600	1·1	2070	2400	4140	2·2	117	942	19·2	471
LOWER-MAST. Conductor ninety-three feet long; copper six inches wide; two laminæ, each $\frac{1}{18}$th of an inch thick.	1674	26784	1·38	4837	6696	9675	2·76	219	1753	54·7	876
	2423	40176	1·2	8064	9692	16128	2·4	418	3358	94·4	1678

As the new conductors proposed by Mr Harris are composed of a series of short joints, which, whilst the continuity is still perfect, allows the conductor to bend or yield to any curvature which the mast can bear, a conductor thus applied gives great strength to a mast. In Portsmouth dock-yard, for example, it was found that the flying jib-boom of the Sapphire sloop of war would require one fifth part more weight to curve it to the same arc when the copper conductor was inserted in it. This very flexible spar was made to rest on its extreme ends, and when weights were hung to its middle point, it was made to bend like a bow, without the conductor suffering the least derangement.

It is a remarkable circumstance, that though Mr Harris has proved the excellence of his invention by its practical application to some British frigates, yet the Admiralty have not felt it their duty to introduce it into the navy. A line-of-battle ship is valued at about L.120,000, and yet it is not thought advisable to expend L.100 in defending from the most irresistible of all enemies this vast and valuable machine, and in protecting the lives of the thousand brave men that live within its walls.

CHAP. II.—DESCRIPTION OF INSTRUMENTS FOR ACCUMULATING, CONDENSING, AND MULTIPLYING ELECTRICITY.

Instruments for accumulating electricity.

The instruments which have been employed for the purposes of accumulating, condensing, doubling, and multiplying electricity, may be divided into four classes:

1. Jars and batteries.
2. Condensers.
3. Doublers.
4. Multipliers.

SECT. I.—*On the Construction and Action of Jars and Batteries.*

Jars and batteries.

By means of the prime conductor of an excited electrical machine, we can obtain electricity in sufficient quantity and intensity for many important researches; but when we wish to accumulate it in great quantities, and to obtain a powerful charge, it is necessary to employ the Leyden phial or jar; and by increasing the number of jars, and uniting them together, we can accumulate electricity to an unlimited extent.

ectrical paratus.

ectrical CCXV. . 1.

An electrical jar, in its best form, is shown in Plate CCXV. fig. 1, where AB is a glass jar, having its lower end CDEB coated both on the outside and the inside with tinfoil, which is made to adhere to the glass by means of gum water. The jar should have no cover, as it generally has, but the charge is conveyed to the bottom of the jar by a copper tube FGH, three eighths of an inch in diameter. This tube terminates in a ball, F, of baked wood, and is kept in its place by a convenient foot, firmly cemented to the bottom of the jar, which is previously covered with a circle of pasted paper, leaving a central portion of the coating free for the perfect contact of the charging rod FGH, which passes through the centre of the foot, as shown by the dotted lines in the figure.[1] When the jars are either employed singly, or united so as to form a battery, they should be placed on a conducting base, supported by short columns of glass, or some other insulating substance, such as rosin or brimstone, so that the whole can be insulated when necessary.

. 2.

In order to allow the jars to be charged and discharged with precision, Mr S. Harris connects them with what he calls two centres of action, A, B, shown in fig. 2. The first of these, A, consists of a brass ball, which slides with friction on a metallic rod AD, so as to admit of its being placed at any required height. This ball has a number of holes perforated in its circumference, to receive the points of the rod or rods which connect it with the jar or jars. The rod AB which supports this ball may be either insulated on a separate foot, and connected with the prime conductor, or it may be inserted directly into it. The second centre of action consists of a larger ball of metal, B, attached to a firm foot, and placed on the same conducting base with the jar, so as to be perfectly connected with it. When the first centre of action, A, requires to have a separate insulation, the insulating glass rod is screwed immediately into the lower ball B, and sustains the metallic rod above described, by the intervention of a ball of baked wood, D, the opposite end of the rod terminating in a similar ball, C, through the substance of which the conducting communication with the machine passes when it is placed on a separate foot. All the metallic connection should be covered with sealing wax, except at the points of junction, and the wooden balls and different insulations should be carefully varnished.

ectrical tery. . 3.

A battery constructed in this manner, and containing six jars, is shown in fig. 3, A and B being the two centres of action, and C and D the two balls of baked wood, as shown in fig. 2. The communication with the prime conductor is made by a wire CE passing through the ball C, and the jars communicate with the centre of action A by means of wires entering the ball A, as shown in the figure.

In order to charge the jar shown in fig. 1, it is only necessary to make the copper tube FG communicate with the prime conductor of the electrifying machine by means of a wire passing through F. It was formerly the custom to make the copper rod HG terminate above in a brass ball at F; and when this was the case the jar could be charged by bringing the ball F near the conductor, or by holding the jar by the outside coating, and bringing the brass knob close to the conductor.

Electrical Apparatus.

Discharging rods. Fig. 4.

When the jar is fully charged, it may be discharged by holding the outside coating in one hand, and touching with the other the copper tube FG, or the ball F if it is a brass one; but in this case the person will receive a shock, the electrical charge passing into his body. The jar may be discharged without receiving a shock, by a very simple instrument, called a *discharging rod*, shown in fig. 4. It consists of two bent wires BC, BD, having a brass ball C and D at each end, and uniting at B, where they are fastened at their common junction into a glass handle AB. The operator takes hold of the glass handle, and placing the lower knob D on the outside coating of the jar, and the upper knob C in contact with the copper wire FG, or the brass ball at F, if there is one, the discharge takes place with a loud snap the instant that the knob C touches F.

Fig. 5.

A more convenient form of discharging rod is shown in fig. 5, where the two balls C, D, and the branches CE, DE, correspond to the balls C, D of the branches CB, DB, in fig. 4; but in place of attaching one insulating glass handle to the joint E, a separate glass handle, viz. A and B, is attached to each branch. By this means, by taking the handle A in one hand, and B in the other, we can open the balls C, D to the required distance without touching the metallic branches CE, DE, and also with greater facility and certainty.

If the jar is connected with the piece of apparatus BC, fig. 2, so that the centre of action A communicates with the internal coating of the jar, and the centre of action B with the external coating, then the jar will be discharged by making the knob D of the discharging rod touch B, while the knob C touches A. In like manner the whole battery in fig. 3 may be discharged by making the knob D of the discharging rod touch B, while the knob C touches A.

Henley's universal discharge. Pl. CCXV. Fig. 6.

A general instrument for discharging jars and batteries, invented by Mr Henley, has been much used, particularly in the deflagration of metals by electricity. It is shown in fig. 6, where A and B are insulating glass pillars, cemented into a wooden stand. A brass cap with a horizontal and vertical motion is fixed on the top of each of these pillars; and at the top of this joint is a spring tube, through which the handles D or C can be slid backwards or forwards. These handles are made of strong brass wire, terminating at one end in a ball, or point, or a pair of forceps, and at the other in a solid glass rod for an insulating handle. A small wooden table F, about five inches in diameter, has a slip of ivory glued into its upper surface, and may be raised or depressed in its socket by the screw-nut G. Sometimes a small mahogany press accompanies the instrument. It consists of two boards, which can be pressed together by two nuts, and is put into the socket in place of the table F, when it is necessary to fix or hold steady the body through which the discharge is to be passed. The body to receive the charge must either be laid on the table or fixed in the press, or held between the balls, points, or forceps. The two sides of the jar or battery are then connected with the two brass caps at the tops of the pillars A, B; and, by means of the insulating handles, the distance is regulated through which the charge has to pass.

This instrument was originally constructed without any insulating handles; and the wires, and the handles C and D, were thick brass wires, terminating on one side in a ball or point, and on the other in a ring of brass, with which the connection with the jar or battery was formed.

Coated plates of glass.

Although it has proved advantageous to use jars for receiving and accumulating electricity, yet this form of the recipient is by no means essential. The very same effect is obtained if a plate of glass is coated on both sides within an inch of its edges; for a jar may be considered as a plate of glass rolled up into a cylindrical form. Hence a battery may be composed of a number of coated plates of glass; and it was actually with one of this kind, consisting of eleven panes of window glass, that Dr Franklin performed most of his experiments.

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[1] The method of constructing the jars and batteries here described is that used by Mr Snow Harris, and described in his valuable paper on the Laws of Electrical Accumulations.

Theory of the Leyden phial.

Dr Franklin was the first person who explained the principle upon which the action of the Leyden jar depends. He began by examining the electricities of the inside and outside coatings. A cork ball suspended by a silk thread was attracted by the outside and repelled by the inside coating. When the jar was charged with the opposite electricity, the ball was repelled by the outside and attracted by the inside coating. Hence it follows that *the outside and inside coatings of a Leyden jar are charged with opposite electricities.*

When the inside coating was charged from the prime conductor, its electricity was positive, while that of the outside was negative; but when the outside of the jar was charged from the same conductor, the outside was positively electrified, and the inside negatively, and the charge was as strong as before.

In order to show that the negative electricity of the one coating was equal to the positive electricity of the other, Dr Franklin hung a small linen thread near the outside coating of a charged jar, and every time that he touched the knob or wire of the jar the thread was attracted by the coating, the electricity taken from the inside by the finger being equal to what was drawn in on the outside by the thread. He then repeated this experiment when the jar was placed upon an insulating stand, and he found that at every successive contact a portion of the electricity of the outside became free, and the linen thread sprang to the outside coating to receive and carry off the superfluous electricity.

Experiment to show the equality of the two electricities.
Fig. 7.

The equality of the two electricities is still more clearly evinced in the fine experiment of Professor Richman, shown in fig. 7. Having coated with tinfoil the opposite sides of a plate of glass AB, to within two inches of its edges, the glass was then placed vertically, and a linen thread *m* was suspended to the upper part of each of the two coatings. When the plate was not charged, the two threads hung down parallel to each other, and touched the tinfoil; but when the plate of glass was charged, the threads were repelled from the glass, and formed equal angles with it on both sides. When any conducting body, such as the finger, was brought near one coating, the thread on that side sunk, and formed a less angle with the glass, while the thread on the other side rose to a greater angle, the augmentation of the angle on one side being exactly equal to its diminution on the other. When the finger touched one coating, the corresponding thread fell down entirely, and the thread on the other side rose to a double elevation, so that the angle formed by the two threads was a constant quantity, depending on the intensity of the charge communicated to the plate.

The next point of inquiry to which Dr Franklin applied himself, was to ascertain where the two electricities resided, and what was the function performed by each coating. Having charged a jar, and placed it on an insulating stand, he took out the ball F, and rod FH, fig. 1, and found that they did not contain any electricity. He then touched the outside coating with one hand, and putting the finger of another hand into the mouth of the bottle, he received a shock as powerful as if the ball and rod FH had been in their place. He next put into the phial some clean water, which, being a conductor, answers the same purpose as tinfoil, and having charged the jar, and poured out the water into an insulated bottle, he found that it would not give the shock. Upon filling the phial with fresh water, and without giving any new charge to the jar, he received a shock as at first, which clearly proved to him that the electricity resided in the glass. This important truth may be clearly established in the following manner:—Take a cylindrical jar, and let the outside and inside coatings of tinfoil be nicely fitted, and applied to the surface without any cement. When this jar is charged in the usual manner, place it on an insulating stand or a glass plate, and holding it by the uncovered part, lift out the interior cylinder of tinfoil without injuring its shape, and then lift the glass cylinder out of its exterior coating. If we now touch the outside of the glass cylinder with one hand, and at the same time the inside with the other, we shall obtain no perceptible shock. In like manner, no shock will be experienced by touching the outside coating of tinfoil with one hand, and the inside with the other, nor by touching either separately. But if the two coatings are again replaced on the glass cylinder, the one on the outside and the other on the inside, a shock will be obtained in the usual way. Hence it follows, as Dr Franklin concluded from the same experiment in another form, that the electricity is accumulated on the surface of the glass, and that the metallic coatings, or other conducting substances, which are placed in contact with both sides of the glass, perform only the function of forming a perfect communication between every point of the external with every point of the internal surface of the glass at the instant of the discharge.

Theory of the Leyden jar.

In order to explain the theory of the Leyden jar, let us place a jar AB uncharged upon an insulating stand CD, and make its outside coating B communicate with a pair of insulated pith balls *m*, *n*, as shown in fig. 12. From the prime conductor convey a few sparks of positive electricity to the jar by the knob F, the pith balls *m*, *n* will diverge with positive electricity, owing to the decomposition of the natural electricity of the external coating. If we now touch the pith balls, the positive electricity which made them diverge will escape, and they will fall into their natural vertical position. But we have not thus removed all the positive electricity which was communicated to the interior coating. A portion of it has become fixed or latent, which can only happen from the influence of a portion of resinous electricity. If we now touch, indeed, the brass ball F, the portion of positive electricity which remains free in the inside coating will cause the pith balls communicating with the outside coating to diverge with negative electricity.

If, when the pith balls are divergent with positive electricity supplied from the conductor, we touch them so as to allow it to escape, the repulsive force which it exerted on that in the interior coating will cease, and the ball F and the interior coating will be capable of receiving an additional quantity from the conductor. The pith balls will again diverge with positive electricity; and if this be again removed, the ball F will again be able to receive a farther supply from the conductor, so as to make the pith balls again diverge. The interior coating will be receiving more and more positive electricity, till its repulsive power becomes so great as to resist the introduction of any more. The jar is now charged, and will give a shock in the usual manner, or may be discharged by the discharging rod. Hence we may conclude that the positive electricity introduced into the inside coating of the jar decomposes the natural electricities of the outside, drives away from it the positive and fixes the negative electricity, which, by its reciprocal attraction, fixes also a part of it in its turn.

From the principles above established, it may be shown that a given quantity of electricity from the prime conductor may be made to charge two or more jars almost as powerfully as if the whole quantity was communicated to

CCXV. g. 9.

one jar only. The jars being placed as in fig. 9, the electricity from the prime conductor is conveyed by a chain A to the ball B of the first jar. The ball F of the second jar has a similar connection with the coating of the first, and by a third chain the coating of the second jar is connected with the earth. When the inner coating of the first jar receives positive electricity, the outer coating has its natural electricity decomposed; the negative portion is fixed by the influence of the positive electricity within, and the positive portion is repelled to the interior of the second jar, where it does the very same thing which was done by the same electricity within the first jar. The positive electricity set free at the exterior of the second jar is repelled to the earth, and any requisite portion of negative electricity is conveyed to the outer coating of the same jar, in order to fix by its influence the positive electricity which arrives at the interior of the jar. If we now remove all the connections, the two jars will have received their full charge; and the same will take place with any number of jars similarly arranged for the purpose.

As the accumulation of electricity in a jar depends upon the mutual attraction of the two electricities, and as this force varies inversely as the square of the distance of the molecules, the intensity of charge which any jar can receive should increase with the thinness of the glass which separates the two fluids. Mr Cavendish inferred from his researches, that the intensity of the charge was inversely as the thickness of the glass; but we cannot avail ourselves of this principle in practice, as a certain thickness of glass is necessary to the due strength of the jar; and it has been proved by experiment, that when the glass is thin, the mutual attraction of the two electricities has been capable of forcing a passage through the glass itself. The common glass jars, therefore, are as thin as they can be made with perfect safety. Mr Brooke always placed a layer of paper between the tinfoil and the glass, for the purpose of enabling the jar to contain a charge of greater intensity.

vallo's lf-charg- g jar.

Before concluding this section, we shall describe a pretty little instrument invented by M. Cavallo, called the *self-charging jar*. Having procured a glass tube eighteen inches long and one and a half inch in diameter, coat one half of the inside of it with tinfoil, and close the aperture of the coated end with a cork, through which there passes a wire touching the inner coating, and terminating in a brass ball fixed at the uncoated end of the tube. If we now hold the uncoated part of the tube in one hand, and rub the outside of the coated part with the other, and after every three or four strokes touch with the rubbing hand the brass knob or ball, the hand will communicate to it a spark, and the inside coating will thus be gradually charged. If we now grasp the outside of the coated end with one hand, and with the other touch the brass ball, we shall discharge the tube and receive a shock.

SECT. II.—*On the Construction of Condensers of Electricity.*

ndensers electri- y. CCXV. g. 10.

An apparatus for condensing electricity in a conducting body was the undoubted invention of M. Æpinus, who also gave the true theory of its action. Volta, however, had the merit of first applying it to an electrometer for indicating small quantities of electricity.

The condenser shown in fig. 10 consists of two separate parts, the first of which is a metallic disc B, supported by a metallic stand BD, and the second is a similar disc A, having a glass handle C rising from its tube, and a small metallic pin and knob P projecting from its circumference. The upper surface of the plate B and the lower surface of A are covered with a thin film of a non-conducting substance, such as varnished silk, rosin, or glass. If it is now wished to condense any feeble electricity from any body, as, for example, from a feebly electrified conductor, bring the metallic pin P into contact with the body or electrified conductor; and while it is in contact let the metallic disc B be brought close under it, as in the figure, the varnished surface of A resting on the varnished surface of B. In this state withdraw the whole from the prime conductor; and having removed the plate B, apply the plate A to two suspended pith balls, which will separate to a very considerable angle in consequence of the electricity having been condensed by the contact of the disc B. That this is the case may be readily proved by applying A to the pith ball before the disc B was joined to A, when their divergence will be greatly less than before. The explanation of this is very simple. The positive electricity, for example, conveyed by the prime conductor to the plate A decomposes the natural electricity of B. The positive portion of B is repelled to the earth by the similar electricity in A, while the negative portion is attracted to the upper surface of B by the opposite electricity in A. In this position it is capable of attracting to the inner surface of A an additional quantity of the free electricity in the prime conductor; and this additional quantity will in its new position produce a farther decomposition of the natural electricity of C. All these effects will take place simultaneously till an equilibrium is established between the free positive electricity supplied to A by the prime conductor, and the negative electricity which the attractive force of this electricity can draw from the earth.

It is manifest, from these observations, that the principle of the condenser is exactly the same as that of the Leyden jar. The upper disc A which receives the electricity corresponds with the inner coating of the jar, the under disc C with the outer coating, and the film or films of rosin, &c. with the glass of the jar.

Volta's condensing electrometer. Fig. 11.

The condensing electrometer of Volta is shown in fig. 11, where CAB is the condenser above described. From the lower side of the plate B are suspended, by two metallic wires, two perfectly even and straight straws *m*, *n*, and on the mouth of the bottle DEFG is fixed the disc B, so that the two straws hang freely in the axis of the neck of the bottle. A graduated circle *op* is pasted on the outside of the bottle, to estimate the angular separation of the straws, which affords a mean of the electricity condensed in the manner already described.

Cuthbertson's condenser. Fig. 12.

Mr Cuthbertson's condenser, shown in fig. 12, consists of two flat circular plates of brass A, B, about six inches in diameter. The receiving plate A is supported by a glass pillar, firmly fixed to a wooden stand, while the condensing plate B is sustained by a brass pillar, but so as to move round a joint at its lower end, in order that it may be thrown back into the dotted position shown in the figure. When the plates stand parallel and vertical, the receiving one A is connected by a wire with the body whose electricity is to be condensed. In this state it is allowed to continue for a short time, when the wire is removed and the plate B thrown back into the dotted position. The electricity will then be found condensed in the plate A.

Fig. 13.

When this instrument is applied to an electrometer, as in fig. 13, it forms an excellent condensing electrometer; and the effect may be greatly increased by uniting Cuthbertson's condenser with that shown in fig. 13. This may be done by merely uniting the moveable plate of the former to the fixed plate A of the latter by a small brass pin.

Nicholson's spinning condenser. Fig. 14.

Nicholson's spinning condenser, which is a very ingenious instrument, is shown in fig. 14, where A is a metallic vase, which revolves about a steel axis EK, whose pivot K runs in the adjustable socket C at the bottom of the stand H; a circular disc of glass D, one and a half inch in diameter and two tenths thick, is fixed to the vase A, and revolves along with it, while a similar plate E is fixed on the top of the stand H. These two discs are shown separately in fig. 15. In the edge of the plate E are drilled two holes to receive metallic hooks F, G, and into the edge of the upper plate D are cemented two small tails of the flattened wire used in making silver lace. These tails are bent down so as to strike the hooks F, G during their revolution, without touching the rest of the apparatus. The two adjacent faces of the glass discs are coated with segments of tinfoil, as shown in fig. 15; and they may be set at any distance by means of the screw C. Each tail communicates with the tinfoil coating of D; the hook F communicates with that of E, but the hook G is insulated so as to communicate only with the electrified body. The coating of E communicates with the earth by means of the stand H.

Fig. 15.

If the vase A, the plate D, and the axis EK, are now set a spinning by the action of the finger and thumb applied at T, one of the tails will strike the hook G, and receive through it from the electrified body some of its electricity, which it will convey to D, which will thus assume the electric state of the body. The tail which has struck G proceeding onwards, will after half a revolution touch F, and will convey the free electricity received at G to the two coatings, which with the hook F constitute one insulated mass. The tail advances, acquires more electricity from G, deposits it at F, and thus condenses it, on the principle of the common condenser, till it is capable of affecting the pith balls at F. The instrument constructed by Mr Nicholson was five inches high, and condensed very small degrees of electricity.

SECT. III.—*On the Construction of Electrical Doublers.*

Electrical doublers.

This class of instruments operate by continually doubling small quantities of electricity till the common electrometer is capable of indicating its presence and qualities.

Bennet's doubler. Pl.CCXV. Fig. 16.

The doubler invented by Mr Bennet consists of three plates, A, B, and C, fig. 16. The plate A, which is of brass, has an insulating handle rising from its centre; the plate B, which is also of brass, has a similar handle fixed in its circumference. The third plate, C, also of brass, is placed on Bennet's gold-leaf electrometer. The under side of A, the upper side of C, and both sides of B, are varnished. The body whose electricity it is required to double is brought into contact with the under side of C, which rests on the cap of the electrometer, while B is touched with the finger of the other hand. The communication with the electrified body being broken off, B is lifted up by its glass handle. If the electrometer leaves do not diverge, A is placed by its handle upon B, thus lifted up; and A being now touched by stretching a finger over the juncture of its insulating handle and immediately withdrawing it, A is separated from B. In this situation two of the plates have obviously nearly equal quantities of one kind of electricity, while the third plate has the opposite kind. The plate A is then made to touch the under surface of C, resting on the electrometer, and at the same time C is covered with B. The plate B is now touched by the finger as A was; and removing A, and withdrawing the finger from B, and lifting it up from C, the electricity is doubled. By repeating this operation ten or twenty times, which may be done in forty seconds, the electricity will, by continual duplication, be augmented 500,000 times. When sparks are required, C must rest on an insulating stand in place of the electrometer.

It was found by Mr Bennet, Cavallo, and others, that the doubler became strongly electrified even when no electricity was communicated to it. To remove this evil, M. Cavallo used three plates without varnish, and he placed them on insulating stands, so as to have a vertical direction, and to stand within one eighth of an inch of each other, the plates of air being a substitute for the varnish. The method of doubling is exactly the same as before. Dr Robison adopted the same idea, but he kept his plates horizontal, making them rest on each other by three small spherules of glass or sealing-wax. Notwithstanding these precautions, however, electricity was still produced.

In order to perform the operation of doubling with more rapidity, Dr Darwin proposed the *moveable doubler*, or one in which the plates could be moved by wheel-work into their proper positions. Dr Nicholson improved upon this idea by producing the whole effect with the simple revolution of a winch.

Nicholson's revolving doubler. Fig. 17.

This *revolving doubler*, as it has been called, is represented in fig. 17. It consists of two fixed plates of brass A, C, two inches in diameter, insulated separately, and placed in the same plane, so that a revolving plate B may pass near them without touching. A brass ball D is fixed on the end of the axis which carries B, and is loaded within at one side so as to counterpoise the plate B, and allow it to rest in any position. The axis PN, and the axes that join the three plates with the brass axis NO, which passes through the brass piece M, by which the plates A and C are supported, are made of varnished glass. One end of this axis carries the ball D, and the other is connected with a rod of glass NP, upon which the handle L is fixed, and also the piece GH insulated separately. The pins E, F rise from the back of the plates A, C, at equal distances from the axis. The arm K is parallel to GH, and the ends of both are armed with pieces of harpsichord wire, so as to touch the pins E, F in certain points of their revolution. A pin I is fixed on M to intercept a small wire proceeding from the revolving plate B. These wires are so bent that, when B is opposite to D, GH connects the two fixed plates A, C, while the wire and pin at I connect the ball D and plate B. On the other hand, when B is opposite C, D is connected with C by the contact of F with the wire at K, the plates A, B being then entirely unconnected with any other part of the instrument. In all other positions the three plates and the ball D will have no connection with each other. The operation of this instrument is thus described by Mr Nicholson: "When the plates A and B are opposite to each other, the two fixed plates A and C may be considered as one mass, and the revolving plate B, together with the ball D, will constitute another mass. All the experiments yet made concur to prove that these two masses will not possess the same electric state; but that, with respect to each other, their electricities will be *plus* and *minus*. These plates would be simple, and without any compensation, if the masses were remote from each other; but as that is not the case, a part of the redundant electricity will take the form of a charge in the opposed plates A and B. From other experiments, I find that the effect of the compensation on plates opposed to each other at the distance of one fortieth part of an inch is such that they require to produce a given intensity, at least a hundred times the quantity of electricity that would have produced it in either singly and apart. The redundant electricities in the masses under consideration will therefore be unequally distributed; the plate A will have about ninety-nine parts, and the plate C one; and for the same reason the revolving plate B will have ninety-nine parts of the opposite electricity, and the ball D one. The rotation, by destroying the contacts, preserves this unequal distribution, and carries B from A to C, at the same time that the tail K connects the ball with the plate C. In this situation the electricity in B acts upon that in C, and produces the contrary state by virtue of the communication between C and the ball; which last must therefore acquire an electricity of the same kind with that of the revolving plate. But the rotation again destroys the contact, and restores B to its first situation opposite A. Here, if we attend to the effect of the whole revolution, we shall find that the electric states of the respective masses have been greatly increased; for the ninety-nine parts in A and in B remain, and the one part of electricity in C has been increased so as nearly to compensate ninety-nine parts of the opposite electricity in the revolving plate B, while the communication produced an equal mutation in the electricity of the ball. A second rotation will of course produce a proportional augmentation of these increased quantities, and a continuance of turning will soon bring the intensities to their maximum, which is limited by an explosion between the plates."

onalds' ndulum ubler. l. CCXV. ig. 18.

An ingenious instrument, called a *pendulum doubler*, has been recently constructed and described by Mr Ronalds. Having found it necessary to keep a telegraphic wire constantly electrified with a very small source of electricity, he converted the bob of a pendulum into the centre plate of a doubler, and he found the instrument thus modified not only useful for that purpose, but also for that class of experiments, such as those on vegetation and animal life, which require a constant supply of small quantities of electricity to supply the loss occasioned by unavoidable defective insulation, either in the glass which is used, or in the surrounding atmosphere. This improvement on the doubler is shown in fig. 18, where A and B are the two fixed plates, about four inches in diameter, supported by glass pillars; C is the bob carried by the pendulum rod D, and insulated by the piece of glass e. The form of the bob C is that of a plano-convex lens, with its interior filled with lead; e is a small cylinder connected to C with screws, which also adjust the plane of C parallel to the plane of vibration; g is another insulating glass rod, carrying the bent wire h, the left end of which lies nearly in the same vertical plane as the end of the wire m, the right end being nearly in the same plane as the end of the wire n. A wire, i, rises perpendicularly from C; and another, k, perpendicular to the plane of vibration, is fixed into the brass cup at the end of the pendulum rod. A wire, l, is screwed into the edge of the plate B, and the long wire m is fixed on the lower edge of B, so as to approach within a small distance of A, where it is bent at right angles, and then projects in a plane perpendicular to that of vibration. Another wire, n, is fixed into the edge of A, so as to bend and project similarly; but n projects farther than m, that the right side of the bow k may pass the end of m without touching it. A wire, o, is fixed at right angles into the base of the instrument.

When the bob C is exactly opposite A, the insulated wire h touches simultaneously the ends of the wires m and n, and establishes a communication between A and B, while at the same time the wire i, by touching o, forms a communication between C and the ground. Now, if a quantity of *positive* electricity, for example $= 1$, is given to A or B when the centres of A and C are opposite to each other, that quantity will be nearly all condensed on A, and C will acquire *negative* electricity nearly $= 1$.

"If C," says Mr Ronalds, "be now allowed to begin its vibrations, the connection of A and B with each other will be instantly broken, as also that of C with the earth, and they will be all insulated, and all retaining the electric states which they possessed before the connections were broken (*i. e.* A will be positive nearly $= 1$, B negative nearly $= 1$, and C positive almost 0).

"When C has arrived opposite B, the *uninsulated* wire k will touch the wire L, and thus place B in connection with the earth; therefore C, by virtue of its negative charge, will induce a positive charge in it nearly $= 1$.

"When C arrives a second time opposite to A, all the former connections will be re-established, and the charge of B will (by means of the wire m) be nearly all condensed on and added to the original charge of A, making a tension nearly $= 2$ of positive electricity, which tension will induce a tension of nearly $= 2$ of negative electricity on C.

"And so the charges in A and C would go on, nearly *doubling* at each vibration of the pendulum, until their tensions would arrive at such a point as to cause a spark to pass between them.

"But P is a Leyden jar furnished with a Lane's discharging electrometer q; a connection is established by means of a small chain between it and A; and the distance between the two balls r and s is considerably less than that between A and C; therefore the spark will be given to the jar, and a spark will be continued to be given at the completion of almost every second vibration, until it is charged almost as highly as A is capable of being charged, or the sparks will continually supply the loss of electricity by any defect of insulation, either of the jar, or of any conducting body in connection with its interior coating within certain limits.

"The contacts of the wires do not impede the velocity of the vibrations, because they are made small enough to act as springs of a required force; but the electric attractions of the plates and bob *do* tend to do so. The pendulum is suspended by two springs, placed one at each extremity of a cross piece, to which the rod is attached, for the purpose of preventing the bob from being drawn, by their attractions, out of its assigned plane of vibration as much as possible."

SECT. III.—*Description of Instruments for Multiplying Electricity.*

Multipliers of electricity. Cavallo's multiplier. Plate CCXV. Fig. 19.

The electrical multiplier invented by M. Cavallo is shown in fig. 19, on a scale about one third of its real size, and is chiefly useful in ascertaining the presence of a considerable quantity of electricity occupying an extended space. Its principal parts are four plates of brass A, B, C, D. The plates A, C are supported by two glass rods G, H, fixed in the wooden base R, S, Q. A similar plate B is supported by another glass rod I, cemented into the wooden lever LK, moving round a pivot K. The fourth plate D is supported by a metallic rod. By the lever KL the plate B can be moved from its position on the figure into the dotted position KX. The plate D is screwed at P into a piece of brass FP, which slides in a groove, so that D can be pulled out to any distance from C. At the corner Q is fixed a brass rod N, and Om is a small bent wire fixed to the brass socket O on the back of B. When B is as near as possible to A, their distance being one twentieth of an inch, this wire m touches the rod N, and forms a communication with the earth; when FP is pushed in as far as possible, the surfaces of C and D are one twentieth of an inch distant. As the lever KL moves towards X, the end m of the wire mO quits N and insulates the plate B; and when the lever has the position KX, the wire m will touch the plate C, so as to put the insulated plates B into communication with each other.

If a body weakly electrified positively is now made to touch A, when A and B are placed together as in the figure, A will acquire a greater quantity of positive electricity from the presence of the uninsulated plate B, which will be negatively electrified. When KL comes into the position KX, so that B touches C by the wire *m*O, its negative electricity will pass almost wholly to C, owing to its proximity to D, which communicates with the ground. By a number of successive oscillations of the lever between the two positions KL and KX, this operation may be repeated till an accumulated charge of negative electricity has been fixed upon C. The plate D must now be drawn away from C by means of the slider FP, and if pith balls are presented to C they will diverge with negative electricity.

Schweigger's multiplier.

In our chapter on the chemical agencies of electricity, we have already described Schweigger's multiplier or galvanometer, which was used by M. Colladon in his experiments on the chemical action of ordinary electricity; and also the multiplier of Dr Faraday with a double helix, which he employed in his researches on the identity of the electricity of the machine with that of the pile. Various improvements have been made on the multiplier by M. Nobili, Professor Oersted, and others; but we must reserve our account of them for the articles GALVANISM and MAGNETO-ELECTRICITY.

CHAP. III.—DESCRIPTION OF INSTRUMENTS FOR INDICATING THE PRESENCE OF ELECTRICITY, AND MEASURING ITS QUANTITY.

Indicators and measurers of electricity.

Instruments which are intended merely to indicate the presence of electricity are called *electroscopes*, while those which are intended for measuring the quantity of electricity are called *electrometers*. The earliest electrometer which seems to have been employed was a pair of silk threads, which indicated the presence of small quantities of electricity by their divergence; and the Abbé Nollet even attempted to measure the quantity communicated to them, by determining the inclination of the two threads, from their shadow on a board. Mr Waitz improved the instrument by suspending small weights to the threads, and Mr Canton perfected it by substituting the finest linen threads for the silk ones, and by suspending from them a pair of small balls turned out of the dry pith of the elder.

Description of Cavallo's Electroscope.

Cavallo's electroscope. Plate CCXVI. Fig. 1.

M. Cavallo made this little instrument portable by fitting it up as in fig. 1, where it is shown in a state of action at B. When it is unloosed, the end B carrying the pith balls is screwed off, and the balls are put into the glass tube at A, which serves for a handle. This glass case is three inches long and three tenths of an inch wide, and half of it is coated with sealing-wax. A cork tapering at both ends is made to fit the mouth of the tube, and to one end of the cork are fixed two linen threads carrying two small cones of elder pith. The case of the electrometer at C incloses at one end a piece of amber for giving negative electricity, and at the other end a piece of ivory insulated upon a piece of amber for giving positive electricity, to the balls, when rubbed with a piece of woollen. All these instruments may be greatly improved by substituting for the pith of elder the pith of the sola, a tree which grows in the East Indies.

Description of Bennet's Gold-Leaf Electrometer.

Bennet's gold-leaf electrometer. Fig. 2, 3.

One of the most useful electrometers is that which was invented by Mr Bennet, and called the gold-leaf electrometer. This instrument, which is shown in fig. 2, and a section of it in fig. 3, consists of a cylinder, ABED, with a broad brass cap, AB. In a hole, *a*, in the centre of the cap, is fixed a wedge of wood, on each side of which is fastened by a little varnish a smooth-edged strip of gold leaf, shown at *m* and *n*, about two inches long and a quarter of an inch broad. Two pieces of tinfoil, *b*, *c*, are pasted opposite each other, and within the cylinder, so as to rise a little higher than the ends of the gold leaves, and the lower ends of these pieces of foil are in contact with the brass stand DEF which sustains the instrument. The inside of the cap AB, and the upper part of the glass cylinder, are sometimes coated with wax. A pointed wire, C, is used to collect the electricity of the atmosphere. In using this instrument, the cap AB is turned round till the surfaces of the gold leaves are parallel to those of the pieces of tinfoil. When no electricity is present the two gold leaves hang in contact in the axis of the cylinder; but if a fully electrified body is made to touch the cap AB, the gold leaves *m*, *n* will diverge as in the figure, and their lower ends will strike the pieces of tinfoil *b*, *c*, which will convey the electricity to the ground.

Mr Nicholson has proposed to substitute two flat radii of brass in place of the tinfoil, and by moving them to and from the gold leaves with a micrometer screw, to make the instrument more sensible, and at the same time obtain a kind of measure of its quantity.

Singer's Improved Electrometer.

Singer's improved electrome ter. Plate CCXVI. Fig. 4, 5.

Although insulation may be procured by coating glass insulators with wax, yet, as Mr Singer observes, this affords only a temporary defence, as moisture is eventually precipitated upon them; and in removing this it is almost impossible to avoid exciting the surface of the wax, and disturbing delicate experiments by the electricity which is thus generated. To remove this evil Mr Singer proposes to inclose the insulator in a narrow channel, as the moist air in contact with it would be then limited in quantity, and little disposed to motion. In applying this principle to the improvement of Bennet's electrometer, the insulation is effected by a glass tube four inches long and one fourth of an inch internal diameter, coated out and in with sealing-wax, and having a brass wire five inches long and one sixteenth or one twelfth of an inch thick to pass through its axis, so as to be perfectly free from contact with any part of the tube, in the middle of which it is fixed with a plug of silk, which keeps it concentric with the internal diameter of the tube. This arrangement is shown in fig. 4, 5, where A is a brass cap screwed upon the upper part of the wire *w*, which prevents the atmosphere from having free contact with the outside of the tube B, and defends at the same time its inside from dust. To the lower end of the wire the gold leaves are fastened, and the glass tube passes through the centre of the usual cap of the electrometer, and is cemented in it near the middle of its length, as may be seen by the dotted lines which represent the cap. "When this construction," says Mr Singer, "is considered, it will be evident that the insulation of the wire, and consequently of the gold leaves, will be preserved until the inside as well as the outside of the glass tube is coated with moisture; but so effectually does the arrangement preclude this, that some of those electrometers that were constructed in 1810, and have never yet (1814) been warmed or wiped, have still apparently the same insulating power as at first." The electrometer constructed upon the preceding principles is shown complete in fig. 5.

Fig. 4, 5

Fig. 5.

Dr Fara day's in structio for usin electrom ters.

Dr Faraday recommends strongly the use of this electrometer; but having found from repeated experience that its indications are not in general well understood by those who have occasion to use it, he has given a very valuable description of the kind of charge which it receives under different circumstances, and the precautions which are necessary in interpreting its indications. As this description would lose its value by any abstract or alteration, we shall make no apology for giving it in his own words, especially as it is applicable to many other analogous instruments.

"If an insulated portion of conducting matter, as a brass ball at the end of a glass handle or silken thread, be electrified, and then placed in *contact* with the cap of the electrometer, the cap and leaves will immediately partake of the electricity of the ball, and the leaves will diverge. If the charge in the ball be of considerable intensity, the leaves will be torn to pieces by their mutual repulsion, and the attraction of the sides of the glass jar; but if the intensity be small, the leaves will diverge moderately, so as not to touch the glass, and the degree of divergence will be in some proportion to the intensity of the charge communicated. The appearances will be the same whether the electricity communicated be positive or negative.

"The circumstances will be different if the body brought in contact with the electrometer is an electrified portion of what is usually called non-conducting matter; if, for instance, it be a stick of sealing-wax rubbed with flannel, instead of a metallic ball. If highly electrified, this will cause the same disturbance and appearance in the leaves during its approach as the ball; if moderately electrified, it will, when in contact with the cap, cause the usual appearance of divergence in the leaves, but upon removing it, the leaves, instead of remaining diverged, will either collapse, or remain very slightly, and frequently uncertainly, electrified. This is a consequence of the non-conducting power of the wax; and the method of transferring electricity to the electrometer in such a case is, to draw the excited parts of the wax over the edge of the cap; small portions will be communicated, and the electrometer will be left electrified similarly to the wax. Such a process is, however, very uncertain; for if the electricity of the wax be weak, the friction of the substance against the electrometer cap will sometimes generate an electricity stronger than that previously existing on the surface of the wax, and the electrometer will become charged, not by the previous electricity of the wax, but by that produced during its friction against the cap.

"This difficulty may, however, be avoided in most circumstances, simply by bringing the electrified non-conductor into contact with the cap, and retaining it there during the experiment; for the electricity which in this way is made by *induction* to exist in the leaves, and causes their divergence, is the same as that which would exist over the whole of the cap and leaves, if the electricity of the wax could be transferred to them.

"Such are the circumstances relating to the charge of the electrometer, by bodies brought into *contact* with it, and communicating to it part of the electricity they previously possessed. As before mentioned, when highly electrified, they cannot be so applied to the instrument without tearing the leaves to pieces; but they may then, when held at a distance, be made to diverge the leaves by *induction*, and even to communicate a charge to the instrument, and thus enable it to exhibit divergencies when the inducing electrified body is removed. The effects thus produced by induction are the same in kind, and nearly in extent, whether the electrified body be a mass of conducting or non-conducting matter, so that in this respect the metallic ball and the stick of wax are equal; the only difference being in the kind of electricity produced, which, with bodies charged positively, is the reverse of that occasioned by such as are charged negatively.

"When an electrified substance is placed at such a distance from the cap of the electrometer as to occasion considerable divergence, and is retained there for a few minutes, the divergence of the leaves will generally diminish, and the more rapidly as the instrument becomes cold or the glass damp, as the leaves are ragged, or any part of the cap angular and pointed.

"On removing gradually the electrified substance to such a distance that it can no longer affect the instrument, it will be found that the leaves will collapse at first, and afterwards expand again more or less, according as they had lost more or less of their first divergence.

"This ultimate divergence of the leaves will be due to a charge of electricity in the instrument, of the *opposite kind* to that of the inducing or approximated body.

"If no effect of this kind takes place, and there be no diminution of the first divergence, nor any ultimate change, then the insulation and goodness of the electrometer is proved by a powerful test. This being ascertained, then, if whilst the electrified body is in the neighbourhood, and the leaves diverged, the cap be touched by the hand, or any other conducting substance communicating with the earth, the divergence of the leaves will instantly cease. In this state of the instrument, if the communication be broken so as to leave the cap and leaves insulated, they will still remain collapsed; but if the inducing electrified body be now removed from the situation in which it at first caused the divergence, the leaves will immediately diverge, and the electrometer become charged with electricity of the *opposite* kind to that of the inducing body. The degree of charge thus given to the instrument will be in proportion to the degree of divergence induced in the leaves *before* they were made to collapse by the touch of the finger.

"In the case in which a weakly electrified non-conducting substance was directed to be laid on the cap of the electrometer, to occasion a divergence by electricity like its own, it may be observed that, if, during the experiment, the cap be touched by the fingers, and the electrified body afterwards removed, the leaves will first collapse, and then diverge with *opposite* electricity, although at the commencement of the experiment they were diverged with the *same* electricity as that of the body to be examined. If, therefore, the electricity of an excited body is to be examined, the leaves of the electrometer are in the first place to be diverged. This may be done with the *same* electricity, by bringing the body, if *weakly electrified*, into contact with the cap, leaving it there if of non-conducting matter, or removing it after contact if of conducting matter; or, if *strongly electrified*, by approaching it so near as to cause a sufficient divergence of the leaves, and retaining it there until the conclusion of the experiment. On other occasions however with strongly excited bodies, it may be convenient, either because of their size or other circumstances, to communicate a charge of the *opposite* kind, in the manner described; then upon determining what that kind is, in the manner to be immediately described, the electricity of the originally electrified body will of course be known to be opposite to it.

"The tests of the kind of electricity by which the leaves are diverged are of the following nature. A stick of sealing-wax rubbed with warm flannel becomes *negatively* electrified; a tube of warm glass rubbed with a dry silk handkerchief, or, better still, with a piece of silk having a little amalgam upon it, becomes *positively* electrified, both these excitations being so strong as to make the leaves of an uncharged electrometer diverge, whilst the wax or glass is at a considerable distance. If one of these excited substances be brought near the cap of an electrometer already diverged, it will either cause the divergence to increase or diminish. The divergence will *increase* if due to electricity of the *same* kind as that of the body approached, but will *diminish* if of the opposite kind; so that the electricity of the body approached being known, that of the electrometer will also be known, and consequently that of the excited body which had originally caused its divergence. The sealing-wax for instance is rendered *negative* by flannel; being approached to a diverged electrometer it may cause the leaves to collapse; the conclusion to be drawn is, that the electrometer leaves were in a *positive* state: being approached to another diverged electrometer it may increase the divergence, in which case it will indicate that the leaves of the electrometer were in a *negative* state. An excited rod of glass brought to these electrometers would make the first diverge still more, and would cause the second to collapse, in both cases indicating the same states as the wax.

"Some precaution is required with respect to the manner in which these excited rods are to be applied. The electrometer being diverged, the wax or glass is to be excited at such a distance as to have no influence over the instrument; the most strongly excited part of the wax or glass is then to be gradually approached to the cap, the hand and all other unnecessary conducting bodies being kept out of the way as much as possible, or at least not moved in the neighbourhood of the electrometer during the experiment. As soon as the rod begins to affect the leaves (even though the distance be two or three feet), the effect must be watched, and then their collapse or further divergence will become evident immediately on moving the rod a little way to or from the instrument.

"It is this first effect that indicates the kind of electricity in the electrometer, and not any stronger one; for although, if the repulsion be increased from the first, no approach will cause a collapse to take place except the actual discharge of the leaves against the sides of the glass, yet when collapse is the first effect, it may soon be completed, and repulsion afterwards occasioned from a too near approach of the strongly excited test-tube. It is, therefore, the first visible effect that occurs, as the test-rod is made to approach from a distance that indicates the nature of the electricity; and when this effect is observed, the rod should not be brought nearer, so as permanently to disturb the state of the electrometer, but should be removed to a distance, and again approached, for the purpose of repeating and verifying the preceding observation.

"It is to be understood, that the approach of the test-rod, though it affects the divergence, causes no permanent change of the electricity in the instrument, unless it be brought much too near, and cause considerable disturbance of the leaves. The electrometer will remain, after a good experiment, in the same state as at first.

"When the body to be examined is so strongly electrified that it may not be brought near to the electrometer, but has been placed at such a distance as to affect it, and left there to cause a proper divergence, then its place should not be directly over but rather on one side the cap, that the test-tube, when applied, may be brought towards the instrument on the other side; the originally electrified body, and the test-tube, being retained in directions as widely apart as they conveniently can be."

Saussure's Electrometer.

Saussure's electrometer. Plate CCXVI. Fig. 6, 7.

The electrometer by which Saussure made the observations on the electricity of the atmosphere is shown in fig. 6, 7. It consists of a glass vessel, ACB, of a bell shape, and so wide that the balls *g*, *g*, when at their maximum divergency, cannot reach the strips of tinfoil *h*, *h*, *h*, *h* pasted within the glass. The pith balls, which are spherical, should not be above half a line in diameter, and should be suspended by the finest silver wires, moving freely in nicely-rounded holes. Four pieces of tinfoil are used, each internal piece having a corresponding one on the outside; and the bottom of the instrument is made of metal, and round it there is a graduated scale for measuring the divergency of the balls.

In order to collect much electricity from the atmosphere, the instrument has a pointed wire one and a half or two feet long, which unscrews in three or four pieces; and in order to preserve its insulation, a small umbrella is screwed on the top of the instrument, see fig. 7. On other occasions he connected with a hook at H a fine metallic wire fifty or sixty feet long, at the end of which was a three or four ounce ball of lead, which he threw to the height of forty or fifty feet, in order to bring down the electricity of the atmosphere. Fig. 7.

By dividing between two equal and similar bodies the electricity contained in one, and carrying on the subdivision progressively downwards, M. Saussure determined the relation between the divergency of the balls *g*, *g*, and the force of the electricity which acted upon them. The results which he thus obtained are given in the following table.

Distance of Balls in fourths of a line.	Relative Forces of Electricity.	Distance of Balls in fourths of a line.	Relative Forces of Electricity.
1	1	13	23
2	2	14	26
3	3	15	29
4	4	16	32
5	5	17	36
6	6	18	40
7	8	19	44
8	10	20	48
9	12	21	52
10	14	22	56
11	17	23	60
12	20	24	64

Method using Sa sure's el trometer

In order to use this instrument, place it in open ground, free from trees and houses, and having screwed the conductor on the top of the electrometer, lay hold of it by its base, and place it so that the base and conductor may touch the ground at the same time; then raise it to the height of the eye, and observe on the scale the number of fourths of a line that the balls have diverged; then lower it till the balls almost touch each other, and measure the distance of the top of the conductor from the ground; this distance is the height at which the electricity of the air begins to become sensible. If the balls still diverge, the other parts of the conductor should be unscrewed, and it will then be seen at what height the electricity becomes sensible.

Hare's Single-Leaf Electrometer.

Hare's gle-leaf electron ter. CCXV Fig. 8.

As the divergency of the gold leaves is increased by the proximity of the strips of tinfoil, Dr Hare, of the university of Pennsylvania, conceives that the leaves are separated by attraction, and not by repulsion; and he was thus led to construct an electrometer with a single leaf, as shown in fig. 8. A brass ball one fourth of an inch in diameter is so situated that it may be made to touch the leaf, or retire from it to the distance of an inch, by means of a screw which supports it. It is obvious that this instrument is not only more simple than the double-leaved electrometer, but less liable to be destroyed by accident;

and Dr Hare informs us that it is exceedingly sensible, and that it has enabled him to detect the electricity produced by one contact between a copper and zinc disc, each six inches in diameter.

Henley's Quadrant Electrometer.

enley's adrant ctrome- . ate 'XVI. g. 9.

This useful instrument is represented in fig. 9. It consists of a semicircle of ivory, C, fixed to the side of a stand, AB, about seven inches high, rounded and smoothed in all its parts. The lower quadrant of the semicircle is divided into 90°, and a thin piece of cane, *ab*, is suspended at the centre *m* of the semicircle, carrying a pith ball, *b*. When the electricity to be measured is communicated to the instrument, the ball is repelled by the stem AB, and the angular elevation of the cane *ab* is a measure of the electrical force. This instrument may be screwed from its base B, and fixed on the end of the prime conductor, or on the summit of a Leyden phial. Mr Achard states from experiment that the quadrant should be divided according to a scale of arcs whose tangents are in arithmetical progression. It is most frequently used as an appendage to the prime conductor, for the purpose of measuring the state of action of the electrical machine.

In employing this instrument to show the progress of the charge of any jar or battery, Mr Faraday justly observes that it should be so placed that the moving index does not approach to any ball, wire, or surface charged similarly to itself, but on the contrary should recede from it. If it is therefore placed on the end of the conductor, the index should move outwards and away from the conductor, and not in a direction over it towards its more central parts; for the latter would interfere with the free indications of the electrometer, and in some cases would make it quite useless.

Brooke's Steelyard Electrometer.

ooke's elyard ctrome- . g. 10.

This electrometer, which is represented in fig. 10, is calculated to measure the number of grains which the repulsive force of the accumulated electricity is capable of raising. Its base AB, about nine inches and a quarter in diameter, adjusted horizontally by screws A, B, sustains an insulating pillar DD, upon which the electrometer rests. To the brass rod H are attached two tubes of copper, G, *g*, which have a motion round the rod, so as to be turned to a proper distance from the body whose electricity is to be measured. The tube G is screwed into a solid piece within the ball F, and moves in a vertical plane about an axis close to F. The balls I, K are of copper, and hollow. The arm E, which moves round an axis in a vertical plane behind the dial-plate R, carries a ball C, which touches the ball L fixed on the top of the glass rod DD. If the arm E rises from a vertical to a horizontal position, or through 90°, the index R on the dial is made to move through a whole circle, or 360°. The apparatus NPH forms the communication between the electrometer and the body whose electricity is to be measured.

Let the body be electrified positively, then the electrometer will be similarly electrified. The balls I, K will repel each other, G will rise in a vertical plane, L will repel C, and EC will also rise in a vertical plane.

The apparatus FG*g*IK is chiefly used for graduating the inner circle of the dial-plate. For this purpose a weight *m* moves along the rod G, till it forms an exact counterpoise to the weight of F. One end of the weight *m* will consequently be the *zero* of the scale. Let *m* be now shifted to *n*, near to the ball I, and determine by a pair of good scales the weight of the ball I, or rather the weight produced by shifting *m* to *n*. Divide the space *mn* into as many divisions as the grains now found, and subdivide it into halves and quarters. These divisions are now to be transferred to the inner circle of the dial-plate, by observing the position of the upper or shorter half of the index R when *m* stands at any number of grains in the scale *mn*. When the inner scale on the dial-plate is thus graduated, the arms G, *g* and balls I, K may be removed.

Cuthbertson's Balance Electrometer.

Cuthbertson's balance electrometer. Plate CCXVI. Fig. 11.

This electrometer, which is particularly useful for jars and batteries, is shown in fig. 11. It consists of a metallic rod CD, about thirteen inches long, terminated by balls C, D, and balanced on a knife edge, the ball *b* being constructed in such a manner as to permit the rod CD to move in a vertical plane. A bent tube of brass FG, supports a similar ball G; and four inches below D is placed another insulated ball E, which communicates with a wire and chain with the *outside* of the jar or battery. If the rod AB be now connected with the prime conductor, or the *inside* of the jar, and this last be electrified, the ball E will attract D, because they are oppositely electrified, from being connected with opposite surfaces of the jar; and when this attractive force exceeds the weight at *a* with which the opposite arm is loaded, the arm *b*D will descend and give out its electricity to the ball E. In order to obtain a measure of the attractive force between D and E, and consequently of the intensity of the charge, the arm C*b* is divided experimentally into sixty parts or grains, which are indicated by one side of the moveable index *a*. A Henley's quadrant electrometer is placed at A, to indicate the progress of the charge, which is not shown by the balance electrometer.

Mr Snow Harris's Electroscope.

Mr Snow Harris's electroscope.

This very ingenious and beautiful instrument, invented and used by Mr Snow Harris of Plymouth, to whom the science of electricity is under many obligations, is represented in fig. 12. The following description of it we owe to the kindness of the inventor:—

Fig. 12.

Fig. 12 represents an electroscope, which acts on the principle of electrical divergence. A small elliptical ring of metal, *a*, is attached obliquely to a small brass rod, *ab*, by the intervention of a short tube of brass at *a*; the rod *ab* terminates in a brass ball, *b*, and is insulated through the substance of the wooden ball *m*. Two arms of brass, *rr*, are fixed vertically in opposite directions on the extremities of the long diameter of the ring, and terminate in small balls; and in the direction of the shorter diameter within the ring there is a delicate axis at *a*, set on extremely fine points. This axis carries, by means of short vertical arms, two light reeds of straw, *an*, *an'*, terminating in balls of pith, and constituting a long index, corresponding in length to the fixed arms above mentioned. The index thus circumstanced is susceptible of an extremely minute force. Its tendency to the vertical position is regulated by small sliders of straw, *ss*, moveable with sufficient friction on either side of the axis. To mark the angular position of the index in any given case, there is a narrow graduated ring of card, board, or ivory, *ef*, placed behind it, the divisions being distinctly legible through sights cut in the reeds. This graduated circle is supported on a transverse rod of glass, *cd*, by the intervention of wooden caps, and is sustained by means of the brass ball *a*, in which the glass rod is fixed. The whole is supported on a long insulator of glass, A, by means of wooden caps terminating in spherical ends.

In the above arrangement, as is evident, the index will diverge from the fixed arms whenever an electrical charge is communicated to the ball *b*.

This instrument is occasionally placed out of the vertical position, at any required angle, by means of a joint at *m*; and all the insulating portions are carefully varnished with a solution of shell-lac in alcohol.

Mr Snow Harris's Electrometer.

Mr Snow Harris's electrometer. Plate CCXVI. Fig. 13.

The object of this electrometer, an account of which has been kindly communicated to us by its inventor, is to measure directly the attractive force of an electrified body, in terms of a known standard of weight, estimated in degrees on a graduated arch, *xy*, fig. 13. An insulated conductor, *f*, is fixed on a varnished rod of glass, *fg*, resting by the intervention of a wooden ball on the extremity of a micrometer screw, *s*, by the aid of which the conductor may be raised or depressed through given intervals to within the hundredth of an inch of any required point. A moveable and similar conductor, *m*, made of light wood, hollowed and gilded, is suspended immediately over the former from the periphery of a small brass wheel W, fig. 13 and 14, by means of a fine silver thread attached near its vertical arm, and passing from thence over its grooved circumference, as shown. This conductor, *m*, is counterpoised by a short cylinder of wood, *pn*, fig. 13, 14, suspended in a similar manner from the opposite side of the wheel by means of a silk thread, and resting partly in water contained in the glass vessel N, fig. 13.

The extremities of the axis of the wheel W, fig. 13, 14, are turned to extremely fine pivots, and rest on two large friction wheels, after the manner represented in the figures,[1] by which great freedom of motion is obtained.

There is a fine index of light straw, W*c*, attached to the extremity of a small steel needle, inserted diametrically through the circumference, which indicates on the graduated arc *xy* the force exerted between the conductors *m*, *f*. The weight of this index is accurately poised by a small globule of brass, *n*, fig. 14, moveable on a screw, cut in the opposite arm of the steel needle carrying the index.

The centre of the wheel W is accurately placed in the centre of the arc *xy*, which, with its radii of support, is made of varnished wood; the graduated scale being of card, board, or ivory. This arc is the sixth part of a circle, divided into 120 equal parts, 60 in the direction *cx*, and 60 in the direction *cy*; the centre *c* being marked zero.

Fig. 14.

Fig. 14 represents the wheel W, with the suspended conductor and counterpoise, the index and its balance-weight, together with the lines of suspension, passing freely over the circumference, and fixed at the point *ii*.

The various wheels above mentioned, with the graduated arc, are sustained on a projecting metallic rod, passing through a glass column B. The column is secured by means of the rod to a sort of double stand, *hh*, fig. 14, supported on three levelling screws. The interval between the plates of this stand contains the glass vessel N and the micrometer screw *s*. The upper plate has a circular hole, *p*, through which the cylindrical counterpoise passes into the water *n*. The levelling screws serve to regulate the position of the counterpoise through the hole; so that when it hangs in it centrally, the whole is accurately adjusted.

The gravity of the suspended conductor *m* being in the above arrangement opposed by that of the counterpoise, it may be so far considered as existing in free space devoid of weight, and will therefore become very readily moved by any new force applied to it. It may consequently be caused to approach to or recede from the fixed conductor *f*, by the operation of forces acting in either of these directions; the motion will, however, be speedily arrested by the cylindrical counterpoise *n*, which becoming either further immersed in, or otherwise raised in the water, furnishes, in the greater or less quantity of water displaced, a measure of the force. In this way the force may be estimated either in degrees or grains of actual weight; since the number of grains requisite to add to either side, in order to advance the index in either direction a given number of divisions, may be immediately found by experiment; and which, as the sections of the cylinder are all similar, will be found to increase or decrease with the degrees of the arc. Thus, if one grain advances the index in either direction five degrees, then two grains will advance it ten degrees, and so on.[2]

In the application of this instrument to electrical inquiries, the force to be measured is first communicated to the fixed conductor *f*, a free communication being established between the suspended conductor *m* and the ground, or otherwise with the negative side of the jar or battery, should the attractive force be derived from this species of accumulation; this is readily effected through the brass work of the apparatus, in connection with the rod passing through the interior of the glass column B.

For the repulsive force we connect the conductor *f* as before, and suspend *m* by a silk thread; in which case it will, after being electrified similarly to *f*, recede from it; but this method of experiment is evidently more complicated than the former, and liable to fallacy. The distance between the conductors *m*, *f* corresponding to a given force, is easily ascertained by means of the degrees indicated on the arc *x y*. In the instrument above described, each degree corresponds to a variation of distance between the conductors equal to the ·01 of an inch. If, therefore, at the commencement of any given experiment, we first bring the nearest points of the conductors *m*, *f* in contact, the index being in zero, and then depress the inferior conductor *f* a given distance, known by means of the micrometer screw *s*, then all subsequent distances may be readily determined between these points.

It is now only requisite to observe, that the interior of the cylindrical counterpoise is hollow, in order to weigh it accurately, and cause it to hang vertically in the water; and there is a small hemispherical cup, *p*, fixed on its stem for the reception of small adjusting weights, by which the position of the index at 0 of the scale is regulated with great nicety. With respect to the form of the conductors *m*, *f*, they are generally plain circular areas, backed by small cones, and are of about two inches diameter. Conductors of other forms, however, such as spheres and cylinders, may be occasionally used when the object is to experiment more particularly on bodies of peculiar forms.

Experiments with this instrument are remarkably clear, considering the subtile character of the principle we have to investigate. Thus, when the insulations are perfect, and the atmosphere dry, the index immediately exhibits the amount of the attractive force, and remains stationary for a much longer time than is required to note the result.

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[1] Mr S. Harris resorted to this method of employing friction rollers, as being more efficient than that in which the axis is allowed to rest in the angle formed between the peripheries of four smaller wheels. In this case it rolls fairly on a large circumference, and is prevented from passing off it on either side by the check-wheels, either of which, when acted on, opposes little or no resistance to motion.

[2] The counterpoise should be free from grease or varnish of every sort, and should, previously to being used, be kept immersed in water: the insulation of the conductor *f* also should be made extremely dry, and occasionally warmed by a stick of burning charcoal.

By varying the superficial dimensions of insulated conductors, and the quantity of electricity accumulated on them, we may, by the help of the above instrument, deduce many curious and important laws of electrical action. It is, however, first requisite to explain a method of charging simple conductors with comparative quantities of electricity; for without an accurate measure of quantity, little can be effected in almost any department of this branch of science.

late CXVI. ig. 15. ig. A.

Simple conductors may have comparative quantities of electricity disposed on them, by abstracting small sparks from an insulated charged jar, fig. 15, either immediately on the given substance, or otherwise, on an insulated transfer plate, *p*, fig. A. An insulated jar charged with a given accumulation, as estimated by the unit of measure, which will be presently described, is of singular importance in researches with simple conductors; for series of sparks may be obtained from it of such slow convergence, that many successive terms may be considered as equal. Thus, an insulated metallic disc, *d*, being placed in connection with the electrometer, fig. 13, or with the electroscope, fig. 14, was electrified many times in succession to precisely the same amount, by sparks drawn on an insulated plate from the positive coating, the negative side of the jar after each contact being restored to a neutral state. When a portion of the charge was abstracted so as to sensibly decrease the quantity in the jar, then a new point is arrived at, from which another series of sparks can be obtained, differing extremely little in quantity; and this process may be continued to a low point of accumulation on the jar.

The quantity given off by the positive coating is dependent on the dimensions of the abstracting conductor, and on the free state of the negative side of the jar. If it be free for each experiment, or be otherwise connected with a conductor of sufficiently large dimensions, it may be observed that a conductor of a double capacity receives a double quantity, a conductor of a treble capacity a treble quantity, and so on. The extent to which this process may be carried with a jar exposing about two square feet of coating is somewhat considerable. We only require in these experiments an extremely perfect insulation.

In disposing given quantities of electricity on simple conductors in this way, and investigating the attractive force by means of the electrometer, Mr Harris arrived at the laws formerly explained. (See page 587.)

Lane's Discharging Electrometer.

Lane's discharging electrometer. Fig. 16.

This admirable instrument is shown in fig. 16. To the stem AB of a Leyden jar, MN, is fixed a bent piece of glass, BC, for the purpose of supporting and insulating the brass rod DE, which has two equal brass balls at its extremities. This rod moves through a spring tube at C, so that the brass ball D can be placed at different distances from the equal ball A, by which the jar is charged. The insulated ball D is connected through the metallic wire DE with the outside coating of the jar, by a wire, EF. If we bring the ball D near to A, a small electrical charge conveyed to the jar MN will discharge itself from A to D, and pass off to the ground by the wire EF. If the distance AD is increased, the jar must be more highly charged before it discharges itself; so that the distance AD of the balls is a measure of the intensity of the charge at the time of its discharge. As long therefore as the jar has not discharged itself, we are sure that its charge is less than that which corresponds to the distance AD. The chief defect of this instrument arises from the occasional interposition of particles of dust or other light conducting materials between the balls, which occasions the discharge to take place sooner than it otherwise would do. The arm of glass is sometimes fixed on the top of the charging rod, where a ball of wood is placed, and is bent downwards, so as to carry the balls D, E. In this case the jar is charged by another ball projecting from the charging rod towards D. This electrometer is sometimes fixed to the prime conductor, with and without a jar accompanying it.

Mr Snow Harris's Measuring Electrometer.

Mr Snow Harris's measuring electrometer.

This elegant instrument, which we have had the advantage of seeing in operation, is an invaluable addition to our electrical apparatus. According to the law of electrical accumulation on coated jars, the quantity added to one side is always proportional to the quantity given off by the other, and reciprocally. Hence the amount of the accumulation may be always estimated by insulating the jar to be charged, and observing, by means of a discharging electrometer, the explosions of a small jar connected with the negative coating. This process is, however, complicated in its general application; but Mr Harris has modified it in the following manner:—Let a small jar, N, be furnished with a discharging electrometer, *n*, and inverted as in fig. 17, being supported by a brass rod, *pq*, inserted into the ball D of the prime conductor ABC. Then, as the electricity passes up the rod and accumulates on the inner coating, a similar quantity is given off from the outer coating, which may be made to pass from a ball at *p*. Now when the small jar N has been charged to a given degree, an explosion or discharge takes place from *m* to *n*, and restores the equilibrium; and hence *one measure* of electricity is marked by the first explosion. When this has taken place, the jar is in the same state as at first; and hence by a repetition of the process we obtain the exact number of measures (or explosions) which pass from the unit jar N, and are finally accumulated on the jar J, or battery, into which the electricity passes from the ball *p*. This process of charging a battery from the outer coating of an exploding jar, instead of from the prime conductor, supersedes all electrometers, and is the best way of measuring quantity.

Plate CCXVI. Fig. 17.

Volta's Flame Electrometer.

Volta's flame electrometer.

It was observed by Mr Bennet, that a lighted candle placed above the cap of his electrometer, and communicating with it, greatly increased the sensibility of the instrument; and it appears from various experiments that flame possesses the property of carrying off from bodies the electricity with which they are charged. M. Volta ingeniously availed himself of this principle in order to bring down to his electrometer the electricity of the atmosphere, the nature and intensity of which he was desirous of examining. This effect is produced by elevating above the atmospherical conductor a lighted match or torch.

Matteucci's Phosphorus Electrometer.

Matteucci's phosphorus electrometer.

As the preceding instrument cannot be employed when there is the least wind or rain, and still less during a storm of hail or wind, M. Matteucci conceived the idea of constructing an electrometer depending on the strong conducting power of the vapour of phosphorus. He prepared rods of this substance between the twenty-fifth and the fiftieth of an inch in diameter, by melting the phosphorus under water, and by blowing it while in a state of fusion through a tube of the requisite diameter. He afterwards made the rod of phosphorus project from the fiftieth to the seventy-fifth of an inch beyond the end of the tube. He then fixed the glass tube on a wooden pole, and he insulated the pole by fixing to its extremity a glass handle. The phosphorus communicated by its base with a metallic wire which descended along the pole, and which could be kept at a distance from the pole by some tubes of glass placed at regular distances. M. Matteucci kept the rod of phosphorus perfectly insulated in the time of rain, by means of a glass hood varnished on both its surfaces, and having its convexity turned upwards. The pole was composed of three or four rods, which were adjusted into one another; and the instrument thus constructed was found extremely useful in examining the electricity of the atmosphere.

Mr Ronalds' Improvements on Electrometers.

Ronalds' improvements on electrometers. Plate CCXVI. Fig. 18.

As threads, pith or cork balls, and even straws when very dry, lose some of their conducting power, Mr Ronalds prefers fine silver wire, and hard charcoal balls from boxwood, for electrometric purposes. The following is the method which he employs in making electrometers of this kind. The instrument which he uses is represented in fig. 18, where ABCD is a bow of steel wire with a hook at each end. When the charcoal ball has been threaded on the silver wire, and rings formed at each end, it is *very* gently stretched in this bow, by passing the hooks through the rings, and shoving it forward with the thumb placed against the end of the tongue near the handle, which tongue is thus made to open wider by pressing the screw E on each side. The screw E is then turned a little farther into the piece F, in order to fix it firmly. The fine wire is now placed cautiously upon a piece of iron, a little below a red heat, which will make it perfectly straight, when it may be taken from the bow, and suspended on one of the rings of the piece of brass, fig. 19. In fig. 20 is shown Mr Ronalds' method of making gold-leaf electrometers.

Fig. 19, 20.

The electroscopes of the Abbé Haüy, and the torsion electrometer of Coulomb, have been described in a preceding part of this treatise.

CHAP. IV.—ON MISCELLANEOUS ELECTRICAL INSTRUMENTS.

1. *Mr Snow Harris's Electrical Balance.*

Mr Snow Harris's electrical balance. Plate CCXVII. Fig. 1.

In investigating the law of the attractive forces of electricity accumulated in jars and batteries, Mr Harris made use of the electrical balance shown in fig. 1. The beam *mn* of the balance, constructed in the usual manner, is suspended from a projecting arm of brass, *ea*, supported by a vertical stand, *abc*, consisting of a brass slider and socket, *ab*, by which the balance can be moved up or down, and of a glass tube, *bc*, with a ball of varnished wood, *b*. A wire, pointed out by the line *ef*, passes through the tube *abc*, and connects the beam with the *negative* coating of the jar. A hollow gilt conductor of wood, *f*, is suspended by a metallic thread from one of the arms *m*, and from the opposite arm *n* is hung by silk lines a light brass scale, *d*. In this scale there is placed as much additional weight as will balance the conductor *f*, and put the whole in a state of equilibrium. By means of an insulated conductor f', of the same dimensions as *f*, and fixed directly under it, the attractive force of the electricity in the jar is made to act directly on the suspended conductor *f*. The conductor f', which is connected with the positive coating, is so placed that it can be depressed from contact with the conductor *f*, through given distances, by means of a cylindrical slide, *r*, attached to it, which moves in the socket *s*, and indicates its depression on an engraven scale, divided into twentieths of an inch. The socket *s* is supported on a glass pillar by means of a varnished ball of baked wood, on which the socket is fixed, and through which the conductor f' is connected with the positive coating. The whole balance can be raised or depressed through a small distance by the micrometer screw at *e*.

From this description it is obvious that the attractive force acts directly between the conductors *f* and f', and can therefore be measured by weights placed in the scale *d*. The scale rests on a small circular stand *q*, which can be raised or depressed by the sliding brass rod and tube *vt*, to accommodate itself to the horizontal position of the beam, and to check any oscillation. The balance is fixed on an elliptical base, having three levelling screws.

The following experiment, made by Mr Harris, will best explain the use and value of this balance.

Having connected the inside coating of a single jar containing five square feet with the conductor *f*, and the outside coating with the wire *ac*, the conductor f' was depressed through half an inch, and a weight of sixteen grains was placed in the scale; then, when five turns of the plate were completed (or, if the measuring electrometer is used, when *n* explosions were conveyed to the jar), the attractive force between *f* and f' was sufficient to tip the beam. The accumulated electricity being discharged, the conductor f' was depressed through a *second interval of half an inch*, making the whole distance *one inch;* and *four grains* or one fourth of the former weight being placed in the balance, the beam was again depressed with *five* turns of the plate, or *n* explosions of the measuring electrometer. The accumulation being again discharged, and the conductor *f* depressed through a third interval of half an inch, and one ninth part of the first weight placed in the scale, the beam was again depressed with five turns of the plate, or *n* explosions. Hence, as the distances in the first experiment were as two to one and the weights four to one, and as in the second experiment the distances were three to one and the weights nine to one, we may infer *that the attractive force between the conductors varied in the inverse ratio of the square of their distance.*

2. *Dr Ure's Detonating Eudiometer.*

Dr Ure's detonating eudiometer. Plate CCXVII. Fig. 2.

The electrical eudiometer is a simple instrument, for detonating or exploding gases by means of an electrical spark or shock. The common eudiometer is merely a short tube of glass closed at the upper end, and having two pieces of platina wire passing through the glass near its upper end, so as nearly to meet at the axis of the tube. These wires communicate, the one with the inner and the other with the outer coating of a charged jar, so that when the discharge passes between the platina points, it inflames the gas in the tube. As the gas subjected to the action of the spark is transferred to the tube over water or mercury, the lower or open extremity of the eudiometer must be kept in the water or mercury, in order to confine the gas. With the common eudiometer two persons are required, the one to manage the instrument and the other to manage the electrical machine; but Dr Ure has given it such a form that a single individual can perform all the operations with the greatest facility.

Fig. 2.

Dr Ure's instrument, shown in fig. 2, consists of a glass syphon, ABC, with a bore of from two tenths to four tenths of an inch. Its legs AB, CB are from six to nine inches long, and from one fourth to half an inch apart. The open end A is slightly funnel-shaped, and the other, C, which is hermetically sealed, has two platina wires, *a*, *b*, inserted near it by the blowpipe. The outer end of the one wire is bent vertically upwards, and then horizontally so as nearly to touch the edge of the aperture A. The end of the other wire is formed into a little hook, to allow a small spherical button, *d*, to be attached to it when the electrical spark is to be transmitted. The sealed leg CB is graduated by introducing in succession equal weights of mercury from a measure glass tube. Seven ounces Troy and sixty-six grains occupy the space of a cubic inch, and thirty-four and a half grains represent a hundredth part of that volume.

Plate CCXVII. Fig. 3.

The method of using this apparatus is shown in fig. 3. The whole syphon being filled with mercury or water, a convenient quantity of the gas to be examined, not exceeding one sixth of the capacity of the tube, must then be introduced in the ordinary manner. The tube is then held upright by the hand, and the gas being transferred into the sealed leg CB, the mercury is brought to a level in both legs, either by the addition of a few drops, or by displacing a portion by pushing down a glass or wooden rod. The tube being grasped as in the figure, the thumb must be placed tightly over the aperture, so as to close it, and at the same time touch the wire next it. A spark from the conductor of the electrical machine is then made to enter the button d, and after inflaming the gas, is conducted away by the thumb and hand of the operator, the tip of the finger feeling only a slight push or pressure. When two or more inches of air are left beneath the thumb, it acts as a recoil spring to restrain the violence of the explosion. When condensation of volume takes place, the finger feels pressed down to the orifice. On sliding it gradually to one side and admitting the air, the mercurial column in CB will rise above that in AB. More mercury must then be poured in till the equilibrium is restored, when without any reduction we may read off the resulting volume of gas. If the charge of a jar is to be transmitted through the wires, the thumb must not touch the wire when it closes the aperture. In this case the wire from the outside coating must be hooked on the eudiometer wire nearest the thumb, and then the knob or ball on the charging rod of the jar must be brought in contact with the button on the other wire, when the gas will be exploded.

3. *Volta's Electrical Lamp.*

olta's ectrical mp.

As hydrogen gas is readily inflamed by a very small electrical spark, Volta conceived the idea of constructing a lamp for temporary purposes, such as that of obtaining a light at night, or in summer for the purpose of sealing letters, by employing the electrophorus to light the hydrogen. With this view a quantity of gas is put into a reservoir, and when subjected to the pressure of a column of water, it escapes from a small aperture by turning a stop-cock. Beneath this reservoir is placed an electrophorus in a box, and from the upper part of the box a wire passes through a glass tube to the small aperture. When the handle of the stop-cock is opened to let out the gas, the cover of the electrophorus is raised by means of a silk cord connected with the handle of the stop-cock, and the spark from this cover is conveyed by this insulated wire to the stream of gas, which is instantly kindled, so as to allow a candle to be immediately lighted. From the smallness of the quantity of gas consumed, a light may be procured an hundred times from the same reservoir of gas. When the hydrogen gas is expended, it is troublesome to persons unaccustomed to chemical manipulations to replenish the reservoir with fresh gas. M. Gay Lussac removed this defect by suspending a bar of zinc on the apparatus, so as to reproduce, by the action of diluted sulphuric acid[1] upon it, as much gas as was exhausted.

r Cut- sh's im- vement on it.

Although a good electrophorus, when well excited, will retain its charge for many months, yet in general its operation has been so uncertain, especially in damp weather, that many persons have been obliged to lay aside the instrument. Mr Cutbush of Philadelphia found that he could produce a spark in the dampest weather when he warmed the electrophorus before exciting it with a fox's tail, and kept the electrophorus box as tight as possible. As the cock is apt to become loose and allow the gas to escape, Mr Cutbush applied a mixture of tallow and finely pulverized plumbago to the cock; and, what is very curious, he found that the hydrogen gas prepared from zinc escapes much more readily than that procured from iron filings. He found that the former sometimes disappeared in twenty-four hours, while the latter often remained more than a week. The gas from iron filings is more impure than the other, from containing more or less carbon. With these precautions Mr Cutbush found that the lamp of Volta seldom disappointed him in producing flame. He ascertained that one cubic inch of gas will light the taper at least ten times if the cock is quickly turned.

Green's hydrogen lamp.

A hydrogen lamp acting by Voltaic electricity in place of that of the electrophorus has been invented by Professor Jacob Green of Nassau Hall, and is quite independent of the state of the atmosphere. Its description, however, belongs to the subject of another article.

4. *Ronalds' Electrograph.*

Ronalds' electrograph. Plate CCXVII. Fig. 4.

M. Magellan had proposed to delineate the changes which take place in the electricity of the atmosphere, by a cylindrical and a plain electrograph. As our limits, however, will not permit us to describe these instruments, we shall content ourselves with giving a drawing and description of the more recent and useful electrograph invented by Mr Ronalds. This instrument is shown in fig. 4, where AA is a box with a strong time-piece placed horizontally, and moved by the weight B, and CC a disc of baked mahogany eight inches in diameter, with an aperture of 2½ inches at D. The circumference of this disc, and also that of the perforation, are provided with edges or rims, and the outer broad rim is divided off and marked with hours and minutes like a common clock. The space between the two edges is almost filled with cement, composed of rosin, bees' wax, and lamp-black, and this part of the apparatus may be taken from the box at pleasure. A glass tube EF, with brass caps, and covered inside and out with hard cement, screws by its lower end into the disc CC, while the upper end carries a small sheave, g. Within this tube EF a stem of glass is fixed by its lower end on the minute arbor of the time-piece, and a pivot attached to its upper extremity passes through F and the sheave g. This pivot carries the iron ball and cap h, into which is screwed the horizontal steel wire i, carrying the slider k, which moves with little friction along the wire. The piece k carries the vertical wire l, terminating below in a hook, upon which hook is hung a ring at one end of a short wire m, whose other end carries a small gold bead. A fine thread, n, is attached to k by one end, and by the other to the sheave g.

When the clock is going, its minute arbor carries round the arm k, and the effect of this is to coil the thread n round the fixed sheave g, and to make the piece k advance towards the ball h, so that the gold bead will trail upon the resinous disc CC, and describe a spiral upon it. If we now cause the little iron cap above h to communicate with a wire connected with any atmospherical conductor, the gold bead will electrify the resinous surface, so that when the plate is removed from the clock and powdered with pounded resin, or even dry hair powder, the spiral line will exhibit configurations varying in shape and in breadth according to the intensity and nature of the electri-

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[1] The acid should be diluted in the proportion of one part of acid to seven of water.

Electrical Apparatus.

city which the resinous surface has received from the trailing bead. The times at which these phenomena took place will be shown by the dial-plate.

If this instrument is used for recording the phenomena of serene weather, dew, &c. the hour arbor should be used in place of the minute one; but if for those of a thunder storm, hard shower of rain, or hail or snow, the minute arbor should be used. Mr Ronalds adds, that he has sometimes found a more rapid motion necessary, which can be obtained by the addition of a third arbor; the glass tube EF, with its appendages, being transferred to the most suitable arbor, and the disc adjusted to a new centre. Sheaves larger and smaller than *g* will be requisite for different applications of this electrograph.

5. *The Electrical Air Thermometer.*

Kinnersley's electrical air thermometer. Plate CCXVII. Fig. 5.

This instrument, invented by Mr Kinnersley, is shown in fig. 5, where AB is a glass tube about ten inches long and two inches wide, having its ends closed by two air-tight brass caps, A and B. Through these caps slide two hooked wires, FG, EI, so that the small brass balls G, I, can be set at any distance, and an electrical spark passing between them may be made stronger or weaker as the occasion requires. Another small tube, HA, open at both ends, passes through a tube in the copper caps, and through this tube a sufficient quantity of mercury or water is introduced to fill the lower ends both of the wide tube AB and the narrow one HA. If an electrical charge is sent through the balls G, I when they are placed in contact, by connecting the hooks E, F with the outside and inside coating of a Leyden jar, no effect will be produced; but if the balls G, I are separated so that the charge passes in the form of a spark through the interposed air, the rarefied and displaced air will press on the surface of the mercury or water at the bottom of the tube AB, and raise it nearly to the top of the small tube HA. It will then sink after the explosion, and resume its former position.

6. *Volta's Electrical Pistol.*

Volta's electrical pistol.

A brass vessel of a pear shape, or of an ellipsoidal form, being perforated at its two ends, a glass tube of the same diameter as the perforation is inserted in one of them, so as to extend to the centre of the ellipsoid, and to project about four inches beyond the vertex. Through this tube there passes a metallic stem, which is furnished with a brass ball at its outer end, while its other extremity reaches beyond the inner end of the glass tube. A mixture of equal parts of hydrogen gas and atmospheric air having been introduced at the second aperture, this aperture is closed tightly with a cork. The operator now grasps the ellipsoid by its equator, and when a spark is taken by its brass ball from the prime conductor, the gaseous mixture will instantly be exploded, and drive out the cork with a smart explosion. In place of a mere perforation at the extremity of the ellipsoid, a barrel may be inserted, and by using a cylinder of cork as a wadding, a ball may be discharged from the pistol.

Fig. 6.

Another form of the electrical pistol is shown in fig. 9, at BCF, forming a part of Mr Ronalds' electrical telegraph. The pistol has the form of a pear, and the brass rod and ball, in place of being a continuation of its axis, is inserted on one side, as shown at D. We have given a separate section of this pistol in fig. 6, where AB is the body of the pistol, which contains the inflammable gas, C the cork which is to be discharged, D the glass tube, G the brass ball with a brass rod going down through the glass tube and extended a little beyond it, and E another little ball and rod fixed in the lower end of the pistol. When the spark is communicated at G, the gas will explode and discharge the cork.

7. *Ronalds' Electric Telegraph.*

Electrical Apparatus.

Ronalds' electric telegraph.

M. Cavallo suggested the idea of conveying intelligence by passing given numbers of sparks through an insulated wire in given spaces of time; and some German and American authors have proposed to construct galvanic telegraphs by the decomposition of water. Mr Ronalds, who has devoted much time to the consideration of this form of the telegraph, proposes to employ common electricity to convey intelligence along insulated and buried wires; and he proved the practicability of such a scheme by insulating eight miles of wire on his lawn at Hammersmith. In this case the wire was insulated in the air by silk strings; but he also made the trial with 525 feet of buried wire. With this view he dug a trench four feet deep, in which he laid a trough of wood two inches square, well lined both within and without with pitch, and within this trough were placed thick glass tubes, through which the wire ran. The junction of the glass tubes was surrounded with short and wider tubes of glass, the ends of which were sealed up with soft wax.

Plate CCXVII. Fig. 7.

Mr Ronalds now fixed a circular brass plate, fig. 7, upon the seconds arbor of a clock which beat dead seconds. This plate was divided into twenty equal parts, each division being worked by a figure, a letter, and a preparatory sign. The figures were divided into two series of the units, and the letters were arranged alphabetically, omitting J, Q, U, W, X, and Z. In front of this was fixed another brass plate, as shown in fig. 8, which could be occasionally turned round by the hand, and which had an aperture like that shown in the figure, which would just exhibit one of the figures, letters, and preparatory signs, for example 9, V, and Ready. In front of this plate was suspended a pith ball electrometer, B (see fig. 9) from a wire, C, which was insulated, and which communicated on one side with a glass cylinder machine, D, and on the other side with the buried wire. At the further end of the buried wire was an apparatus exactly the same as the one now described, and the clocks were adjusted to as perfect synchronism as possible.

Fig. 8.

Fig. 9.

Hence it is manifest, that when the wire was *charged* by the machine at either end, the electrometers at both ends *diverged*, and when it was *discharged* they collapsed, at the same instant. Consequently, if it was discharged at the moment when a given letter, figure, and sign, on the lower plate, fig. 7, appeared through the aperture, fig. 8, the same figure, letter, and sign would appear also at the other clock; so that by means of such discharges at one station, and by marking down the letters, figures, and signs seen at the other, any required words could be spelt.

This is not the place to describe the method of using the telegraphic dictionary, but we may state, that the electrical pistol F, which passed through the side of the clock-case GG, had an apparatus H, by which a spark might pass through it when the sign *prepare* was made, in order that the explosion might excite the attention of the superintendent, and obviate the necessity of close watching.

8. *Ronalds' Atmospherical Conductor, founded on a New Mode of Insulation.*

Ronalds' atmospherical conductor. Fig. 10.

This conductor is shown in fig. 10. A glass pillar, A, passes through a circular piece of hard boxwood, B, and also through the piece C, the sides of the perforations in these pieces being lined with thick leather. Nut bolts, D, D, pass through B and C, to secure the glass pillar in its place. The dotted part of the support is hollow. The glass is about one fourth of an inch thick at the opening, and the upper part of it is coated with sealing-wax. A small spirit-lamp, E, with a single thread of cotton wick, and having a glass chimney, is placed beneath the open mouth of the glass pillar. The pillar terminates above with a strong brass socket carrying the ball F, which is perforated to admit the lowest joint of a long bamboo fishing-rod G, gilt and inclined at an angle of about 45°. The strong bent wire H carries the upper part of a Volta's straw electrometer I, which rests upon the table M. The piece which supports the straws is entirely detached from the glass bottle I, being fixed to the arm H when the instrument is in use. The same piece carries a cone or funnel K. From the bent wire N, similar to H, a pair of wood charcoal balls are suspended, or instead of them the quadrant electrometer O, which serves to mark the higher electrical intensities, such as those of rain, hail, snow, and heavy clouds, which are too strong to be measured by more delicate instruments.

When this instrument is screwed upon a table in an upper room, and the fishing-rod thrust out of the window, it will be found highly useful for examining the usual atmospherical electricity of serene weather. If it is to be used in the open air the ball F is unnecessary, and the rod can be placed vertically in the brass socket. Two insulators of this kind may be used to sustain a wire if required. (N. N. N.)

ELECTRIDES, anciently islands in the Adriatic Sea, which received their name from the quantity of amber (*electrum*) which they produced. They were at the mouth of the Po, according to Apollonius of Rhodes; but some historians doubt their existence.

ELECTRO-MAGNETISM. See Galvanism, Magneto-Electricity, and Thermo-Electricity.

ELECTROMETER. See Electricity.

ELECTUARY, in *Pharmacy*, a form of medicine composed of powders and other ingredients, incorporated with some conserve, honey, or syrup, and divided into doses, like boluses.

Vossius observes, that all the remedies prescribed for the sick, as well as the confections taken by way of regale, were called by the Greeks *εκλειγματα*, from the verb *λειχω*, *I lick;* whence, he thinks, was formed the Latin *electarium*, and afterwards *electuarium*. This conjecture he supports from the laws of Sicily, where it is ordained that *electuaries*, syrups, and other remedies, shall be prepared after the legal manner. The Bollandists, who relate this etymology, seem to confirm it.

ELEEMOSYNA Carucarum, or *pro Aratris*, in our ancient customs, a penny which King Ethelred ordered to be paid for every plough in England, towards the support of the poor. Sometimes it is also called *eleemosyna regis*, because first appointed by the king

ELEEMOSYNARIUS, in our old writers, means the almoner or peculiar officer who received the eleemosynary rents and gifts, and distributed them for pious and charitable purposes. There was an officer of this description in all religious houses. Formerly the bishops also had their almoners, as the king has at present.

ELEGANCE (from *eligo*, I choose), denotes a manner of doing or saying any thing politely, agreeably, and choicely; politely, so as to please people of delicate taste; agreeably, so as to diffuse a relish which gratifies every body; and choicely, so as to rise above the common way or mode.

ELEGIT, in *Law*, a writ of execution, which lies for a person who has recovered debt or damages; or upon a recognizance in any court against a defendant who is not able to satisfy the same in his goods.

ELEGY, a plaintive poem, written in a kind of stanza or verse the cadence of which is suited to the expression of mournful feelings and sentiments.

ELEMENT, in a figurative sense, is used for the principles and foundations of any art or science; as Euclid's Elements.

Elements, in *Physics*, the first principles of which all bodies are composed. These, it has been supposed, are few in number, unchangeable in their nature, and, by their multiform combinations, produce that endless variety of objects which we observe in the works of creation.

Elements, in *Astronomy*, are those principles deduced from astronomical observations and calculations, and those fundamental numbers which are employed in the construction of tables of the planetary motions. Thus, the elements of the theory of the sun, or rather of the earth, are his mean motion and eccentricity, and the motion of the aphelia. The elements of the theory of the moon are its mean motion, that of its node and apogee, its eccentricity, the inclination of its orbit to the plane of the ecliptic, and so on.

ELENCHUS, in *Antiquity*, a kind of ear-ring set with large pearls.

Elenchus, in *Logic*, by the Latins called *argumentum* and *inquisitio*, is a vicious or fallacious argument, which deceives under the appearance of a truth, and is the same with what is otherwise called *sophism*.

ELEPHANT. See Mammalia.

Knights of the Elephant, an order of knighthood in Denmark, conferred upon none but persons of the first rank and merit. It is also called the *order of St Mary*. Its institution is said to have arisen from a gentleman belonging to the Danish crusaders having killed an elephant in an expedition against the Saracens in 1184; in memory of which achievement King Canute instituted the order. The badge is a towered elephant, with an image of the holy virgin encircled with rays and suspended by a watered sky-coloured ribbon, like the George in England.

ELEPHANT ISLE, called by the natives Gharipoor, a small island situated between Bombay and the main land, about five miles and a half from Bombay. It is nearly five miles in circumference, and contains about a hundred inhabitants, who are employed in the cultivation of rice, and in rearing sheep and poultry for the Bombay market. The island is nearly overgrown with wood of a luxuriant growth, and contains several springs of good water. But it owes its chief celebrity to the mythological excavations and sculptures of Hindu superstition which are contained in it. Opposite to the landing place is a colossal statue of an elephant, cracked and mutilated, from which the Portuguese gave the island the name which it still bears. At a short distance from this is a cave, the entrance to which is nearly sixty feet wide and eighteen feet high, supported by pillars cut out of the rock; the sides are sculptured into numerous compartments containing various representations of the Hindu deities, but the figures have many of them been defaced by the blind zeal of the Mahommedans and Portuguese. In the centre of the excavations there is a remarkable bust of the Hindu Triad, or three-formed god, namely, Brahma the Creator, Vishnu the Preserver, and Seva or Mahadeva the Destroyer. The heads are six feet in length, well cut, and the countenances, with the exception of the under lip, are handsome. The head-dresses are curiously ornamented; and one of the figures, that of the destroyer, holds in its hand a cobra capella snake, whilst on the cap are, amongst other symbols, a human skull and a young infant. On each side of the Trimurti is a pilaster, the front of which is filled up by a human figure leaning on a dwarf, both much defaced. There is a huge compartment to the right, hollowed a little, and covered with a great variety of figures, the largest of which is sixteen feet high, representing the double figure of Seva and Parvati, named Viraj, half male and half female. On the right is Brahma, four-faced, on a lotus; and on the left is Vishnu. On the other side of the Trimurti is another compartment with various figures of Seva and Parvati, the most remarkable of which is Seva in his vindictive character, eight-handed, with a chaplet of skulls round his neck. On the right of the entrance of the cave is a square apartment, supported by eight colossal figures, containing a gigantic symbol of Mahadeva or Seva cut out of the rock. There is a similar chamber in a smaller cavern, having the walls covered with sculptures, which however can hardly be seen, owing to the rubbish with which the place is filled. This singular seat of Hindu superstition is said to have been dedicated to Seva, but it contains numerous representations of all the Hindu deities. It has, however, from time immemorial been forsaken by its priests or Brahmins; and it is not even the resort of pilgrims; its only devotees being married women, who offer up their prayers here for an increase of their family. This place is a most wonderful monument of antiquity and superstition. The work must have been one of incredible labour; and there is not the least trace or tradition to point out the time when this temple flourished, much less the period of its formation. Yet it clearly shows that the Brahminical religion must have flourished in India at a very remote period of antiquity. Long. 73. E. Lat. 18. 57. N.

ELEPHANTIASIS, called also the *leprosy of the Arabians*, in *Medicine*, a chronical disease, one of the two species of leprosy which affects the whole body, where even the bones as well as the skin are covered with spots and tumours, which are at first red, but ultimately become black.

ELEPHANTINE, a small island of the river Nile, now *Geziret-el-Zahir*, or the Flowery Island, distant half a stadium from Syene in Upper Egypt. The beauty of nature in this confined spot formed a strange contrast to the arid appearance of the country along the banks of the Nile. The inhabitants protected it against the inundations of the river by powerful dykes; and when the heats of summer had parched up every other part of the land, here nature appeared in all the verdure of spring, by means of artificial irrigation. This island being only one hour distant from the Cataract, became naturally the emporium of all the trade which was carried on with the inhabitants of the more southern portions of Africa. There was a city in it, of the same name, which contained a temple of Knuphis, and a nilometer, which is thus described by Strabo (xvii. 817): "The nilometer is a well or cistern on the banks of the Nile, built of well cemented stone (συννόμῳ λιθῳ). It serves to mark the height of the inundation, as the water in this well rises and falls with that of the river: there are marks on the wall which show the height of the increase, and the result of this observation is regularly published for the use of the cultivators of the ground. By this means they are able to judge to what height the inundation will rise, and thereby the labourers are enabled to regulate the proper distribution of the water. The governors of the province also regulate by this the tax imposed upon the land, for they increase it in proportion as there is an appearance of the water rising to a great height." It is curious that neither this intelligent geographer nor any of the ancient writers have thought proper to inform us how high the Nile rose when confined within precipitous banks, as it was in this southern portion of the country. It is from Aristides, who lived in the second century, that we first learn that it rose twenty-eight cubits above the lowest water mark; yet this was not sufficient to cover the valley with water, and it is now an arid desert, incapable of cultivation. See article EGYPT.

ELEPHANTINE, in Roman antiquity, an appellation given to the books in which were registered the transactions of the senate and magistrates of Rome, the emperors, or the generals of armies, and even of the provincial magistrates, the births and classes of the people, and other things relating to the census. They are supposed to have been so called, from having been made of leaves of ivory or elephants' tusks.

ELEUSINIA, in Grecian antiquity, a festival observed in honour of Ceres, by some states every fourth, but by others every fifth year. The Athenians celebrated it at Eleusis, a town of Attica; and hence arose the name.

Ceres, says Isocrates, wandering in quest of her daughter Proserpine, arrived in Attica, where some good offices were rendered her, which it is unlawful for those who are not initiated to hear. In return she conferred two unparalleled benefits, namely, the knowledge of agriculture, by which the human race is raised above the brute creation; and the mysteries, from which the partakers derive sweeter hopes than other men enjoy, both as to the present life and a future state of existence. It was the popular opinion that the Eleusinian goddesses suggested prudent counsel to their votaries, and influenced their conduct; and that the latter were respected in the infernal regions, and had precedence in the assemblies of the blessed, whilst the unhallowed were left in utter darkness, wallowing in mire, or labouring to fill a leaky vessel. The Athenians were solicitous to secure these advantages to their children, by having them initiated as soon as possible in the Eleusinian mysteries.

Ceres was supposed to be particularly partial to Eleusis and its vicinity. There were the memorials of her presence and of her bounty; the well named *Callichorus*, by which she had rested, in the reign of Erectheus; the stone on which she sat, named the *sorrowful;* the Rharian plain, where barley was first sown; and the thrashing floor and altar of Triptolemus, a herdsman whom she instructed in the culture of that grain, the use of which succeeded to acorns. Her mysteries continued to possess a pre-eminence in holiness, and to be accounted as much superior to all other religious festivals as the gods were to the deified heroes. Even the garments worn at the solemnity were supposed to partake of the efficacy of the mysteries, and to be possessed of signal virtues. It was customary to retain them until they began to decay, and then to dedicate them in the temple, or to use them as swaddling clothes.

The mystic temple, as it was called, provided by Pericles for the solemnity, created by its sanctity an awe only equalled by the astonishment which its beauty and magnitude excited in every beholder. The profane or uninitiated were forbidden to enter it upon any pretence. Two young Acarnanians happening inadvertently to mix with the crowd at the season of the mysteries, and to go in, were discovered and put to death. The chief priest, hierophant, or mystagogue, was taken from the Eumolpidæ, a holy family which flourished at Athens, and derived its descent from Eumolpus, a shepherd and favourite of Ceres. He was enjoined to observe celibacy, and he wore a stole or long garment, and in his hair a wreath of myrtle. The grand requisites in his character were strength and melody of voice, solemnity of deportment, magnificence, and strict decorum. Under him, besides many of inferior station, was the daduchus or torch-bearer, who likewise wore his hair with a fillet; the priest, who officiated at the altar; and the hiero-ceryx, or sacred herald; all very important personages. The latter was of a family which claimed the god Mercury, and Aglauros, the daughter of Cecrops, for its ancestors.

The secrecy in which the mysteries were enveloped served to enhance the idea of their consequence, and to increase the desire of participation. It was so strict that no person was allowed even to name the hierophant by whom he had been initiated; whilst public abhorrence and detestation awaited the babbler, and the law decreed that he should die the death.

The Athenians suffered none to be initiated into these mysteries excepting such as were members of their city. This regulation, which compelled Hercules, Castor, and Pollux, to become citizens of Athens, was strictly observed in the first ages of the institution; but after a time all persons, barbarians excepted, were freely admitted.

The festivals were divided into greater and lesser mysteries. The institution of the latter arose out of the following circumstance. Hercules having passed near Eleusis while the Athenians were celebrating the mysteries, desired to be initiated. As this request could not be complied with, he being a stranger, and as Eumolpus was unwilling to displease him on account of his great power, and the services which he had rendered to the Athenians, another festival was instituted without violating the laws; it was denominated *μικρα*, and Hercules was solemnly admitted to the celebration, and initiated. These lesser mysteries were observed at Agræ, near the Ilissus. The greater were celebrated at Eleusis, from which place Ceres has been called *Eleusinia.* In later times the lesser festivals were preparatory to the greater, and no person could be initiated at Eleusis without a previous purification at Agræ. This purification they performed by keeping themselves pure, chaste, and unpolluted during nine days; after which they came and offered sacrifices and prayers, wearing garlands of flowers called *ἱμερα*, and having under their feet *Διος κωδιον*, *Jupiter's skin*, which was the skin of a victim offered to that god. The person who assisted was called *ὑδρανος*, from *ὑδωρ*, *water*, which was used at the purification; and those purified were called *μυσται*, *the initiated.* A year after the initiation into the lesser mysteries they sacrificed a sow to Ceres, and were admitted into the greater, and the secrets of the festivals were solemnly revealed to them.

This festival was observed in the month Boedromion or September, and continued nine days, from the 15th till the 23d. During that time it was unlawful to arrest any man, or present any petition, on pain of forfeiting a thousand drachmas, or, according to others, on pain of death. It was also unlawful for those who were initiated to sit upon the cover of a well, and to eat beans, mullets, or weazels. If any woman rode to Eleusis in a chariot she was obliged by an edict of Lycurgus to pay six thousand drachmas. The design of this law was to destroy all distinction between the richer and poorer citizens. When the season approached, the mystæ, or persons who had been initiated only in the lesser mysteries, repaired to Eleusis to be instructed in the ceremonial. The service for the opening of the temple, with morning sacrifice, was performed, and the ritual was then produced from the sanctuary. It was enveloped in symbolical figures of animals, which suggested words compendiously, in letters with ligatures, the tops being huddled together, or disposed circularly like a wheel, and the whole utterly inexplicable to the profane. The case, which was called *petroma*, consisted of two stones exactly fitted; and the mysterious record, after being read, was closed up and replaced until a future festival. The principal rite was nocturnal, and confined to the temple and its environs. The mystæ waited without with impatience and apprehension. Lamentations and strange sounds were heard. Thunder pealed above these noises, and flashes of light and fire irradiated the gloom, rendering the darkness which followed more awful and sublime. The candidates for initiation were beaten by some invisible hand, whilst frightful apparitions, and monsters of a canine form, were presented to them, which filled them with apprehension and terror, and paralysed their energies. The scene then suddenly changed to one of a brilliant and agreeable character. The propylæa or vestibules of the temple were opened, the curtains withdrawn, and the hidden things displayed. They were introduced by the hierophant and daduchus, the former of whom revealed to them the mysteries. The splendour of illumination, the glory of the temple and of the images, and the singing and dancing which accompanied the exhibition, all contributed to soothe the mind after its recent agitation, and to render the wondering devotee tranquil and satisfied. After this inspection, or, as it was called, the *autopsia*, they retired, and others advanced. The succeeding days were employed in purification, in sacrifice, in pompous processions, and in spectacles, at which they assisted, wearing myrtle crowns. The second day was called *ἁλαδε μυσται*, *to the sea, ye initiated;* because they were commanded to purify themselves by ablution in the sea. On the third day sacrifices were offered, as also a mullet, and barley from a field of Eleusis. These oblations were called θυα, and were held so sacred that the priests themselves dared not, as in other sacrifices, partake of them. On the fourth day they made a solemn procession, in which the *καλαθιον*, or *holy basket of Ceres*, was paraded in a consecrated cart, while on every side the people shouted *χαιρε Δημητερ*, *Hail, Ceres.* After these followed women, called *κιστοφοροι*, who *carried baskets*, in which was sesamin, carded wool, grains of salt, a serpent, pomegranates, reeds, ivy boughs, and so on. The fifth was called *ἡ των λαμπαδων ἡμερα*, *the torch day*, because on the following night the people ran about with torches in their hands. It was usual to dedicate torches to Ceres, and contend who should offer the largest, in commemoration of the travels of the goddess, and of her lighting a torch in the flames of Mount Ætna. The sixth day was called Ιακχος, from Iacchus, the son of Jupiter and Ceres, who accompanied his mother in her search after Proserpine, with a torch in his hand. From this circumstance the hand of his statue was furnished with a torch, and carried in solemn procession from the Ceramicus to Eleusis. The statue, with those who accompanied it, called *Ιακχαγωγον*, was crowned with myrtle. In the way nothing was heard but singing and the noise of brazen kettles as the votaries danced along. The way through which they issued from the city was called *ἱερα οδος*, or *the sacred way*, the resting place *ἱερα συκη*, from a *fig-tree* which grew in the neighbourhood. They also stopped on a bridge over the Cephisus, where they derided those who passed by. After they had crossed this bridge, they entered Eleusis by a place called *μυστικη εισοδος*, or *the mystical entrance.* The seventh day was devoted to sports, in which the victors were rewarded with a measure of barley, that grain having been first sown in Eleusis. The eighth day was called Επιδαυριων *ἡμερα*, because Æsculapius on his return from Epidaurus to Athens was initiated by the repetition of the lesser mysteries. It became customary therefore to celebrate them a second time upon this occasion, in order that those who had not hitherto obtained the privilege might be lawfully initiated. The ninth and last day of the festival was called *πλημοχοαι*, or *earthen vessels*, because it was customary to fill two such vessels with wine, one placed towards the east, and the other towards the west; which, after the repetition of some mystical words, were both thrown down, and the wine spilt on the ground was offered as a libation.

The story of Ceres and Proserpine, the foundation of the Eleusinian mysteries, was both verbally narrated and represented in allegorical show. Proserpine was gathering flowers when she was stolen by Pluto; and hence the procession of the holy basket, which was placed on a car dragged along by oxen and followed by a train of females, some carrying the mystic chests, shouting *Hail, Ceres.* At night a procession was made with lighted torches, in order to commemorate the goddess searching for her daughter. A measure of barley, the grain which, it was believed, she had bestowed, was the reward of the victors in the gymnic exercises; and the proceedings at the temple had a reference to the legend. A knowledge of these things, from which the profane were excluded, formed the amount of what was communicated to the initiated; and the mode in which it was performed was skilfully adapted to the reigning superstitions. The operation was forcible, and the effect in proportion. The priesthood flourished as piety increased; and although the dispensation was corrupt, its tendency was not malignant. It produced sanctity of manners, an attention to the social duties, and a desire to be distinguished for what was then deemed virtue. (See *Divine Legation of Moses demonstrated;* Gibbon, in his *Miscellaneous Works*, on Virgil's account of Æneas's Descent into the Shades; and Heyne's *Excursus*, in reference to the same subject.)

ELEUSIS, a city of Attica, four leagues from Athens, and close to the shore opposite the island of Salamis. Like most of the other cities of Greece, its origin is ascribed to various fabulous characters, and, among these, to Ogyges; a circumstance which at least proves it to be of the highest antiquity. In the earlier period of its history it seems to have been an independent state, and was even so powerful as to contest with Athens itself the palm of superiority. A considerable portion of its small territory was occupied by the plains of Thria, remarkable for their fertility, though the hopes of the husbandmen were not unfrequently disappointed, from the blight of the south wind. To the west was the Campus Rharius, where Ceres is said to have sown the first seeds of corn; and on its confines was the field called Orgas, planted with trees consecrated to Ceres and Proserpine. The temple of Eleusis, sacred to Ceres and her daughter, was considered as one of the most beautiful productions of the genius of Greece; it is said to have been founded by Pandion II., and Clemens Alexandrinus places it even 120 years earlier, in the reign of Lynceus. Its position and riches naturally exposed it to the attacks of the enemies of Attica, and though defended by a strong fortress, it was seldom able to make any lengthened resistance. Cleomenes, king of Sparta, dared to violate its sacred precincts; but if we may believe the statements of the Athenians, he was soon overtaken by the just vengeance of the gods, and seized with a sudden fit of madness. The Persians burnt it to the ground after the battle of Platæa; but scarcely had they evacuated the confines of Greece, when the Athenians determined to rebuild it with even more than its original magnificence. Ictinus, the architect of the Parthenon, was ordered to draw up the plan of the new edifice. He adopted the Doric order of architecture, without the erection of pillars in front of the building. We know not whether he lived long enough to carry his plan into execution; but it was during the splendid administration of Pericles, and under the cultivated taste of Phidias, that the temple of Eleusis was completed in all its magnificence. The mystic cell was begun by Corœbus, but he lived only to finish the lower row of columns, with their architraves. Metagenes, of the district of Xypete, added the rest of the entablature and the upper row of columns. Xenocles of Cholargus built the dome on the top. A portico was long afterwards added by Demetrius Phalereus, who employed for that purpose the architect Philo. This magnificent structure continued to exist for many centuries, till the destructive hordes of Alaric completed its overthrow in the year 396. The city immediately disappeared on the destruction of the temple, which had been its ornament and principal support; and upon the site nothing is now found but a miserable village called *Lessina*, amidst the ruins of the sacred edifice. But the coins of Eleusis are still common, and represent Ceres drawn by dragons or serpents. The inscription is ΕΛΕΥΣΙ, or ΕΛΕΥ, within a wreath of ears of corn.

ELEUTHERIA, a festival celebrated at Platæa, in honour of Jupiter *Eleutherius*, or "the assertor of liberty," by delegates from almost all the cities of Greece. Its institution originated thus: After the victory which the Grecians under Pausanias obtained over Mardonius the Persian general, in the country of Platæa, an altar and statue were erected to Jupiter Eleutherius, who had freed the Greeks from the tyranny of the barbarians. It was further agreed upon, in a general assembly, by the advice of Aristides the Athenian, that deputies should be sent every fifth year from the different cities of Greece, to celebrate Eleutheria, or festivals of liberty. The Platæans celebrated also an annual festival in memory of those who had lost their lives in that famous battle. It was celebrated thus: At break of day a procession moved forward, headed by a trumpeter, who sounded a signal for battle; and after him followed chariots loaded with myrrh, garlands, a black bull, and certain free young men, no signs of servility being permitted to appear during the solemnity, because they in whose honour the festival was instituted had died in the defence of their country. They carried libations of wine and milk in large-eared vessels, with jars of oil and precious ointments; and the rear was brought up by the chief magistrate, who, although not permitted at other times to touch iron, or wear garments of any colour but white, yet on this occasion appeared clad in purple, and taking a water-pot out of the city chamber, proceeded through the middle of the town towards the sepulchres, with a sword in his hand. There he drew water from a neighbouring spring, and washed and anointed the monuments; after which he sacrificed a bull upon a pile of wood, invoking Jupiter and Mercury, and inviting to the entertainment the souls of those happy heroes who had perished on the plains of Platæa. After this he filled a bowl with wine, saying, I drink to those who lost their lives in the defence of the liberties of Greece. There was also a festival of the same name observed by the Samians in honour of the god of love. Slaves, also, when they obtained their liberty, kept a holiday, which they called *Eleutheria*.

ELEUTHEROLACONES, or INDEPENDENT LACONIANS, a name given to the twenty-four confederate towns of Laconia, the independence of which was confirmed by a decree of Augustus. At a much earlier date, when the power of Sparta had been broken and her freedom annihilated by the tyrant Nabis, Titus Quintius had detached the hamlets from all connection with Sparta, and placed them under the protection of the Achæan league. Augustus allowed these towns to be governed by their own laws, and to form a small distinct confederation. Of these twenty-four towns only eighteen are mentioned by Pausanias (iii. p. 21), probably because the others had gradually become depopulated.

ELEVATION, the same with altitude or height.

ELEVATION *of the Host*, in the church of Rome, that part of the mass where the priest raises the host above his head for the people to worship it.

ELEVATOR, in *Anatomy*, the name of several muscles, so called from their serving to raise the parts of the body to which they belong.

ELEVATORY, in *Surgery*, an instrument for raising depressed or fractured parts of the skull, to be applied after the integuments and periosteum have been removed.

ELEVE, a term purely French, though used also in our language. It signifies literally a disciple or scholar bred up under any master, being formed from an Italian word signifying an apprentice or novice. It was first used by the French writers in speaking of painters; such a painter was said to be an élève of Da Vinci, of Raffaelle, and so on. From painting it came to be applied to such as studied or learned any other art under a master. In the Royal Academy of Sciences there were twenty élèves; and in that of Inscriptions, ten élèves.

ELF, a term now almost obsolete, formerly used to denote a fairy or hobgoblin; an imaginary being, the creature of ignorance and superstition.

Elf-Arrows, in *Natural History*, a name given to the flints anciently fashioned into arrow-heads, and still found in Scotland, America, and several other parts of the world. It was believed by the vulgar that they were shot by fairies, and that cattle were sometimes killed by them.

ELFSBORG, a province in the southern part of Sweden. It is bounded on the north by Carlstadt, on the north-east by Wenar, on the east by Skaraborg, on the south-east by Jonkoping, on the south-west by Helmstadt, and on the west by Gotteborg. It extends over 3106 square miles, is divided into six bailiwicks, comprehends five cities, one market-town, and 4266 rural establishments, and contains 156,271 inhabitants. The land is generally mountainous and stony, or marshy and sandy, and yet produces corn nearly sufficient for the demand; but that demand is considerably lessened by the supply of potatoes, ruta baga, and other vegetables. It also produces some hemp and flax. The woods are the chief sources of the means of subsistence, by the employment they give to the labourers in cutting down, sawing, and conveying timber to the sea. The chief place is Wernersburg.

ELGANDEL, a town of Hindustan, in the Nizam's dominions, in the province of Hyderabad, ninety-five miles north-east from Hyderabad. Long. 79. 20. E. Lat. 18. 29. N.

ELGIN is the capital of Moray or Elginshire. It is a royal burgh, and returns a member to parliament along with Banff, Cullen, Peterhead, Inverury, and Kintore, Elgin being the returning burgh. It is a very thriving and improving town, containing about 5600 inhabitants. In approaching from Fochabers on the east, the traveller, viewing it from the bridge of Llanbryde, is struck with its beautiful appearance and fine situation. The town lies at the foot of the Lady Hill, and is overlooked by an elegant modern building, Gray's Hospital, with the Quarrywood Hill beyond, clothed with wood to the summit, the lower parts being covered with fine copses. The town chiefly consists of one principal street, named the High Street, with a few smaller ones intersecting it at various distances. The High Street is upwards of a mile in length from the New Institution to Gray's Hospital, which form beautiful terminations to it on the east and west. It is handsome and well paved, possessing many good houses and some rather elegant shops. Its width in the middle is so considerable, that a fine new church, lately built, stands in the middle of it, on the site of the old church of St Giles, and close to the Jail and Court-House, which are now about to be removed. Besides the new church, Elgin possesses various handsome public buildings, namely, the Academy, Gray's Hospital, Anderson's Institution, Trinity Lodge Rooms, Gas Works, &c. The Academy stands on the south side of the town, in a well-aired and central situation, and has become justly celebrated as one of the best in the north of Scotland. This academy is in a highly flourishing state in every respect, and is attended by nearly three hundred scholars of both sexes. A rector presides over the classical department; another master over that of mathematics and arithmetic, geography, &c.; and the third teaches English and elocution; whilst Mr Forbes, the Roman Catholic clergyman, unconnected with the Academy, gives private lessons in French and Italian. Gray's Hospital is a spacious and handsome edifice, surmounted with a dome, which, however, appears rather heavy and cumbersome. It stands on a gentle eminence at the west end of the High Street; it was built in 1816, and cost upwards of L.6000; and it contains from ten to thirty patients. Adjoining to this hospital a small Lunatic Asylum is now constructing, at the expense of the county; it is to be supported by annual contributions and voluntary donations, and attended by the hospital physicians. Anderson's Institution, for the education of youth and the support of old age, stands at the east end of the town. Its founder, the late General Anderson of the East India Company's service, was a native of Elgin, and at his death, a few years ago, bequeathed the bulk of his fortune, L.70,000, for the erection and support of this magnificent and truly benevolent institution, which was opened in 1833. This is a chaste and elegant pile of building, having a very handsome front, with pillars, and being surmounted by a dome, with an entablature, and piece of sculpture representing the benevolent founder in an attitude corresponding to his character. It contains ample accommodation for all connected with the establishment, and is capable of receiving many more, both old and young, than it now contains, when its revenue shall admit of an increase of numbers. In the construction of this building, as well as the new church, the beautiful free-stone of which they are built, and for which Morayshire is so famed, is shown to the greatest advantage. An infant school has also been lately opened, and is well attended. Trinity Lodge Rooms is a very handsome building in the North Street, and affords excellent accommodation for public meetings. The old Jail and Court-House, standing in the middle of the High Street, only deserves notice as being perhaps one of the worst in the kingdom; but there is at length a prospect of its being speedily removed, and better and more suitable accommodation provided both for the prisoners and courts of justice; notice having been already given that the town and county mean to apply for leave to obtain an act of parliament for the erection of a new one, in a better situation than the present.

The ruins of the cathedral, which was founded in 1224, once the most magnificent, and still one of the finest in the kingdom, is situated at the eastern extremity of the town. This noble cathedral was first destroyed by the Earl of Buchan. It was again rebuilt by the bishops of Moray; but in 1568 it was unroofed by order of the Regent Morton, for the sake of the lead. The ruins of this beautiful edifice have been lately put into excellent keeping, by order of the barons of exchequer. Around the cathedral stands the bishop's town house, now the property of the Duke of Gordon, whose family burial-place is in the cathedral; and also those of the dean and canons. The ruins of the Grey-Friars are on the south side of the town, and adjoining to the field where those of the old *Maison Dieu* were to be seen until very lately. At the west end of the town, the pretty green mount called Lady Hill affords an extensive and delightful view over the town and country, almost to Fochabers and the Spey. This hill bears distinct traces of having been an ancient fortification. It is said to have been used as a hunting seat by one of the Malcolms. The ruins show that it was built of stone and run lime, as used in early ages, and that the walls must have been of considerable thickness.

The trade of this town is at present not very considerable. A flourishing woollen manufactory has been carried on for many years, and employs fifty hands, chiefly in making blankets, plaiding, shawls, and drugget. There are likewise tan-works; and the glovers and sutors of Elgin were in former times famous for their extensive dealings at markets. Shoemakers are still a numerous body, and manufacture largely for the markets, which are held weekly on Fridays, and monthly on Tuesdays, the latter being for cattle and horses. The want of a good harbour at Lossiemouth, which is five miles distant, has long been a drawback to the increase of trade; but measures are now in progress to construct a new harbour, which, if successful, will give a great facility to the merchants in getting their goods directly from London, and to the farmers and corn-merchants in shipping grain, from twenty to thirty thousand bolls of which are exported from Morayshire annually. There is a literary association, combining the formation of a library with a public news-room, to which there are numerous subscribers; and a circulating library, established forty years ago by Mr Forsyth, and still successfully carried on by Forsyth and Young. There is also a mechanics' library, and one belonging to the academy, all highly useful establishments; and there is a weekly newspaper, the Elgin Courier, which has been published for five or six years.

Of benevolent institutions, several highly useful ones may be enumerated. A savings bank was instituted some years ago, and has been found to answer admirably. An excellent institution for female industry was lately formed, and has been found of great utility. Besides the Established Church, there is a Scotch Episcopal, an Antiburgher, and two Relief Chapels, with a few Roman Catholics. The improvements recently carried on in this town are numerous and considerable. A joint-stock company for lighting the streets and houses of the town with gas was formed about three years ago. Of late years several handsome new streets have been built, and on the south and west sides of the town many handsome villas and cottages have also been erected.

The town of Elgin is undoubtedly very ancient. By some historians its name is said to have been derived from Helgy, a Norwegian chief, who in the ninth century overran Morayshire. Other accounts derive it from the Saxon *Hely*, or Holy, and Dun, a hill. At the present time, perhaps, there are few towns in Scotland which possess equal attractions as a place of residence.

ELGINSHIRE, or MORAYSHIRE. See MORAYSHIRE.

ELGIN MARBLES is the name applied to that noble collection of sculptured figures which was acquired by the British Museum from Lord Elgin. They are mostly basso relievos and fragments of statuary which had adorned the Parthenon at Athens. The history of this collection may be thus shortly stated. It was in 1799 that the idea of such a collection first occurred to Lord Elgin, when he was appointed ambassador at Constantinople. Mr Harrison, an architect, suggested to him, in course of conversation, that though the public possessed every thing requisite to give them a general knowledge of the remains of Athens, yet to artists nothing but the actual representation by cast could be of essential service. Lord Elgin, struck with the truth of this observation, entered into communication with government on the subject; but the important transactions in which the nation was then engaged prevented ministers from undertaking an expense of so indefinite a nature. When Lord Elgin met Sir William Hamilton in Sicily, he entered with him into a more minute examination of the feasibility of the scheme, and they considered the best plan to be pursued in order to ensure success. It appeared to them most advisable that his lordship should be accompanied by artists from Italy. He accordingly obtained permission from the king of the Two Sicilies to take with him Signor Lusieri, a painter of great reputation, who was then in the service of that monarch; whilst he dispatched Mr Hamilton to Rome, in order to engage two architects, two modellers, and a figure painter. In the summer of 1800 these persons reached Athens in safety. At this period the French were in possession of Egypt, and the Turks felt little inclined to afford any facilities towards furthering the object which Lord Elgin had in view. They in fact did every thing to thwart him, and his artists could only obtain admission to the Acropolis, for the purpose of taking drawings, on the payment of a large daily fee. No sooner, however, did our arms prove victorious in Egypt, than a sudden and favourable change took place. The Sublime Porte showed an inclination to grant whatever our nation might think proper to ask; and Lord Elgin, availing himself of this opportunity, obtained, in the summer of 1801, firmans or warrants to the chief authorities of Athens, in which it was stated "that he might view, draw, and model the ancient temples of the idols, and the sculptures upon them, and make excavations, and *take away any stones* that might appear interesting to him." There was little difficulty after this permission had been granted; and as the Turks showed a perfect apathy in respect to the preservation of these remains, and indeed often wantonly destroyed them, Lord Elgin determined to remove as many as his means and the opportunity would allow. In this way did these noble remains of antiquity come into the possession of a British subject.

In 1811 an offer was made by Mr Percival to purchase the whole collection for the public, and the sum of L.30,000 was named as the price which the government was willing to give; but Lord Elgin thought this an inadequate compensation for the outlay occasioned in procuring the collection, and refused to listen to the proposal. In 1812 eighty more cases of architecture and sculpture were added, and also a collection of medals.

In 1815, however, Lord Elgin presented a petition to the House of Commons, in which he offered to make over the collection to the nation, on such conditions as it might seem just and reasonable to that assembly to recommend. Accordingly a select committee was appointed to examine into the affair, and after due consideration, and the examination of many witnesses, the committee came to the resolution of recommending the house to offer L.35,000 as a reasonable and sufficient price for this collection.

There can be no doubt that the House of Commons acted wisely in acceding to this proposition, and securing for the nation these noblest models which the genius of man has ever produced, knowing, as we do, how highly the cultivation of the fine arts has contributed to the reputation, character, and dignity of every government by which they have been encouraged, and how intimately they are connected with the advancement of every thing valuable in science, literature, and philosophy. No country is certainly better adapted than our own to afford an honourable asylum to these monuments of the school of Phidias, and of the wise administration of Pericles.

For further information, consult the *Report from the Select Committee on Lord Elgin's Collection of Sculptured Marble, &c.*; also the *Memorandum of the Earl of Elgin's Pursuits in Greece*, 4to, 1810. For an account of these marbles, see PARTHENON.

ELI, a high priest of the Israelites, and judge over them for forty years, was descended from Ithamar, a junior branch of the house of Aaron, and seems to have blended the priestly with the judicial character. He flourished in the year 1156 before the commencement of the Christian era. It appears that the Jews were in a state of subjection or vassalage to the Philistines during the greater part of Eli's administration, and, what may at first appear singular, he contributed to the degeneracy of his countrymen, although his own piety and goodness were unimpeachable. He did not exert his magisterial authority in the exemplary punishment of vice, and even permitted his own sons to perpetrate with impunity the most atrocious acts of impiety and debauchery.

The deity was so justly offended with this deportment of Eli, that a sacred seer was commissioned to upbraid him for his ingratitude and want of resolution. The young Samuel was likewise favoured with a vision of the approaching ruin of Eli's family, which he related to the venerable high priest, on being solemnly adjured not to conceal a single circumstance. When Eli heard the declaration of the young prophet, being fully convinced that his conduct had been highly reprehensible, he exclaimed, "It is the Lord; let him do what seemeth him good." Soon after this the Israelites sustained a considerable loss in attempting to procure their emancipation, carrying the ark of God into their camp in order to animate the people and intimidate their enemies; but the ark was captured by the Philistines, and Hophni and Phineas were slain. When intelligence was brought to Eli that the ark of God was taken, he instantly fell backwards from his seat, broke his neck, and died, in the ninety-eighth year of his age.

ELIJAH, who is sometimes denominated Elias, was one of the most distinguished of the Jewish prophets, and surnamed the *Tishbite*, probably from the district in which he was born. He entered upon his prophetic office about 920 years before Christ, in the reign of wicked Ahab, by whom the Sidonian idolatry was introduced amongst the Israelites. The prophet was commissioned to appear before this impious prince, and to threaten the country with a long drought as a punishment for his crimes. The indignation of Ahab was so great against the prophet for this prediction, that he resolved to punish him in a signal manner; but Elijah eluded his vengeance by withdrawing at the divine command, to a secret place, where he was supplied with provisions by a raven commissioned by heaven. He was afterwards ordered to go to Sarepta, in the territory of Sidon, where, in the house of an indigent widow, whose son he restored to life, the prophet was again supported in a miraculous manner.

When the three years of famine, occasioned by the continued drought, had expired, Elijah was commanded to appear before the king, and exhort him to that genuine repentance which an interposition of the deity so very remarkable unquestionably called for. He had an interview with Obadiah, the governor of the king's house, who was a religious man, and had frequently, at the hazard of his own life, screened many from the vengeance of Jezebel the queen. Inspired with dauntless fortitude, the prophet said to Obadiah, "Go, tell thy lord, behold Elijah is here." The good man's regard for the prophet was so great that he was afraid to deliver this message, alleging that Ahab had used every effort to discover the prophet's retreat. The king was however informed of his coming; and the first interview was distinguished by invectives on the part of the intrepid prophet and the proud sovereign, the former giving a promise of rain on the following terms: The priests of the Sidonian gods, and an assembly of the people of Israel, were to meet on Mount Carmel, where the prophet Elijah intended to give an incontestible proof of the almighty power of the God of Israel, and the total insignificance of the Sidonian divinities. For a detailed account of this memorable experiment, we must refer our readers to the book of Kings, as an abridgment of such a beautiful narration would do it manifest injury. It produced the fullest conviction in the minds of the Israelites that Jehovah alone was entitled to adoration; and the priests of Baal were instantaneously put to death, as the most abominable perverters of the divine law.

This was followed by abundance of rain, in answer to the devout prayers of the prophet; but his glorious triumph over idolatry so exasperated Jezebel, that she resolved to murder the prophet, who, in order to avoid her rage, fled into the wilderness, till the deity again employed him in the honourable but often hazardous duties of a prophet. He afterwards foretold that Hazael should be king of Syria, and Jehu king over Israel; and he appointed Elisha the son of Shaphat to be his own successor. He denounced dreadful judgments against Ahab and his wicked queen Jezebel; but those which respected the king were not executed during his life, on account of the genuine repentance which he discovered. The successor of Ahab having been confined to bed in consequence of an accident, the god of Ekron was consulted relative to his recovery, a circumstance which induced the prophet to declare that he should assuredly die. The king being informed that it was Elijah who dared to send such a message, dispatched a captain and fifty men to bring him by force into the royal presence; but they were destroyed by fire from heaven, and a second company shared the same fate. A third company confessed the visible interference of heaven in the prophet's behalf, the captain throwing himself on the mercy of Elijah, who went with him to the king. In the royal presence he undauntedly repeated the same denunciation against the idolatrous monarch, which was very soon accomplished; and not long after this the holy prophet, having, by the divine command, divided asunder the waves of Jordan, dropped his prophetic mantle to the astonished Elisha, took the flaming chariot commissioned for his reception, and ascended in majesty to heaven.

ELIS, or ELEA, a province in the north-west of the Peloponnesus, which was comprehended in its greatest extent between the promontory Araxus, where it touched on Achaia, and the river Neda, which separated it from Messenia. In the interior it was separated from Arcadia by the ridges of Mount Pholoë, and farther south by a continuation of the mountains from Arcadia.

In earlier times this tract of country was divided into three distinct principalities independent of each other. The most northern was surrounded by the lofty mountain Pholoë, which, sending out two ridges towards the coast, the one towards the promontory Araxus, the other towards the promontory Chelnatas, inclosed a large extent of champaign country, called from this circumstance the Hollow Elis (ἡ κοιλη Ηλις). The second principality was named Pisatis, and through its territories flowed the river Alpheus; whilst the district to the south was called Triphylia.

Elis was by far the most fertile and populous district of the Peloponnesus, chiefly because its extensive plains enjoyed an almost uninterrupted state of peace. Towards the coast the soil becomes sandy; a broad belt of sand stretches along the sea nearly as far as the Triphylian Pylos, so often called by Homer "the sandy." This tract of country is but little raised above the level of the sea, and from that reason a number of small lakes or lagoons have been formed, which extend along the greater part of the coast. It was the only district in Greece which produced flax; but this, though equal in fineness, was far inferior in colour, to that of Palestine. Another extraordinary circumstance was, that no mules could be here engendered, though they abounded in the adjacent district.

At a very early period we find it under the government of Endymion, and called the kingdom of the Epei. Homer was acquainted with the divine Elis, where the Epei ruled. His son Ætolus having accidentally committed a murder, was obliged to fly, and proceeded to found a kingdom on the opposite coast, called from him Ætolia. He was succeeded by Eleus, the grandson of Endymion, who gave name to the country, and after him came Augeas, who was put to death by Hercules because he refused him the reward he had promised for clearing out his stables. We now lose sight of Elis till the irruption of the Heraclidæ into Greece, eighty years after the destruction of Troy, when Oxylus, a descendant of Ætolus, offered to become their guide, on condition of receiving the province of Elis, which he considered as the inheritance of his family. A numerous body of Ætolians attended him, and uniting cordially with the native inhabitants of Elis, they conquered a great part of Pisatis, and took possession of Olympia about 1190 before Christ. Then it was that the Olympic games were first established on the banks of the river Alpheus, though they were not regularly celebrated till the year 776 before Christ, when Corœbus obtained the prize of victory. In the wars between Messenia and Sparta, they were faithful allies of the latter; and with their assistance they took possession of the whole country belonging to the Caucones and Minyæ, to which the name of Triphylia was then given. During the Peloponnesian war, we still find them staunch supporters of Spartan politics; and they continued so till the conclusion of the treaty after the battle of Amphipolis, when the countenance afforded by the Spartans to the independent movements of the people of Lepreum produced a rupture between the two nations. Elis endeavoured to take vengeance on the Spartans, by excluding them from all participation in the Olympic games; but the marauding invasions of the Spartans were soon so severely felt, that the inhabitants of Elis were glad to sue for peace, and to renew their ancient alliance with Sparta. In the year 365 before Christ, a few years after the battle of Leuctra, they were engaged in war with the Arcadians, and were so unsuccessful that they were compelled to cede the greater portion of their southern possessions. During the Social War, the Eleans were staunch allies of the Ætolians, and no reverses could detach them from the cause which they had joined, or induce them to unite with the Achæan League. These seem to have been the last events in which the Eleans took part as an independent people; and we find them finally included in the general decree which annexed the whole of Greece to the Roman empire.

Elis, the chief city of the district of Elis, in the Peloponnesus, situated on the banks of the river Peneus, 120 stadia from the sea, and first formed into a district corporation by the union of several detached villages after the Persian war, about 490 years before Christ. The people of this portion of Greece had for ages been devoted to the pleasures of a country life, and they had been able to indulge this natural desire by the sacred character which had been long attached to their territory. At the time when Oxylus got possession of this fertile province, and became master of the temple of Olympia, he had such influence with the Heraclidæ as to obtain from them the sanction of an oath that this district should be considered as under the immediate protection of the god whose festival was there solemnized. This seems to have been so strictly attended to that those who founded the city did not think it necessary to surround it with walls, or to take any steps to ward off the attack of an enemy. In the unsettled times which followed the death of Alexander, Elis was occupied, and probably fortified, by Telesphorus, who commanded the fleet of Antigonus. (Diodor. xix. 87; Strab. viii. 357; Xen. Hall. iii. 2, 20.) It appears, in the time of Pausanias, to have still retained much of its former beauty and magnificence, if we may be allowed to judge from the account he has left us of the public buildings. "Its ruins," says he, "are found now at a spot called *Paleopoli*, consisting of several masses of Roman tile and mortar, with many wrought blocks of stone and fragments of sculpture scattered over a space of two or three miles in circumference. The most remarkable of the ruins is that of a square building of about twenty feet on the outside, which is in the form of an octagon with niches. Like most of the other remains, it is built of alternate strata of Roman tile and stone rubble." (Leake's *Morea*, vol. i. p. 6.)

ELISHA the prophet, famous for the miracles which he performed, died about 830 years before Christ.

ELISION, in *Grammar*, the cutting off or suppressing a vowel at the end of a word, for the sake of sound or measure, the next word beginning with a vowel. Elisions are pretty frequently met with in English poetry, but oftener in the Latin, French, Italian, and other languages. They consist chiefly in the suppression of the *a*, *e*, and *i*, though an elision suppresses any of the other vowels.

ELIXATION, in *Pharmacy*, the extracting of the virtues of ingredients by boiling or stewing.

ELIXIR, in *Medicine*, a compound tincture extracted from many efficacious ingredients. Hence the difference between a tincture and an elixir seems to be this, that a tincture is drawn from one ingredient, sometimes with an addition of another to open it and to dispose it to yield to the menstruum; whereas an elixir is a tincture extracted from several ingredients at the same time.

ELIZABETH, queen of England, daughter of Henry VIII. and Anne Boleyn, was born at Greenwich, on the 7th of September 1533. According to the custom of the times, she was early instructed in the learned languages, first by Grindal, who died when she was about seventeen, and afterwards by the celebrated Roger Ascham. She likewise acquired considerable knowledge of the Italian, Spanish, and French languages. Dr Grindal was also her preceptor in divinity, which she is said to have studied with uncommon application and industry. That Elizabeth became a Protestant and her sister Mary a Catholic, was the effect of that cause which determines the religion of the greater part of mankind, namely, the opinion of those by whom they were educated; and this difference of opinion in their tutors is not at all surprising, when we recollect that their father Harry was of both religions, or of neither.

But the studies of Elizabeth were not confined merely to languages and theology; she was also instructed in the political history of the ancients; and was so well skilled in music as to sing and play "artfully and sweetly."

After the short reign of her brother Edward, her sister Mary succeeding to the crown, Elizabeth experienced a considerable degree of persecution, so as to be not a little apprehensive of a violent death. She was accused, imprisoned, and, we are told, inhumanly treated. At last, by the intercession of King Philip of Spain, she was set at liberty; which she continued to enjoy, till, on the death of her sister, she, on the 17th of November 1558, ascended the throne of England. Her history as a queen is detailed in the article England. The cares of government did not wholly suspend her pursuit of learning. Ascham, in his *Schoolmaster*, tell us that about the year 1563, five years after her accession, she read more Greek in one day than some prebendaries of that church did read Latin in a whole week. That the Latin language was familiar to her, is evident from her speech to the university of Oxford, when she was nearly sixty, and also from her spirited answer to the Popish ambassador in the year 1598. And that she was also skilled in the art of poetry, appears not only from the several scraps which have been preserved, but likewise from the testimony of a contemporary writer, Puttenham, in his *Art of English Poetry.* These are his words: "But last in recital and first in degree is the queen, whose learned, delicate, noble muse, easily surmounteth all the rest, for sense, sweetness, or subtility, be it in ode, elegy, epigram, or any other kind of poem." In this author are to be found only a specimen of sixteen verses of her English poetry. "But," says Mr Walpole, "a greater instance of her genius, and that too in Latin, was her extempore reply to an insolent prohibition delivered to her from Philip II. by his ambassador, in this tetrastic.

> Te veto ne pergas bello defendere Belgas:
> Quæ Dracus eripuit, nunc restituantur oportet:
> Quas pater evertit, jubeo te condere cellas:
> Religio papæ fac restituatur ad unguem.

She instantly answered him, with as much spirit as she used to return his invasions,

> Ad Græcas, bone rex, fient mandata kalendas."

She died in her palace at Richmond, the 24th of March 1603, aged seventy, having reigned forty-four years; and was interred in the chapel of Henry VII. in Westminster Abbey. She was the author of the following works: 1. The Mirror, or Glass of the Sinful Soul, which she translated from French verse into English prose when she was eleven years old. The translation was dedicated to Queen Catharine Parr. Probably it was never printed; but the dedication and preface are preserved in the *Sylloge Epistolarum*, in Hearne's edition of *Livii Foro-Juliensis*, p. 161. 2. Prayers and Meditations, dedicated to her father, and dated at Hatfield, 1545. Manuscript in the Royal Library. 3. A Dialogue from Xenophon, between Hiero a king yet some time a private person, and Simonides a poet, touching the life of the prince and the private man. This was first printed from a manuscript in her majesty's own handwriting, in the Gentleman's Magazine for 1743. 4. Two Orations of Isocrates, translated into Latin. 5. Latin Oration at Cambridge, preserved in the king's library; also in Hollinshed's Chronicle, and in Fuller's History of Cambridge. 6. Latin Oration at Oxford. 7. Comment on Plato. 8. Boethius *De Consolatione Philosophiæ*, translated into English anno 1593. 9. Sallust *De Bello Jugurthino*, translated into English anno 1590. 10. A Play of Euripides, translated into Latin. 11. A Prayer for the use of her fleet in the great expedition in 1596. 12. Part of Horace's Art of Poetry, translated into English anno 1598. 13. Plutarch *De Curiositate*, translated into English. 14. Letters on various occasions to different persons. 15. Several Speeches to her Parliament; and a number of other pieces. (See Wood's *History and Antiquities of Oxford;* and Walpole's *Catalogue of Royal and Noble Authors.*)

ELIZONDO, a town of Spain, in the province of Navarre. It is the capital of the district of the Valley of Bastan, near Roncesvalles, which enjoys some peculiar privileges; and is situated in a cold country, near the Pyrenees, which produces wheat, maize, hemp, and flax. Many turnips are grown in this district; and it has excellent cider, but no wine. Lat. 43. 9. 43. N.

ELK, in *Zoology*. See MAMMALIA.

ELL (*ulna*), a measure which obtains, under different denominations, in most countries, and by which cloths, stuffs, linens, silks, and the like, are usually measured, answering nearly to the yard of England, the canna of Italy, the vara of Spain, and the palm of Sicily. See WEIGHTS AND MEASURES.

ELLBOGEN, a circle in the Austrian kingdom of Bohemia, extending over 1343 square miles, and comprehending forty-three cities and towns and 609 villages, with 32,829 houses and 193,537 inhabitants. The chief town, of the same name, stands on a steep rock, at the foot of which runs the river Eger, which makes a bend that nearly surrounds it. It contains 457 houses, with 1508 inhabitants, who subsist by handicraft employments, and by the preparation of alum and of sulphur.

ELLESMERE, a market-town of Shropshire, in the hundred of Pimhill, 242 miles from London. The name is derived from a beautiful lake or meer, near to which it is situated. From Ellesmere castle there is a fine prospect extending over the surrounding counties, none of which, it is said, can be seen from it. A navigable canal connects the town with the Mersey. The market is held on Tuesday. The population amounted in 1801 to 5553, in 1811 to 5639, in 1821 to 6056, and in 1831 to 6540.

ELLICHPOOR, a town of Hindustan, in the province of Berar. It was first acquired by the Mahommedans in 1294, and is the proper capital of Berar, Nagpoor being of recent date. The travelling distance from Nagpoor is 122 miles, from Delhi 604, from Madras 671, and from Calcutta 844 miles.

ELLIOT, THE RIGHT HONOURABLE GEORGE AUGUSTUS, Lord Heathfield, was the youngest son of Sir Gilbert Elliot, Baronet, of Stobbs, in Roxburghshire, and was born about the year 1718. He received the rudiments of his education under a private tutor, and at an early period of life was sent to the university of Leyden, where he made considerable progress in classical learning, and spoke with fluency and elegance the German and French languages. Being designed for a military life, he was sent from thence to the celebrated *Ecole Royale du Génie Militaire*, conducted by Vauban, at La Fère in Picardy, where he laid the foundation of that science which he so conspicuously exhibited at the defence of Gibraltar He completed his military course on the Continent by a tour, undertaken for the purpose of seeing in practice what he had studied in theory. Prussia was the model for discipline, and he continued some time as a volunteer in the service of that state.

Mr Elliot returned, in the seventeenth year of his age, to his native country, Scotland; and was the same year, 1735, introduced by his father Sir Gilbert, to Lieutenant-Colonel Peers of the twenty-third regiment of foot, then stationed at Edinburgh, as a youth anxious to bear arms for his king and country. He was accordingly entered as a volunteer in that regiment, where he continued for upwards of a year. From the twenty-third regiment he went into the engineer corps at Woolwich, and made great progress in study, until his uncle Colonel Elliot appointed him adjutant of the second troop of horse grenadiers. With these troops he went upon service to Germany, and was present with them in a variety of actions. At the battle of Dettingen he was wounded. In this regiment he obtained the rank of captain and major, and afterwards purchased the lieutenant-colonelcy. On arriving at this grade he resigned his commission as engineer, which he had enjoyed along with his regimental rank, and quitted a branch of the service in which he had been actively employed very much to the advantage of his country. He received the instructions of the famous engineer Bellidor, and made himself completely master of the science of gunnery; and had he not so disinterestedly resigned his rank in the engineer department, he would long before his death have, by regular progression, reached the head of that corps. Soon after this he was appointed aid-de-camp to George II. and was distinguished for his military skill and discipline. In the year 1759 he quitted the second troop of horse grenadier guards, being selected to raise, form, and discipline, the first regiment of light horse, which was called after him *Elliot's*. As soon as they were raised and formed he was appointed to the command of the cavalry in the expedition on the coasts of France, with the rank of brigadier-general. After this he passed into Germany, where he was employed on the staff, and greatly distinguished himself.

During the peace he was not idle. His great talents in the various branches of the military art procured him ample employment. In the year 1775 he was appointed to succeed General A'Court as commander-in-chief of the forces in Ireland; but he did not continue long on this station, not even long enough to unpack all his trunks; for finding that interferences were made by petty authority derogatory of his own, he resisted the practice with becoming spirit; and not choosing to disturb the government of the sister kingdom on a matter personal to himself, he solicited to be recalled. The government acceded to his request, and, in a fortunate hour for the safety of Gibraltar, he was appointed to the command of that important fortress. The system of his life, as well as his education, peculiarly qualified him for this trust. He was perhaps the most abstemious man of the age, indulging himself neither in animal food nor in wine. He never slept more than four hours at a time, so that he was up later and earlier than most other men. He so inured himself to habits of hardiness, that the things which prove difficult and painful to other men were to him his daily practice, and rendered pleasant by use. It could not be easy to starve such a man into a surrender, nor possible to surprise him. The example of the commander-in-chief in a besieged garrison has the most persuasive efficacy in forming the manners of a soldiery. Like him, his brave followers came to regulate their lives by the most strict rules of discipline before there arose a necessity for so doing; and severe exercise, with short diet, became habitual to them from their own choice. The military system of discipline which he introduced, and the preparations which he made for his defence, were contrived with so much judgment, and executed with so much address, that he was able with a handful of men to preserve his post against an attack, the constancy of which, even apart from the vigour with which it was made, would have been sufficient to exhaust any common set of men. Collected within himself, he in no instance attempted by premature attacks to destroy the labours which it would cost the enemy time, patience, and expense to complete; he deliberately observed their approaches, and, with the justest discernment, seized on the proper moment at which to make his attack with success. He never spent his ammunition in useless parade or in unimportant efforts. He never relaxed his discipline from the appearance of security, nor hazarded the lives of his garrison by wild experiments. By a cool and temperate demeanour, he maintained his station for three years of constant investment, in which the whole powers of Spain were employed against him. All the eyes of Europe were on this garrison; and his conduct has justly exalted him to the most elevated rank in the military annals of his time. On his return to England, the gratitude of the British senate was as forward as the public voice in awarding him that distinguished honour which his merit deserved. Both houses of parliament voted an unanimous address of thanks to the general; the king conferred on him the honour of knight of the bath, with a pension during his own and a second life of his own appointment; and on the 14th June 1787, his majesty advanced him to the peerage by the title of Lord Heathfield, Baron Gibraltar, permitting him to take, in addition to his family arms, the arms of the fortress which he had so bravely defended.

His lordship died on the 9th of July 1790 at Aix-la-Chapelle, of a second stroke of the palsy, after having for some weeks preceding enjoyed tolerable good health and an unusual flow of spirits. His death happened two days before he was to have set out for Leghorn on his way to Gibraltar, of which place he was once more appointed governor, in the view of an approaching war. He married Anne, daughter of Sir Francis Drake of Devonshire, and had by her Francis Augustus, by whom he was succeeded in his title.

ELLIPSIS, in *Grammar*, a figure of syntax, in which one or more words are not expressed; and from this deficiency it has got the name of *ellipsis*.

ELLIPTIC, or ELLIPTICAL, something belonging to an ellipsis.

ELLIPTIC TURNING. Wood and other substances are turned into an elliptic form by means of a chuck, which is applied on the common turning lathe. This chuck is on the principle of the trammel, Plate CCXVIII. fig. 1. The grooves in the chuck are much wider than in the trammel, and the points of the chuck that correspond to C, D of the trammel, fig. 1, remain fixed, and in one horizontal line; whereas in the trammel these are the points which are put in motion.

Illustration of the principle.

If two straight lines, crossing each other, be drawn on a piece of transparent paper or mica; if this transparent paper be laid upon a sheet of white paper, with two points marked on it; if the transparent paper be moved round, so that the cross lines shall travel over the two points, in like manner as the two points C, D in the trammel, fig. 1, travel over the cross grooves of the trammel; and if the point of a pencil be held fixed, and touching the transparent paper, so as to leave a trace on the transparent paper when the paper is moved; then after the transparent paper has made a revolution, the trace left on it by the point of the pencil will be an ellipse. This method of describing an ellipse represents the action which takes place in the chuck for turning ellipses; the point of the pencil which remains unmoved is in the same situation as the turner's gouge; the transparent paper which receives the trace of the ellipse from the fixed pencil is analogous to the wood, which is to be turned into the form of an ellipse by the fixed cutting gouge.

Description of the chuck.

In fig. 2, the chuck is represented as fitted on a common turning lathe, of which A is the pulley of the maundrel, B and C are the sides of the frame supporting the pulley, P the rest, D the frame in which the rest slides, E, F the feet of that frame, I the nut and screw which serve to fix the rest, G, H are the continuation of the sides B, C. K is the elliptic chuck, with two grooves, through which the knobs of the slider pass. These knobs are connected by a strong bar of iron screwed into their ends; and on this bar of iron is seen the screw for fastening the board, to which is fixed the wood or other substance which is to be turned elliptically.

Fig. 3 shows the other side of the chuck, which in fig. 2 is turned towards the side of the frame C. N, in fig. 3, is the board with the grooves which contain the slider O. In the middle of N is seen the end of the screw, which is fixed to the maundrel. The board N has a circular motion, being fixed on the axis of the maundrel, whilst the slider O, at the same time that it is carried round by the circular motion of N, is constrained to perform other motions by the grooves in N and by the groove in O, fig. 3, which slides on the ring M, fig. 4.

In fig. 4, L is a part of the side C of the maundrel frame, with the ring M fastened to it. On this ring the broad groove in the slider O, fig. 3, moves when the lathe is set agoing; and this groove is at right angles to the grooves in N, fig. 3, in which the knobs of O move. In fig. 4 it is seen that the centre of the ring M may be made to coincide with the centre of the spindle of the maundrel, in which case a circle is described. If the ring is fixed, so that the centre of the ring does not coincide with the centre of the maundrel, an ellipse is described by the wood screwed upon the bar of O in fig. 2; and the most eccentric ellipse that the machine describes is obtained when the maundrel is at the circumference of the ring. The centre of the spindle of the maundrel, and the centre of the ring M, are always in one immoveable horizontal line, and are analogous to the points C, D of the trammel, fig. 1. In fig. 3 it is seen that the sides of the grooves may be brought nearer together by means of screws; so that the sliders and the cylindric ring may fit exactly to the grooves. The best elliptic chucks are made of brass. See *Mechanical Exercises*, by Peter Nicholson, London, 1812. (B. B.)

ELLIPTOGRAPH, an instrument for drawing ellipses. The trammel is an instrument which has long been known and used for describing ellipses. On the principle of the trammel Mr Farey constructed his elliptograph in a form much more commodious for drawing. Mr Farey's elliptograph is represented at Plate CCXVIII. fig. 5. The circle A slides between the two parallel rulers D, E. The circle B slides between two parallel rulers F, G, at right angles to the former. In this way, if a line joining the centres of the circles is made to revolve, M, the extremity of that line, will describe an ellipse in the same manner as the extremity E of the line CDE, fig. 1, does in the trammel. The elliptograph may be considered as a trammel, in which the pins C and D, fig. 1, are enlarged into the circles A and B, fig. 5. The pinion at K, fixed to one of the arms of the lower circle, acting on a rack screwed to the upper circle, serves to alter the distance of the centres of the circles A and B; and, by so doing, this pinion serves to vary the eccentricity of the ellipses which the instrument describes. When the centres of the circles A, B coincide, the describing pen M draws a circle. When the centres are removed from each other, and on the circles being turned round, an ellipse is described by the pen; and when the distance of the centres in increased, the eccentricity of the ellipse is increased. When the pen is at the centre it describes a straight line, continually moving to and fro on that line when the circles are turned round. The two circles are fixed together by screws, and can only be made to slide the upper circle over the lower by the action of the pinion K. The pinion at L moves a rack, by which the describing pen M, which draws the ellipse, is brought nearer to the centre for the purpose of drawing a small ellipse, and removed farther from the centre of the ellipse when a large one is to be drawn. The size of the ellipse may be increased as far as the size of the instrument will admit. The pair of rulers D, E are placed below the pair F, G, as is seen in fig. 6. The instrument, when used, is held upon the paper with the thumb and a finger of the left hand at the nuts N, O; and the circles are moved by applying the right hand to the pins *f*; the pen M, pressing by its weight on the paper, then describes the ellipse.

Fig. 7 shows H, the socket for the compasses, with the centre pin on which the socket moves; and the pinion L and rack *h*, for moving along the frame *g* between the bars; and the other pinion K, for separating the circles.

The ruler P has two points, to fix the instrument to the paper. The ruler is united to the frame by screws, which serve to adjust the position of the instrument after the ruler has been fixed to the paper.

Mode of using the instrument.

By means of the elliptograph any ellipse can be described, of which the long and short axes are given, provided it does not exceed the size of the instrument. When an ellipse is to be described, draw on the paper the longer and shorter axes, bisecting each other; place the instrument on the paper, so that the centre of the four rulers appears to coincide with the centre or the intersection of the two axes of the ellipse; and fix the instrument in this situation by the points that go into the paper. By the pinion L move the pen to one extremity of the short axis of the ellipse; turn the circles half round, to see if the pen comes to the other end of the short axis; if it does not, adjust the error one half, by moving the pen by the pinion L, the other half by moving the frame on the paper; continue this adjustment till the pen, setting out from the one end of the short axis, arrives in a half revolution at the other end. Next, by means of the pinion K, bring the pen to one end of the long axis of the ellipse; turn the circles half round, and if the pen reaches the other extremity of the long axis of the ellipse, the instrument is rectified; if not, one half of the error is to be corrected by moving the circles by means of the pinion K, and the other half by moving the instrument to a side on the paper, by means of the nuts N, O. The instrument is now adjusted, and the pen resting on the paper traces the ellipse required when the circles are turned round by the handles.

Elliptograph for engraving.

An instrument similar to the elliptograph has been employed for engraving ellipses on copper plates, and for dividing these ellipses accurately, so as to give the perspective representation of a circle divided into equal parts, both in the case where the distance of the eye is limited, and in the orthographic projection. The Society for Encouraging Arts rewarded Mr Farey with their gold medal for his invention, and a description of the elliptograph is contained in the thirty-first volume of the Transactions of that society. (B. B.)

ELLMORE, a town of Hindustan, in the northern circars, and district of Cicacole, twenty miles N.N.E. from the town of Cicacole. Long. 84. 10. E. Lat. 18. 24. N.

ELLORE, a town of Hindustan, capital of the northern circar of the same name. Long. 81. 10. E. Lat. 16. 45. N. The circar is situated principally between the sixteenth and seventeenth degrees of north latitude. The principal towns are Ellore, Colaircotta, and Gundgoli.

ELLRICH, a city of Prussia, in the government of Erfurt and circle of Hohenstein. It stands on the river Zorge, and contains 470 houses, with 2820 inhabitants, who find employment in woollen manufactories, tanneries, and paper and oil mills. About two miles from it is the celebrated cavern called Hartzhole. It is 290 feet long, 260 broad, and 156 high. The entrance to it is 150 feet high, and it is filled with water to the depth of 50 feet.

ELLWANGEN, a bailiwick of the circle of the Jaxt, in the kingdom of Wirtemberg, comprehending two cities, one town, and two hundred and thirty-four villages, with 25,337 inhabitants. It is better adapted for pasture than for corn. The capital is a city of the same name, situated on the Jaxt, in which is a gymnasium and high school. It contains eleven churches, 408 houses, and 2590 inhabitants. Long. 9. 57. E. Lat. 48. 58. N.

ELLYS, DR ANTHONY, who was born in 1693, and educated at Clarehall, Cambridge, after rising through many inferior degrees of dignity in the church of England, was in 1752 promoted to the see of St David's. He died at Gloucester in 1761, and is mentioned here only on account of his works, which are but little known. They are as follow: 1. A Plea for the Sacramental Test as a just security to the Church established, and very conducive to the welfare of the State; 2. Remarks on Hume's

Essay on Miracles; 3. Tracts on the Liberty spiritual and temporal of Protestants in England, addressed to J. N., Esq. at Aix-la-Chapelle, the first part of which was printed in 1763, and the second in 1765; besides occasional sermons. In these tracts, as the editors of them truly observe, he " discovers not only fine parts, extensive knowledge, and sound judgment, but a heart overflowing with benevolence and candour, and a most Christian temper; for he always thought a person, though on the right side of the question, with principles of persecution, to be a worse man than he that was on the wrong." This amiable and respectable writer afforded in his own conduct a proof that a man may be steadily attached to a party without wishing to encroach upon the rights of others.

ELMACINUS, Elmacin, or Elmakyn, George, author of a *History of the Saracens*, and known in the East by the name of Ibn-Amid, was a Christian of Egypt, where he was born in the year of the hegira 620, and of our era 1225. He occupied the place of ketib or secretary at the court of the sultans of Egypt; an office which was usually filled by Christians. His history comes down from the time of Mahommed till the year of the hegira 512, answering to the year of our Lord 1117; in which he sets down year by year, in a very concise manner, whatever regards the Saracen empire, intermixed with some passages relating to the eastern Christians. His abilities must have been considerable, since, as we have just seen, he held an office of trust near the persons of the Mahommedan princes. He was son to Yaser Al Amid, secretary to the council of war under the sultans of Egypt for forty-five years; and in 1238, when his father died, succeeded him in his place. He died at Damascus in the year of the hegira 675, and of our era 1273. His history of the Saracens was translated from Arabic into Latin by Erpinius, and printed in both languages at Leyden, 1625, in folio. Erpinius died before the publication was completed; but Golius superintended it, and added a preface. It was dedicated by Erpinius's widow to Dr Andrews, bishop of Winchester. The title of the work is, *Historia Saracenica, quâ res gestæ Muslimorum, inde a Muhammede primo imperii et religionis Muslimicæ auctore, usque ad initium imperii Atabecæi, per XLIX. imperatorum successionem fidelissime explicantur, insertis etiam passim Christianorum rebus in Orientis potissimum ecclesiis eodem tempore gestis.* Arabice olim exarata a G. Elmacino et Latine reddita. Leyden, 1625, 8vo. The Latin text was printed separately the same year, in quarto; and there also exists an edition which only contains the Arabic text, and appears to have been designed for the Christians of the Levant. The work has been translated in whole or in part into several modern languages.

ELOGY, a praise or panegyric bestowed on any person or thing, in consideration of its merit. The beauty of elogy consists in an expressive brevity. Eulogiums should not have so much as one epithet, properly so called, nor two words synonymous; they should strictly adhere to truth, as extravagant and improbable elogies rather tend to lessen than exalt the character of the person or thing they would extol.

ELOHI, Eloi, or Elohim, in Scripture, one of the names of God. But it is to be observed that angels, princes, great men, judges, and even false gods, are sometimes called by this name. The sequel of the discourse is what assists us in judging rightly concerning the true meaning of this word. It is the same as *Eloha*, only the one is the singular and the other the plural. Nevertheless *Elohim* is often construed in the singular number, particularly when the true God is spoken of; but when false gods are spoken of, it is construed rather in the plural.

ELOINED, in *Law*, signifies restrained or hindered from doing something. Thus it is said, that if those within age be eloined, so that they cannot sue personally, their next friend shall sue for them.

ELONGATION, in *Astronomy*, the digression or recess of a planet from the sun, with respect to an eye placed on our earth. The term is chiefly used in speaking of Venus or Mercury, the arch of a great circle intercepted between either of these planets and the sun being called the *elongation* of that planet from the sun.

ELORA, a town of Hindustan, in the province of Aurungabad, near the city of Dowletabad. In a mountain near this town there are some remarkable excavations, containing mythological symbols of the Hindu worship, and temples ornamented with representations and statues of many of the deities worshipped by the Hindus. The principal figures are those of Indra, the god of the firmament, and his consort Indranee. Besides these, there are some figures of the deities adored by the sectaries of Boodh and Parisinath; but all of them have been forsaken by the priests. The temples here are said to have been built by the rajah Edoo of Ellichpoor, who was cured of some cutaneous disorders by a spring near the place, and who in gratitude gave orders for the construction of the temple, which measures 138 feet in front, and in the interior extends 247 feet in length by 150 feet in breadth, and is in some places 100 feet high. The sixth volume of the *Asiatic Researches* contains a minute account of these curious antiquities. Long. 76. E. Lat. 19. 56. N.

ELPHINSTONE, William, a Scotish prelate and statesman of considerable eminence, was born at Glasgow in the year 1431. At the university of this city he received his education, and in the learning which distinguished the period he made extraordinary proficiency. He afterwards went to France, to make himself master of the civil and canon law in the university of Paris, where in due time he became a professor, and for the space of six years acquired reputation in the discharge of his duty. On his return to Scotland he entered into holy orders, was soon appointed official of Glasgow, and afterwards of St Andrews. He was admitted a member of the king's council; and on a misunderstanding taking place between James III. of Scotland and Louis XI. of France, his powerful mediation at the latter court, in conjunction with the Bishop of Dunkeld and the Earl of Buchan, effected an amicable reconciliation. As Elphinstone on this occasion displayed much prudence and eloquence, the king was so grateful for his meritorious services that he rewarded him with the see of Ross, from which he was translated to that of Aberdeen about the year 1484. He was also appointed to the high office of chancellor of the kingdom, which he managed with so much moderation and equity that all parties esteemed and admired him. When the civil wars broke out between James and the discontented nobility, Bishop Elphinstone appears to have declined all interference with public affairs of a political nature, and to have confined himself to the discharge of his episcopal duties. But when James IV. ascended the throne, his abilities as a statesman were again called forth, and he was chosen ambassador to the Emperor Maximilian, in order to negociate a marriage between his royal master and the emperor's daughter; but she had been previously promised to another. Yet the bishop's mission was not without its salutary effects, as he was the mean of terminating an enmity which had long existed between the Dutch and Scots. This he conducted in such a masterly manner, that James never undertook any thing of importance without first procuring the sanction of his approbation. He was equally the zealous patron of learning; and it is generally believed that the establishment of a university at Aberdeen was entirely owing to his influence with the pope, from whom he obtained a bull for that purpose; and by his exertions was King's College undertaken and completed. Having bequeathed a large sum of money for its support, he terminated his mortal career in 1514. Although he had attained the age of about eighty-three, his constitutional vigour was very little impaired, and all the faculties of his mind were in full force; but the calamity which the nation sustained at Floddon-field had broken his heart. He wrote a history of his native country, which is among the manuscripts of Sir Thomas Fairfax, in the Bodleian Library at Oxford.

ELPISAN, a town of Asiatic Turkey, in the province of Diarbekir, situated on the river Euphrates, two miles north-west of Kerkisieh.

ELSFLETH, a town in the duchy of Oldenburg, in Germany, at the conflux of the Hunte and the Weser. It contains 192 houses, and 1562 inhabitants. The vessels which frequent this port anchor lower in the river, near Brake. Long. 8. 21. 5. E. Lat. 53. 14. 50. N. It is the capital of a bailiwick, with six parishes, 1135 houses, and 7510 inhabitants.

ELSINEUR, a city of Denmark, in the island Zealand. It was formerly a Hanse town, and is now the second city in Denmark proper. It is strongly fortified, and has a castle, Cronburg, designed to command the entrance of the Baltic Sea by the Sound; but in the English attacks on Copenhagen it was found of no avail. The passage of ships, who pay a toll, makes the town active and prosperous. It contains 552 houses and 5000 inhabitants, besides the garrison. The environs are pleasant and fruitful, and the castle, with Hamlet's Garden, as it is called, is visited by most English travellers who arrive at Elsineur. It is in long. 12. 35. 19. E. and lat. 56. 1. 40. N.

ELSNAPPEN, a small seaport of Sweden, in Westmanland. It is on the side of the Baltic, and is capable of admitting ships of war. Thirty-two miles east-north-east of Nykioping.

ELTHAM, a market-town of the county of Kent, in the hundred of Blackheath, eight miles from London. The market is held on Monday. It is remarkable for the manor-house called King John's Palace, formerly a royal residence; and for a modern building on Shooter's Hill, erected by Commodore James, to celebrate his capture of a similar fortress called Savendroog, belonging to Angria, a pirate on the coast of Bombay, in India. The population amounted in 1801 to 1627, in 1811 to 1813, in 1821 to 1883, and in 1831 to 2129.

ELTMANN, a bailiwick of the circle of the Lower Maine, in the kingdom of Bavaria, extending over forty-four square miles. It contains, besides the capital, thirteen villages and 3039 inhabitants. The capital, of the same name, is situated on the river Zeil, and contains 1010 inhabitants.

ELVAS, a town of Portugal, in the province of Alemtejo. It is well fortified, and may be considered as one of the keys of the kingdom to the south, on the side of Spain; and it is one of the fortresses opposed to the city of Badajos.

ELY, a city of Cambridgeshire, the chief place of a division of that county distinguished as the Isle of Ely, having a distinct jurisdiction, the chief justice and other magistrates of which are nominated by the bishop. The city, though elevated somewhat above the surrounding country, is considered as unhealthy, from the marshy soil which surrounds it. It is not a well-built place, and consists chiefly of one street. The cathedral is an object of attraction as the work of several ages, displaying a mixture of the Anglo-Norman and English styles of architecture. It is upwards of 400 feet in length, and has a tower at the west end 270 feet in height. There are, besides, two parish churches. The bishopric is one of the most valuable in England, both on account of its income and its patronage. It is the only city which sends no members to the House of Commons. The land around it is highly fertile; much of it is appropriated by market-gardeners, and supplies the neighbourhood as far as Cambridge with culinary vegetables. The market is held on Saturday. It is sixty-six miles from London, and fourteen from Cambridge. The population amounted in 1801 to 3713, in 1811 to 4249, in 1821 to 5079, and in 1831 to 6189.

ELYSIUM, the place which, according to the ancient poets, the souls of the blessed inhabited. By Homer it was placed in the vicinity of Oceanus, and on the extreme confines of the earth. Here Nature produced her most delicious fruits without assistance from the hand of man. No winter storm ever obscured the brilliancy of the atmosphere; but cooling zephyrs refreshed the air, and wafted on their wings the most delightful perfumes. Such was the abode destined by Jupiter for his son-in-law Menelaus. It is curious to observe the various changes of position in respect to these Elysian Fields, as a more intimate acquaintance with the geography of different countries successively dispelled the erroneous impressions made by the foolish statements of travellers. The Greeks in the earlier ages placed them in the district of Thesprotia, where they also found the Acheron, Cocytus, and Avernus; and it was to this elysium that Homer tells us Mercury conducted the souls of the suitors of Penelope, after they had been killed by Ulysses. But they afterwards transported the Elysian Fields and Avernus to the vicinity of Baia in Campania.

> Largior hic campos æther et lumine vestit
> Purpureo; solemque suum, sua sidera norunt.

And it was not till later times that they thought of fixing these imaginary abodes at the extremity of Iberia, where they found the Lethe, "that slow and silent stream, the river of oblivion," which is now called *Guadalete*, as well as another of the same name in Lusitania.

ELZEVIRS, celebrated printers at Amsterdam and Leyden, who greatly adorned the republic of letters with many beautiful editions of the best authors of antiquity. They were five in number, namely, Louis, Bonaventure, Abraham, Lewis, and Daniel. Louis began to be famous at Leyden in 1595, and was remarkable for being the first who observed the distinction between the *v* consonant and *u* vowel, which had been recommended by Ramus and other writers long before, but never regarded. Daniel died in 1680 or 1681; and though he left children who carried on the business, he nevertheless passes for the last of his family who excelled in printing.

EMANATION, the act of flowing or proceeding from some source or origin. Such is the emanation of light from the sun; that of effluvia from odorous or fragrant bodies; of wisdom from God, and so on. The word is formed of the Latin *e*, out of, and *manare*, to flow or stream. Emanation is also used to signify that which proceeds, as well as the act of proceeding. The power given to a judge is an emanation from the royal authority; the reasonable soul is an emanation from the divinity.

EMANCIPATION, in the Roman law, the setting free of a son from the subjection of a father; so that whatever moveables he acquires belong in property to him, and not to his father, as before emancipation.

By emancipation the son was put in a capacity of managing his own affairs, and of marrying without his father's consent, although a minor. Emancipation differed from manumission, as the latter was the act of a master in favour of a slave, whereas the former was that of a father in favour of his son.

There were two kinds of emancipation; the one tacit, which was by the son's being promoted to some dignity, by his coming of age, or by his marrying, in all which cases he became his own master of course; the other express, where the father declared before a judge that he emancipated his son. In performing this act, the father executed an imaginary sale of his son to another person, who was called *pater fiduciarius*, or father in trust; from whom the son was immediately purchased by the natural father, who thereafter manumitted him before the judge by a verbal declaration.

EMATHIA, the ancient name of Macedonia, which was afterwards restricted to the country in the immediate vicinity of Edessa. This district was originally a part of Pæonia, and contained the extensive and fertile plains on the banks of the rivers Axius and Erigonus. (Polyb. *Frag.* xxiv. 8; Liv. x. 4, 11.) In the time of the Romans Emathia must have extended much farther to the south, as Ptolemy includes in this district the cities of Berrhœa and Pella.

EMBALMING is the opening of a dead body, taking out the intestines, and filling the space with odoriferous and desiccative drugs and spices, in order to prevent putrefaction and decomposition. The Egyptians excelled all other nations in the art of preserving bodies from corruption; for some that were embalmed several thousand years ago remain whole to this day, and are often brought as curiosities into other countries. Their manner of embalming was this: They scooped the brain with an iron scoop out at the nostrils, and threw in medicaments to fill up the vacuum; they also took out the entrails, and having filled the body with myrrh, cassia, and other spices (except frankincense), proper to dry up the humours, they pickled it in nitre, where it lay soaking for seventy days. The body was then wrapped up in bandages of fine linen and gums, to make it stick like glue; and so was delivered to the kindred of the deceased, entire in all its features, the very hairs of the eyelids being preserved. They used to keep the bodies of their ancestors, thus embalmed, in apartments magnificently adorned, and took great pleasure in beholding them, alive as it were, without any change in their size, features, or complexion. The Egyptians also embalmed birds and other animals. The prices for embalming were different; the highest was a talent, the next twenty minæ, and so on, decreasing to a very small matter. But they who had not wherewithal to answer this expense contented themselves with infusing, by means of a syringe, through the fundament, a certain liquor extracted from the cedar; and, leaving it there, wrapped up the body in salt of nitre. The oil thus infused preyed upon the intestines, so that when they took it out, the intestines came away with it, dried, and not in the least putrefied; and the body being inclosed in nitre, grew dry, nothing remaining besides the skin glued upon the bones. The process of embalming is described both by Herodotus and Diodorus. The former, who is unquestionably the better authority, says (book ii. sect. 85), "This service is performed by persons appointed to exercise the art as their business. When a dead body is brought to them, they show their patterns of mummies in wood, imitated by sculpture; and the most elaborate of these they say belongs to the character of one (Osiris), whose name I do not think it pious to mention on such an occasion; the second that they show is less costly; the third, the cheapest of all: and having shown these, they inquire in which way the service shall be performed; upon which the parties make their agreement, and the body is left for preparation. The interior soft parts being removed both from the head and from the trunk, the cavities are washed with palm wine and fragrant gums, and partly filled up with myrrh and cassia, and other spices; the whole is then steeped in a solution of soda for seventy days, which is the longest time permitted; and then, having been washed, the body is rolled up with bandages of cotton cloth, being first smeared with gum instead of glue. The relations then, receiving the body, procure a wooden case for it in a human shape, and inclose the dead body in it; and when thus inclosed, they treasure it up in an appropriate building or apartment, placing it upright against the wall. And this is the most expensive mode of preparation. For those who prefer the middle class, in order to avoid expense, the process is simplified by omitting the actual removal of the interior parts, and introducing a corrosive liquid to melt them down; the soda consumes the flesh, so that skin and bone only are left when the body is returned to the friends. The third and simplest process is merely to cleanse the body well, within and without, by means of some vegetable decoctions, and to keep it in the alkaline solution for the seventy days, without farther precautions." Embalming appears also to have been performed by filling the cavities of the thorax and abdomen, after the intestines were removed, with a species of pitch which was poured into the trunk of the body in a liquid state, through an aperture made on purpose in the right side, whilst the head was treated in a similar manner. See the article MUMMY.

EMBANKMENT a mound or wall of earth, or other materials, used as a defence against the inundations of rivers, or the extraordinary flux of the sea.

The great value of alluvial soil to the agriculturist no doubt gave rise to the invention of banks or other barriers, to protect such soils from the overflowing of their accompanying rivers. The civilized nations of the highest antiquity were chiefly inhabitants of valleys and alluvial plains, the soil, moisture, and warmth of which, by enlarging the parts, and ameliorating the fruits of the vegetable kingdom, afforded to man better nourishment at less labour than could be obtained in hilly districts. The country of Paradise and around Babylon was flat, and the soil a saponaceous clay, occasionally overflown by the Euphrates. The inhabited part of Egypt was also entirely of this description. Historians inform us that embankments were first used by the Babylonians and Egyptians, very little by the Greeks, and a good deal by the Romans, who embanked the Tiber near Rome, and the Po for many stadia from its embouchure. The latter is perhaps one of the most singular cases of embankment in the world.

The oldest embankment in England is that of Romney Marsh, as to the origin of which Dugdale remarks, "that there is no testimony left to us from any record or historian." (*History of Embanking and Draining.*) It is conjectured to have been the work of the Romans, as well as the banks on each side of the Thames for several miles above London, which protect from floods and spring tides several thousand acres of the richest garden ground in the neighbourhood of the metropolis.

The commencement of modern embankments in England took place about the middle of the seventeenth century, under Cromwell. In the space of a few years previously to 1651, about 425,000 acres of fens, morasses, or overflown muddy lands, were recovered in Lincolnshire, Cambridgeshire, Hampshire, and Kent, and let at from 2s. 6d. to 30s. an acre. (Harte's *Essays*, p. 54, 2d edit.) Vermuyden, a Fleming by birth, and a colonel of horse under Cromwell, who had served in Germany during the thirty years' war, was the principal undertaker of these works. The works of this sort constructed in our own times will be found described in the *Agricultural Reports* of the maritime counties, especially of Lincolnshire, by Arthur Young.

Previously to entering on the detail of the different descriptions of banks for the purpose of embanking, we shall here observe, that the pressure of still water against the sides of the vessel containing it being as its depth, it follows that a bank of any material whatever, impervious to water, whose section is a right-angled triangle, and the height of whose perpendicular side is equal to that of the water it is to dam in, will balance or resist this water, whatever may be the breadth of the surface of the latter; and therefore, that as far as width or extent is concerned, it is just as easy to exclude the Atlantic Ocean as a lake or a river of a few yards in width.

The earthen wall.

1. The Earthen Wall (Plate CCXVIII. fig. 1,) is the simplest description of embankment, and is frequently erected by temporary occupiers of lands, on the general principle of inclosing and subdividing, which is sometimes made a condition of tenure between the landlord and tenant. This wall applies to lands occasionally but rarely overflown or inundated, and is set out in a direction generally parallel to the river or shore. Its base is commenced on the surface from two to five feet wide, regularly built of turf on the outsides, with the grassy sides underneath. The middle of the wall is filled up with loose earth. The wall is carried up with the sides bevelled towards the centre, so as to finish in a width of one foot or eighteen inches at five or six feet in height. In the inside of such walls, and at the distance of three or four feet, a small open drain is formed, as well to collect the surface-water of the grounds within, as that which in time of floods will necessarily oose through a wall of this construction. The water so collected is let through the wall by tubes, or tunnels of boards, with a valve opening outwards on their exterior extremity. Such a tube and valve is represented by fig. 2. When the flow of water from without approaches, it shuts the valve, which remains in this state till the flood subsides, when, the height of the water within being greater than that without, it presses open the valve and escapes. Walls and valves of this kind were erected about the year 1800, on the estate of the Earl of Galloway near Wigton, by Mr Hannah, tenant for life of Cue farm, and by Mr Hutchinson, tenant for thirty years of Mersehead farm, on the Solway Frith. (*Farmer's Magazine.*) They are common enough in the drier parts of the fenny districts of Lincolnshire and Cambridgeshire; and in Caernarvonshire 1800 acres were in 1804 completely protected in this way on the estate of Tre Madoc, by the proprietor, who has since made greater efforts in embanking, to be afterwards described.

The earthen mound.

2. The Earthen Mound (fig. 3) is the most general description of embankment, and, as it is executed at considerable expense, is only undertaken by such as have a permanent interest in the soil. This barrier applies to sea lands overflown by every spring tide, and to alluvial plains inundated by every flood. It is set out in a direction parallel to the shore and to the general turns of the river, but not to its minute windings; and it is placed farther from or nearer to the latter, according to the quantity of water in time of floods, the rapidity of the current from the declivity of the bed, the straight course of the stream, and the intended height of the bank. The two sides of such a mound are generally formed in different slopes. That towards the land is always the most abrupt, but can never be secure if more so than 45°; that towards the water varies from 45° to 15°; the power of the bank to resist the weight of the water, as well as to break its force when in motion, being inversely as its steepness. The power of water to lessen the gravity of bodies, or, in other words, to loosen the surfaces over which they flow or stand, is also lessened in a ratio somewhat similar.

The formation of such a mound consists merely in taking earth from the general surface of the ground to be protected, or from a collateral excavation, distant at least the width of the mound from its base line, and heaping it up in the desired form. The surface is then in general cases covered with turf, well rolled in order to bind it to the loose earth. The earth of such mounds is generally wheeled by barrows; but sometimes it is led by carts placed on a wooden roller instead of wheels, which, with the treading of the horses, serves in some degree to consolidate the bank.

The excavation within serves the same purpose as the open drain in the *earthen wall*, and similarly constructed sluices or valves are introduced on a larger scale. Sometimes also the interior water is drawn off by windmills, and thrown over the mound into the river. This is very common in Huntingdonshire, and might be greatly improved on by employing steam-engines for entire districts, one of which, of a ten-horse power, would do the work of twenty mills, and this in calm weather, when the latter cannot move.

Embankments of this description are the most universal of any, and their sections vary from a scalene triangle of ten feet in base and three feet in height, as on the Forth near Stirling, and the Thames at Fulham, to a base of 100 feet and a height of ten feet, as on the great bank of the Ouse, near Wisbeach. The great rivers of Germany and Holland are embanked in this way when so far from the sea as to be out of the reach of the tide; as the Vistula at Marienwerder, the banks of which, near Dantzic, are above fifteen feet in height; the Oder, the Elbe, &c. All these banks are closely covered in every part with a grassy surface, and sometimes ornamented with rows of trees.

But near the sea, where such banks are washed by every tide when the course of the wind is towards the shore, and by all land floods and spring tides, grass is only to be found on and near their summits. The rest of the bank is bare, and to preserve it from the action of waves, currents, and the stones, pieces of wood, and other foreign matters which they carry with them, the surface is covered with gravel, reeds, or straw, kept down by pieces of wood, faggots, wicker hurdles, nets of straw-ropes, or any other contrivance, according to the situation, to prevent the washing away of the bank. It is common to attribute to these coverings the power of breaking the force of the waves; but this power depends, as we have already stated, on the slope of the bank and its smoothness; and the use of the surface covering, and of the constant attention required to remove all obstacles which may be left on it by floods and tides, is to prevent the loosening power of the water from wearing it into holes. For this purpose, a sheet of canvass or straw-netting is as good whilst it lasts as a covering of plate-iron or stone pavement.

All banks whatever require to be constantly watched in time of floods or spring-tides, in order to remove every object, excepting sand or mud, which may be left by the water. Such objects, put in motion by the water, in a short time wear out large holes. These holes, presenting abrupt points to the stream, act as obstructions, soon become much larger, and, if not immediately filled up, turfed over, and the turfs pinned down, or the new turfs rendered by some other means not easily softened and raised up by the water, will end in a breach of the bank. A similar effect is produced by a surface formed of unequal degrees of hardness and durability. The banks of this description in Holland, at Cuxhaven, and along the coast of Lincolnshire, are regularly watched throughout the year; the surface protection is renewed whenever it goes out of repair, as is the body of the bank in the summer season.

Varieties of the mound.

Mound with puddle-wall.—It generally happens that the earth of such banks is alluvial, and their foundation of the same description; but there are some cases where the basis is sand, silt, or gravel, or a mud or black earth, as in some parts of Cambridgeshire and Lincolnshire, which does not easily become so compact. Here it is common, before beginning the bank, to bring up what is called a puddle-ditch, or section of clay, in the centre of the highest part of the mound in the direction of its length, and of three or five feet wide, according to the depth of the silt and the intended height of the bank. When the clay of this puddle-ditch is well worked, either by men's feet or clay rammers, the bank will be perfectly impervious to water, and, if against a mild stream or shore, need not contain such an accumulation of earth as where the imperviousness of the bank to water depends chiefly on the mass of materials. An important point to attend to in this variety of mound is, to found the section or wall of clay so deep as to be in contact with a stratum, either by induration or its argillaceous nature impervious to water.

Mounds with reversed slopes (fig. 4).—In some cases of embanking rivers, as where they pass through parks, it is desirable to conceal as much as possible the appearance of a bank from the protected grounds, less able to break the force of waves. Here the mound is simply reversed, the steepest side being placed next the water. It is proper to observe, that such banks are not so strong by the difference of the weight of the triangle of water which would rest on the prolonged slope were it placed next the river, and are more liable to be deranged in surface in proportion to the difference of the slopes.

Mound faced with stones.—This is the same species of mound, with a slope next the water of forty-five or fifty degrees, paved or causewayed with stones or timber. In Holland this pavement or causeway is often formed of planking or bricks; but in England generally with stones, and the mortar used is either some cement which will set under water, or, what is better, plants of moss firmly rammed between them. The objections to such banks are their expense, and their liability to be undermined invisibly by the admission of the water through crevices. They are, therefore, chiefly used where there is little room, or where it is desirable to narrow and deepen the course of a river.

Mound protected by a wicker hedge.—This is a Dutch practice, and, where appearance is no object, has the advantage of not requiring watching. Wicker-work, however, subjected to the strain of waves, will be obviously less durable than where it lies flat on the ground, and can only decay chemically. This wicker hedge is sometimes a series of hurdles supported by posts and struts; but generally in Britain it is a dead hedge or row of stalks wattled or wrought with bushes presenting their spray to the sea or river. Besides placing such a hedge before a bank, others are sometimes placed in parallel rows on its surface; the object of which is to entrap sand, shells, and sea-weeds, to increase the mass of mound, or to collect shells for the purpose of carrying away as manure.

The sea wall (fig. 5) is an embankment formed to protect abrupt and earthy shores or banks of rivers, and consists of a wall, varying in thickness, and in the inclination of its surface, according to the required height and other circumstances. Belidor, in his *Traité de Hydraulique*, has given the exact curve which the section of such a wall ought to have in order to resist loose earth, and which is somewhat greater than what we have given in the figure referred to, where the earth behind the wall is supposed to be chiefly firm. Some fine examples of such walls, for other purposes, occur in the CALEDONIAN CANAL; and perhaps the finest in the world are the granite walls which embank the Neva at Petersburg, the construction of which may serve as an example of a river case with a foundation of soft bog earth. A space of the river, say 100 feet long, and twenty wide along shore, being inclosed by a double row of piles, and filled in with loam in the usual way, the water is pumped out, and the ground excavated about ten feet deeper than the margin of the bed of the river. Poles are then inserted nearly as close as they can be put in, and driven to their full length. When finished, this foundation occupies a breadth of from twelve to eighteen feet, generally fifteen. The tops of the piles are now cut level, and covered with planks, and on this is raised a mass of brick-work for five or six feet, sloping on both sides as it ascends towards the centre line of the wall. In the course of rising six or seven feet, it is narrowed to five feet, and is within five feet of the bed of the margin of the river. Here the granite facing begins in immense blocks, and is continued at a slope of fifteen degrees from the perpendicular, till it reaches the surface of the intended pathway. Here the wall from three feet is narrowed to an upright parapet eighteen inches wide; and at four feet of height it is finished in a projecting coping of Finnish granite. The voids on each side of the wall are now filled with earth, the pavement on the land side (generally narrow) completed, and the piles removed, and another length taken in to repeat the operation.

There is another mode, adopted in Petersburg, of building under water by driving the piles and cutting them over level with a machine, and then sinking caissons of brick-work. This mode, however, is unsuitable for sea walls in general, which ought to be founded as deep as possible, and at all events under the bed of the water. The motion of the Neva is so slow as hardly to render this worth attending to.

In Britain, such walls are fortunately rare; for in proportion as it is agreeable and flattering to self-love to protect or gain lands never before cultivated, it must be mortifying to be obliged to protect such as have long been subjected to agriculture, and where success can only be said to have a negative advantage.

Embankments for fixing drifting-sands, shells, or mud.—In several tracts of coast, the sea at ordinary tides barely covers a surface of sand, and these sands in dry weather, during high winds, are drifted and blown about in all directions. Great part of the north shores of the Solway Frith, of Lancaster Bay, and of the coast of Norfolk, is of this description. Mr Young, in his *Farmer's Letters*, informs us, that a considerable part of the county of Norfolk was drift-sand, even as far inland as Brandon in Suffolk, before the introduction of the turnip culture; and Harte (*Essay I.*) states, that some of what is now the richest land in Holland was, about the middle of the sixteenth century, of this description. The suggestion of any mode, therefore, by which, at a moderate expense, such tracts could be fixed and covered with vegetation, must be deemed worthy of a place in this article.

The mode which nature herself employs is as follows: After the tides and wind have raised a marginal strip of sand as high as high-water mark, it becomes by degrees covered with vegetation, and chiefly by the *elymus arenarius*, *triticum junceum*, various species of *Juncus*, and sometimes by the *galium verum*. With the exception of the first of these plants (the leaves and stalks of which are manufactured into mats and ropes in Anglesea, and the grain of which is ground and used as meal in Ireland), they are of no other use than fixing the sands, which, being composed in great part of the debris of shells, expand as they decay, and contribute to raise the surface still higher, when the fibrous roots of good grasses soon destroy the others.

To assist nature in fixing drift-sands, it is only necessary to transplant the *elymus*, which is to be had in abundance in almost every sandy coast in Britain; and as it would be liable to be blown away with the sands if merely inserted in the common way, it seems advisable to tie the plants to the upper ends of *willow* or *elder* rods, of two or three feet in length, and to insert these in the sand, by which means there is the double chance of the grass growing, and the truncheon taking root. The elder will grow exposed to the sea breeze, and no plant throws out so many and such vigorous roots in proportion to its shoots.

The mode by which sands were fixed in Holland was by the formation of wicker work embankments, and by sticking in the sands branches of trees, bushes, furze, &c. in all directions. These obstructed the motion of the sands, and collected masses of sand, shells or mud, and sea-weeds around them, which were immediately planted with some description of creeping grass; or, what was more frequent, covered with a thin coating of clay, or alluvial earth, and sown with clover.

Though the most certain and least expensive mode of gaining such lands be undoubtedly that of seconding the efforts of nature, by inserting bushes, and planting the *elymus* in this way, yet it may sometimes be desirable to make a grand effort to protect an extensive surface, by forming a bank of branches, which might in a single or in several tides be filled with sand and shells. It is evident that such a bank might be constructed in various ways; but that which would be most certain of remaining firm, and effecting the purpose, would be one regularly constructed of framed timber, the section of which would resemble a trussed roof; each truss being joined in the direction of the bank by rafters, and the whole inside and surface stuck full of branches. To retain it firm, piles would require to be driven into the sand, to the upper parts of which would be attached the trusses. The height of such a barrier would require to be several feet above that of the highest spring-tides; and the more its width at base exceeded the proportion of that of an equilateral triangle the better.

A more economical mode, and one, therefore, suited to a less extensive scale of operation, is to intersect a sandy shore in all directions with common dead or wicker-work hedges, formed by first driving a row of stakes six or eight feet into the ground, leaving their tops three or four feet above it, and then weaving among these stakes branches of trees or the tops of hedges. The Dutch are said to weave straw ropes, and thereby to collect mud in the manner of *warping*. This mode being little expensive, seems to deserve a trial in favourable situations; and, in so doing, it must not be forgotten that much depends on the immediate management of the surface after it is in some degree fixed. In an extensive trial of this sort made on the west coast of Scotland, under an English gentleman, seeds and roots were baked in a mixture of loam and dung in the gravel, and then formed into masses, and scattered over a sandy surface. These, from their weight, will not, it is thought, be moved by the water or the wind; but becoming more or less covered with sand, the mass will be kept moist, and the seeds and roots will grow, and, fixing themselves in the soil, will in time cover the surface with verdure.

Embankments for straightening the course of rivers.—Where a river in a fertile valley is very circuitous in its course, land may be gained, and a more rapid efflux of the water produced, by straightening its course. The best plan in general for effecting this is, to find an entirely new bed or course for the river; otherwise, when it passes alternately through new soil and through a part of its old bed, its action on surfaces which are so different in regard to induration ends, if great care be not taken, in holes and gulleys in the new bank, which require to be constantly filled up with loose stones thrown in, and left to be fixed by the pressure and motion of the water.

The embankment used in straightening the course of rivers is almost always the mound with a clay wall in the centre, varying in width according to the depth of the different parts of the old bed of the river which it has to intersect. The materials for these banks are obtained from excavations for the new bed.

The pier called the *protecting pier* is to be considered as a species of embankment the object of which is to prevent the increase of partial breaches made in the banks of rivers, by accidental obstructions during floods. A tree or branch carried down by a stream, and deposited or accidentally fixed or retained in its banks, will repel that part of the stream which strikes against it, and the impulse, counteracted more or less by the general current, will direct a substream against the opposite bank. The effect of this continual action against one point of the opposite bank is to wear out a hole or breach, and the protecting pier is placed so as to receive the impulse of the substream, and reverberate it to the middle of the general stream. If this pier be not placed very obliquely to the substream, as well as to the general stream, it will prove injurious to the opposite bank, by directing a subcurrent there as great as the first; and, indeed, it is next to impossible to avoid this; so much so, that Mr Smeaton, in every instance in which he was consulted in cases of this sort, recommended removing the obstacle where that could be done, and then throwing loose stones into the breach. A perfect bed of a river would be a perfect half cylinder, and therefore we are decidedly of opinion that Mr Smeaton's mode is the best, as tending to maintain as much as possible this form. Mr Marshal (*Treatise on Landed Property*) has treated on piers of this description at considerable length; but a very little reflection will show that they are more likely to increase than to remedy the evil they are intended to cure. We have seen the injurious effects of such piers on the Tay and the Dee; and on a part of the Jed near Crailing they are so numerous that the stream is, to use a familiar phrase, bandied about like a football from one shore to the other; behind every pier an eddy is formed, and, if the stream does not strike it exactly, a breach in the bank. Many of these piers have in consequence been taken down.

The use of such piers can only be justified where the obstruction, from ill neighbourhood or some such cause, cannot be removed from the opposite bank; or where, as is sometimes the case, it arises from an island of sand or gravel thrown out by the river near its middle, and which, however absurd it may appear, the interested parties cannot agree as to who may remove it. The case of buildings also being in danger may justify such a pier for immediate protection; but if such breaches are taken in time, a few loads of loose stones will effect a remedy without the risk of incurring or occasioning a greater evil.

Such piers are frequently constructed of wicker work; either a mere wicker hedge projecting into the water, as is common where the rivers are of slow motion, as in England, and particularly on the Thames, Tame, and Severn; or a case of wicker work filled with stones, as is common where the motion is rapid, as in Scotland, and particularly on the Esk, Tweed, Tay, and Clyde.

Embankments to serve as roads are generally mounds without clay walls, carried through countries liable to be overflown, without reference to protecting any part from water, through lakes or marshes, or across straits of the sea. The earth in such mounds is generally allowed to take its own slope on both sides, which is commonly from forty to forty-five degrees, and the width at top is regulated by that of the intended road. The materials, when the mound is formed in a country merely liable to be overflown, as in many parts of Lincolnshire and Huntingdonshire, are excavated from ditches, or taken from the surface on each side of the mound. In Holland the roads formed on such mounds are bounded by rows of trees; a practice which it is to be regretted has not been more attended to in England, where accidents not unfrequently happen in the night, and particularly on the Boston and Wisebeach roads, both of which are formed in great part on such mounds, unprotected by hedges, rails, or trees. In passing through part of a lake, or strait, or marsh, the earth must of course be taken from the firm ground on the shores; and here the ground being generally soft below, the first operation is to lay a foundation three or four feet thick, of branches or faggots of copsewood, in order that the mound may sink in a body. The next thing, the direction of the mound being marked out by a line of poles placed along its centre, is to begin at one end, and wheel or cart on earth, throwing it down in the direction of the bank, raising it to its proper height and width, leaving the slopes at the sides to adjust themselves, either by the gravity of the material alone, or jointly with the loosening and spreading operation of the water.

The noblest attempt of this sort ever made in Britain was that of W. A. Madocks, Esq. in order to unite the counties of Merioneth and Cardigan by a mound across an estuary and embouchure of the Glasslyn, two miles wide. Mr Madocks had, in 1802, succeeded in protecting from spring tides, by a wall or bank of the first species, 1800 acres of good alluvial soil, which he let at from 30s. to 50s. per acre; and his enterprising spirit induced him to contemplate the idea of gaining the whole bay or mouth of the stream, extending to nearly 4000 acres of alluvial and sandy earth, overflowed in great part by every tide. Besides the mere gaining of the land, this patriotic improver had another object in view; that of uniting two maritime points in two counties which at that time were separated by a day's journey; and, by effecting this, he would at the same time have rendered practicable a new line of road from Worcester along the top of this embankment, through a creation of his own, called the town of Tre Madoc, to the newly formed harbour of Porthdynlleyn, by which forty miles would have been saved to the public between Dublin and London, and fifty between Dublin and Bath.

After consulting various engineers, the first operation was begun in 1807, and consisted in forming an immense bridge of flood-gates in the solid rock of the shore, as such a bridge and gates could not be formed in any part of the mound. The use of this was to admit the exit of the river. This done, the mound was commenced from both shores, and rocky, sandy, and clayey materials thrown down in the direction of the mound, and left to take their own slope. The greater part of these materials consisted of argillaceous rock broken into small pieces, which being mixed with clay, the mound would have been of the strongest texture. As the work proceeded, an iron railroad was laid along the top of it, and extended to the quarries and excavations, by which means much labour was saved. In the course of three years the work was brought within fifty yards of meeting in the middle, but it was found extremely difficult to close it, from the rapidity of the influx and reflux of the tide. This difficulty, however, would have been overcome, and the proposed improvement effected at little more than the estimated cost, L.20,000, had not the various and extensive projects in which the proprietor was at that time engaged led him into pecuniary difficulties, which put an end to the undertaking, and, as is usual in such cases, called forth popular clamour against the plan. It is but justice, however, to those concerned to state, that the very plan now put in execution was contemplated above a century ago by Sir Hugh Middleton, who then wrote to a friend, that if he were not so deeply engaged in the scheme of bringing water to London, he should certainly engage in it.

Very little has been written on the subject of embankments, as a separate branch of art, by British authors. Dugdale's work is entirely historical and topographical; but the writings of Smeaton, Young, Gregory, and others, contain the general principles on which is founded the art of embanking, and every other operation connected with water.

EMBARCADERO, in *Commerce*, a Spanish term, much used along the coasts of America. It signifies a place which serves some other considerable city farther inland for a port or place of shipping, that is, of embarking and disembarking commodities.

EMBARGO, in *Commerce*, an arrest on ships or merchandise by public authority, or a prohibition of state, commonly on foreign ships, in time of war, to prevent their going out of port, or coming in, and sometimes both, for a limited time.

EMBER WEEKS are those in which the *ember* or *embring days* fall.

In the laws of King Alfred and those of Canute, these days are called *ymbren*, that is, circular days, from which the word was probably corrupted into *ember days*. By the canonists they are called *quatuor anni tempora*, the four cardinal seasons on which the circle of the year turns; and hence Henshaw takes the word to have been formed by corruption from *tempora*. The ember days are the Wednesday, Friday, and Saturday, after Quadragesima Sunday, after Whitsunday, after Holy-rood day in September, and after St Lucia's day in December; which four times answer well enough to the four quarters of the year, spring, summer, autumn, and winter. Mr Somner thinks they were originally fasts, instituted in order to crave God's blessing on the fruits of the earth; agreeably to which, Skinner supposes the word *ember* taken from the ashes, *embers*, then strewed on the head. These ember weeks are now chiefly taken notice of on account of the ordination of priests and deacons; because the canon appoints the Sundays next succeeding the ember weeks for the solemn times of ordination; though the bishops, if they please, may ordain on any Sunday or holiday.

EMBLEM, a kind of painted enigma, which represents some obvious history, with reflections underneath, and instructs us in some moral truth or other matter of knowledge. Such is that very significant image of Scævola holding his hand in the fire; with the words, *Agere et pati fortiter Romanum est*, to do and to suffer courageously is Roman. The word is pure Greek, formed of the verb εμβαλλειν, *to cast in* or *insert*. Suetonius relates that Tiberius caused the word to be erased from the decree of the Roman senate, because borrowed from another language. The emblem is somewhat plainer and more obvious than the enigma. Gale defines emblem an ingenious picture, representing one thing to the eye, and another to the understanding.

The Greeks also gave the name *emblems*, εμβληματα, to inlaid or mosaic works, and even to all kinds of ornaments of vases, moveables, garments, and the like. The Latins also used *emblema* in the same sense. Accordingly, Cicero, reproaching Verres with the statues and finely wrought works he had plundered from the Sicilians, calls the ornaments fixed thereto, and which on occasion might be separated from them, *emblemata*; and, further, the Latin authors frequently compare the figures and ornaments of discourse to these *emblemata*. Thus, an ancient Latin poet praising an orator, says, that all his words were ranged like the pieces in mosaic:

> Quam lepide λεξεις compostæ, ut tesserulæ omnes,
> Arte pavimento, atque *emblemate* vermiculato.

With us emblem ordinarily signifies no more than a painting, bas-relief, or other representation, intended to convey some moral or political instruction.

What distinguishes an emblem from a device is, that the words of an emblem have a full and complete sense of themselves; whereas those of a device are significative only with reference to some particular person or thing. A device, in short, is a symbol appropriated to some person, or that expresses something which concerns him particularly; whereas an emblem is a symbol that regards all the world alike. These differences will be more apparent from comparing the emblem above quoted, with the device of a candle lighted, and the words *Juvando consumor*, I am wasted in doing good.

EMBOLISMUS, Εμβολισμος, in *Chronology*, signifies *intercalation*. The word is formed from εμβαλλειν, *to insert*. As the Greeks made use of the lunar year, which is only 354 days, in order to bring it to the solar, which is 365 days, they had every two or three years an embolism, that is, they added a thirteenth lunar month every two or three years, which additional month they called *embolimæus*, εμβολιμαιος, because inserted or intercalated.

EMBOSSING, or IMBOSSING, in *Architecture* and *Sculpture*, the forming or fashioning of works in relief, whether cut with a chisel or otherwise. Embossing is a kind of sculpture in which the figure stands out from the plane on which it is cut; and according as the figures are more or less prominent, they are said to be in alto, mezzo, or basso-relievo; or high, intermediate, or low relief.

EMBRASURE, in *Architecture*, an enlargement made of the aperture of a door or window on the inside of the wall, the use of which is to give greater play for the opening of the door or casement, or to admit more light.

EMBROIDERY, a work in gold, or silver, or silk thread, wrought by the needle upon cloth, stuffs, or muslin, into various figures. In embroidering stuffs, the work is performed in a kind of loom, because the more the piece is stretched the easier it is worked. As to muslin, it is spread upon a pattern ready designed, and sometimes, before it is stretched upon the pattern, it is starched, to make it more easy to be handled. Embroidery on the loom is less tedious than the other, in which, whilst the flowers are worked, all the threads of the muslin, both lengthwise and breadthwise, must be continually counted; but, on the other hand, this last is much richer in points, and susceptible of greater variety. Cloths too much milled are scarcely susceptible of this ornament, and in effect we seldom see them embroidered.

There are several kinds of embroidery, viz. 1. Embroidery on the stamp, where the figures are raised and rounded, having cotton or parchment put under them to support them. 2. Low embroidery, where the gold and silver lie low upon the sketch, and are stitched with silk of the same colour. 3. Guimped embroidery. This is performed either in gold or silver. A sketch is first made upon the cloth, then put on cut vellum, and afterwards sewed on the gold and silver with silk thread; and on this kind of embroidery are often put gold and silver cord, tinsel, and spangles. 4. Embroidery on both sides, that which appears on both sides of the stuff. 5. Plain embroidery, or where the figures are flat and even, without cords, spangles, or other ornaments.

EMBRUN, an arrondissement of the department of the Upper Alps, in France, extending over 583 square miles. It is divided into five cantons and thirty-six communes, and contains 28,628 inhabitants. The capital, of the same name, is situated on the top of a steep rock, at the foot of which flows the river Durance. It has a cathedral, an episcopal palace, and a large prison; and contains 700 houses and 3133 inhabitants. Long. 6. 20. E. Lat. 44. 34. N.

EMBRYO, in *Physiology*, the rudiments of an animal in the uterus, before the several members are distinctly formed, after which period it is denominated a *fœtus*.

EMDEN, a bailiwick of the province of West Friesland, in the kingdom of Hanover, extending over eighty-one square miles, and containing a city, a market-town, and thirty parishes, with 18,925 inhabitants. It is mostly marsh land, and is only preserved from inundation by powerful dikes or embankments, which are maintained at a vast expense; but the land is highly fertile, and more than adequate to defray these charges. It is especially productive in oats, and in butter and cheese. The capital, from which it takes its name, is situated on the river Ems, but a mile and a half distant, and is surrounded with walls, which, however, are indefensible. It contains four reformed, one Lutheran, and one Catholic church, a Menonite chapel, and a Jews' synagogue, with 1808 houses, and 12,100 inhabitants. It is a place of great trade, as well for the export of oats, butter, cheese, and bacon, as for the herring fishery; and there are many breweries and distilleries, some ship-building, and other occupations of industry. It is, besides, the seat of government for East Friesland. Long. 7. 5. 35. E. Lat. 53. 22. 8. N.

EMERALD, *Smaragdus*, *Schmaragd*, *Eméraude verte*. In mineralogy this includes two subspecies; the emerald properly so called, or the precious emerald, comprehending the transparent and beautiful green-coloured varieties, and the beryl, which has already been described under its appropriate head.

The emerald always occurs crystallized, its most common form being that of a regular six-sided prism, occasionally modified by truncations on the terminal edges. It is in general well characterized by that pure and lively green colour which has hence received the name of *emerald green;* its hue, however, varies somewhat, inclining at times to verdigris or grass green, and frequently becoming rather pale. This fine colour is occasioned by the presence of a minute portion of the oxide of chrome, to which, indeed, may be attributed the principal distinction between emerald and the beryl; the mountain-green and yellow colours of the latter being produced by an admixture of iron in different states of oxidation. The most magnificent crystals of emerald occur in veins of magnesian carbonate of lime, which traverse a hornblende rock in the mine of Muso, near Santa Fé de Bogota, in Peru. A hexagonal prism from this locality, upwards of two inches in length, and measuring across its three diameters $2\frac{1}{4}$, $2\frac{1}{8}$, and $1\frac{7}{8}$ inches, is now in the possession of the Duke of Devonshire: it weighs eight ounces and eighteen dwts. and, though imperfect for the lapidary's purposes, from the numerous flaws it contains, is unquestionably the finest crystallized emerald at present in Great Britain. Less distinct varieties, generally of muddy emerald-green colours, occur imbedded in mica slate in the Pinzgau valley, Saltzburg; also in mica-schiste at Mount Zabara in Upper Egypt, a locality whence the ancients are believed to have obtained their emeralds.

The Peruvian emerald, according to the analyses of Klaproth and Vauquelin, contains,

Silica	68·50	64·50
Alumina	15·75	16·00
Glucina	12·50	13·00
Oxide of iron	1·00	0·00
Oxide of chrome	0·30	3·25
Lime	0·25	1·60

Its specific gravity ranges between 2·6 and 2·8, and its hardness between 7·5 and 8·0 of the scale of Mohs; that is, it scratches quartz, and is very little inferior to topaz in hardness. It possesses a vitreous lustre, more or less shining, and a conchoidal, uneven fracture. By friction it becomes electric, and before the blowpipe with borax fuses into a transparent colourless glass. But it is as a gem inferior only to the diamond and the ruby that this mineral is so highly prized and esteemed. Its colour, which is perfectly distinct from that of any other gem, is the richest, and presents by daylight the most pleasing hue imaginable. An emerald, therefore, possessing considerable surface, and free from flaws and impurities, has always been very highly prized, and, according to Pliny (lib. xxxvii.), even in his time commanded immense sums. Haüy describes one in the tiara of the sovereign pontiff when in Paris in 1804, consisting of a cylinder about two inches long by two and a quarter broad, which is supposed to have been brought from Africa, as it bears the name of Julius II. who flourished anterior even to the conquest of Peru. The most magnificent cut emerald in this country is that in the possession of Mr Hope of London: it weighs six ounces, is perfect in colour and transparency, and cost L.500. It is believed to be from Coimbetoor.

Emeralds are cut and polished with facility. The usual form given them is that of a square table with the edges replaced, the lower surface being cut into facets parallel to their sides. When fine they are always set without a foil, and, in consequence of their brilliancy being somewhat impaired by candle light, are generally surrounded with small diamonds or pearls, which on such occasions add considerably to their lustre and effect. This gem has been imitated by the manufacturers of paste stones in France with very considerable success, the colouring matter which they use being the oxide of chrome.

EMERSION, in *Physics*, the rising of any solid above the surface of a fluid specifically heavier than itself, into which it had been violently immerged or thrust down.

It is one of the known laws of hydrostatics, that a lighter solid being forced down into a heavier fluid, immediately endeavours to emerge, and that with a force or momentum equal to the excess of weight of a quantity of the fluid above that of an equal bulk of the solid. Thus, if a solid be immerged in a fluid of double its specific gravity, it will emerge again till half its bulk or body be above the surface of the fluid.

EMERSION, in *Astronomy*, is when the sun, moon, or other planet, begins to re-appear after having been eclipsed, or hid by the interposition of the moon, earth, or other body.

The difference of longitude is sometimes found by observing the immersions and emersions of the first of Jupiter's satellites. The immersions are observed from the time of Jupiter's being in conjunction with the sun to his opposition, and the emersions from the opposition to the conjunction; two intervals which are usually six months each, and divide the year between them. But when Jupiter is in conjunction with the sun, and fifteen days before and afterwards, there is nothing to be observed, the planet, with his satellites, being then lost in the light of the sun.

EMERSION is also used when a star, before hid by the sun, as being too near him, begins to re-appear and to get out of his rays.

EMERSON, WILLIAM, an eminent mathematician, was born on the 14th May 1701, at Hurworth, a village about three miles south of Darlington; at least it is certain that he resided here from his childhood. His father Dudley Emerson taught a school, and was a tolerable proficient in mathematics; and without his books and instructions, perhaps his son's genius, though eminently fitted for mathematical disquisitions, would have never been unfolded. The latter was instructed in the learned languages by a young clergyman, then curate of Hurworth, who was boarded at his father's house. In the earlier part of his life he attempted to teach a few scholars; but, whether from his concise method of explaining his ideas, in which he was not happy, or from the warmth of his natural temper, he made no progress in his school; he therefore soon left it off, and, satisfied with a moderate competence left him by his parents, he devoted himself to a studious retirement. Towards the close of the year 1781, being sensible of his approaching dissolution, he disposed of the whole of his mathematical library to a bookseller at York; and on the 20th of May 1782 he died of a lingering and painful disorder, at his native village, in the eighty-first year of his age.

Mr Emerson in his person was rather short, but strong and well made, with an open countenance and ruddy complexion. He was exceedingly singular in his dress and manners, and his appearance, which was rather clownish, if not boorish, did not bespeak the man of science; but his eccentricities were more than atoned for by the uncompromising independence of his character, and by the possession of strong natural parts, of which he has left ample evidence in his writings. He always walked up to London when he had any thing to publish, and revised it sheet by sheet himself. It was a favourite maxim with him to trust no eyes but his own. He never advanced any mathematical proposition which he had not first tried in practice, constantly making all the different parts himself on a small scale, so that his house was filled with all kinds of mechanical instruments together or disjointed. Fishing was a diversion which he was remarkably fond of, and while engaged in it he would frequently stand up to his middle in water. He used to study incessantly for some time, and then seek relaxation by taking a ramble to any pot-ale-house where he could get any body to drink with and talk to. The Duke of Manchester was highly pleased with his company, and used often to come to him in the fields and accompany him home, but could never persuade him to get into a carriage. He was a married man, and his wife used to spin on an old-fashioned wheel, of which a very accurate drawing is given in his Mechanics. He was deeply skilled in the science of music, the theory of sounds, and the various scales both ancient and modern, but as a performer he had nothing to boast of.

The following is a list of Mr Emerson's works: 1. The Doctrine of Fluxions, 1748, 8vo; 2. The Projection of the Sphere, orthographic, sterographic, and gnomical, 1749, 8vo; The Elements of Trigonometry, 1749, 8vo; 4. The Principles of Mechanics, 1754, 8vo; 5. A Treatise of Navigation, 1755, 12mo; 6. A Treatise of Algebra, in two books, 1765, 8vo; 7. The Arithmetic of Infinites, and the Differential Method, illustrated by Examples, 1767, 8vo; 8. Mechanics, or the Doctrine of Motion, 1769, 8vo; 9. The Elements of Optics, in four books, 1768, 8vo; 10. A System of Astronomy, 1769, 8vo; 11. The Laws of Centripetal and Centrifugal Force, 1769, 8vo; 12. The Mathematical Principles of Geography, 1770, 8vo; 13. Tracts, 1770, 8vo; 14. Cyclomathesis, or an easy Introduction to the several branches of the Mathematics, 1770, in 10 vols. 8vo; 15. A short Comment on Sir Isaac Newton's Principia; to which is added, A Defence of Sir Isaac against the objections that have been made to several parts of his works, 1770, 8vo; 16. A Miscellaneous Treatise, containing several Mathematical Subjects, 1776, 8vo.

EMERY, a rich iron ore, found in large masses of no determinate shape or size, but extremely hard and very heavy. It is usually of a dusky-brownish red on the surface; but when broken it is of a fine bright iron grey, though not without some tinge of redness, and is spangled all over with shining specks, which are small flakes of a foliaceous talc, highly impregnated with iron. It is found in some of the Greek islands, in Tuscany, and in some parts of Germany.

EMIGRATION.

The natural propensity of mankind is to settlement and rest, and this principle is still further strengthened by the influence of local associations over the mind. Every one is strongly attached to the place of his birth, or to the place where he has passed his earlier years; and it may be generally remarked, that, in whatever spot man fixes his abode, there he takes root. Habits and sympathies are created, strong attachments are formed, and the longer he remains in any particular place, his aversion to change grows upon him. The power of early associations over the mind is exemplified by constant experience. How many of those adventurers who, at an early age, had quitted their home and their country in pursuit of fame or fortune, do we see daily returning to revive those local affections which, being deeply impressed on the heart while it was yet warm and susceptible, neither time nor distance has been able to efface. And to the powerful influence of the same tender recollections are we to ascribe that painful longing and deep despondency to which the Swiss and other nations are liable when they have been long absent from their country and their home. Such being the general disposition of mankind to rest where their lot is cast, such the various and powerful ties by which they are attached to particular spots, and so general their aversion to change, we may fairly conclude, when we see the inhabitants of any country eagerly engaging in projects of emigration, in opposition to their natural attachment to their native land, and in defiance of all the uncertainty and peril of a new settlement on a distant and unknown shore, that their conduct is not the result of choice, but of necessity; and that, in thus leaving their kindred and their country, they are flying from the pressure of some great and general misery.

General view of the subject.

The great and radical evil which afflicts society is the want of food, which necessarily arises from the tendency of mankind to increase faster than the means of subsistence can be provided. The importance of this great law of nature, under which the want of food is everywhere found to be the grand obstacle to the multiplication of the species, was first duly appreciated by Mr Malthus, who, in his profound and invaluable work *On Population*, has explained and enforced the principle with such elementary clearness and force, and with such various and striking illustrations, that it is now universally adopted as an indisputable maxim of political science.

According to the simple view of this interesting subject, contained in the work of Mr Malthus, it has been ascertained, from the history of the American and other newly settled colonies, that where there is abundance of food, the population has been doubled in some cases in twenty-five, in others in fifteen years; and it is obvious that if 10,000, or any other number of inhabitants, can be doubled within fifteen or twenty-five years, 20,000 or 100,000, or any greater number, may be doubled in the same period with equal facility. The increase of population takes place, therefore, according to a geometrical ratio; every successive addition affording the means of a still greater increase, until the earth being at length replenished with inhabitants, room and food are alike wanting for any farther addition to the human species.

It is not easy to determine the rate according to which the productions of the earth may be supposed to increase. This will in a great measure depend on accidental circumstances. Where there are extensive tracts of fertile and unoccupied land, food will be produced in great abundance; but after these are all cultivated, and the less fertile parts of the country begin to be settled by its increasing inhabitants, subsistence will be produced at a slower rate, and with greater toil. In this manner, we find, the population continues to advance according to an accelerated process, the increase of one period only affording the means of a still greater increase during the next, and this without any limit; whilst the subsistence for this rapidly increasing population, instead of being produced with the same facility, instead of increasing in proportion to the growing wants of the community, is necessarily produced at a slower rate, and with greater toil, at the period when it is most wanted. Whilst the principle of population is yet in full vigour, and is every day acquiring new powers of increase, the produce of the earth is daily procured with greater difficulty. The same causes, therefore, which occasion a continual multiplication of inhabitants, prevent any progressive increase in the supply of provisions. By a long process of skilful cultivation, the earth may at last reach the utmost limits of its productive powers. This state of things, it is supposed, has already taken place in China. No efforts of human industry, however judiciously directed, could ever probably double the produce of this highly cultivated country. But the population could still be doubled in fifteen or twenty years with the same facility as before. All countries which have been long settled and cultivated, are in some measure in a similar condition. No efforts of human skill could possibly draw from Great Britain double its present produce within the period during which its population could be doubled; and in all such countries, therefore, the further increase of inhabitants is checked by the want of food. It is manifest, indeed, that the number of people in any country, or in the world at large, must be limited by the quantity of subsistence provided for their support.

But though it is certain that the population of every country must be kept within the limits of its food, this object may be accomplished by the operation of two different causes. 1*st*, General habits of refinement, or prudential motives, such as the fear of bringing children into existence without the means of supporting them, may so far operate on the minds of the labouring classes as to discourage marriage; in which case no superfluous inhabitants will be produced, and the supply of food, though it will admit of no increase, will still be sufficient for the maintenance of the population already in existence. Where the want of food operates in this manner to check the progress of population, Mr Malthus distinguishes it by the appellation of the *preventive* check. 2*dly*, So strong, however, is the impulse by which man is prompted to multiply his species, that this preventive check seldom operates with sufficient force to restrain the undue increase of population. In all countries mankind have a perpetual tendency to increase faster than food can be provided; and even when the preventive check operates with most effect, the population frequently presses on the very verge of its subsistence, and is thus exposed, by an accidental failure in the ordinary supply of food, to all the miseries of want. As the number of inhabitants is necessarily restricted by the supply of subsistence, it is certain that, if the population increases beyond this limit, it will speedily be brought down to the level of its food by the operation of famine and disease, which Mr Malthus terms the *positive*, in opposition to the *preventive* checks to population.

From this view, then, of the natural and immutable condition of human society, the want of subsistence seems to be a necessary and an inherent evil, under every form of it; to avoid which, mankind, as they begin to increase, are forced to separate in quest of new settlements, in which, the inhabitants being fewer, food is more easily procured. The want of subsistence is therefore the universal and constant cause of emigration, which forces mankind to disperse themselves, and to explore the world for a more desirable abode. It is no love of change or of adventure which prompts them to wander into unfrequented parts. It is the urgent pressure arising from an overcrowded population which impels them from their homes, which breaks the ties of kindred, and forces them to encounter all the hardships and dangers of new and untried scenes. Where a community is happy and prosperous, mankind will follow their natural propensity to settlement and rest; and it is only when this principle is disturbed by an opposite and equally powerful principle, namely, the fear or the actual experience of want, that emigration will be resorted to, as the least of two evils, not from choice, but from necessity. It is under the influence of this great law of nature, namely, the tendency of mankind to increase faster than food can be provided for them, that the earth has been overspread with inhabitants. From the original seats of population and improvement, the human race would naturally overflow into other parts. The regions which were most desirable from their happier soil and climate would be first occupied; these being replenished with people, the overflowing stream would naturally reach the less habitable parts, until at length the frozen regions of the north and the burning climes of the south would be fully peopled, in proportion to the scanty subsistence to be drawn from them by an unskilful and barbarous race.

The earth being in this manner filled with people, and no more vacant space remaining for new emigrations, the great check to population, from the want of subsistence, must now be felt in all its force; and it is evident that no further increase of inhabitants can take place, unless new modes of subsistence be contrived, by which a greater supply of food may be derived from the same extent of territory. The most primitive and barbarous mode of life ever found to prevail among mankind, is when they depend for subsistence on hunting and fishing, or on a casual supply of such produce as the earth spontaneously yields. From the humble and degraded condition of hunters, they gradually emerge into that of shepherds; and while their flocks and herds afford them a more certain provision, the care of these necessarily calls forth a greater degree of foresight than belongs to the hunting tribes; and the community being also in possession of a stock for their immediate subsistence, are in every respect in a superior condition to mere savages. It is in the agricultural state, in which a community, adopting all the most ingenious and successful modes of cultivation, and improving at the same time in all the arts of commerce and industry, gradually accumulates capital and acquires habits of luxury and refinement, that the earth supports the greatest number of inhabitants; and to this state therefore mankind, impelled to improvement by the stimulus of necessity, continually tend. But as the course of improvement is retarded by a variety of causes, it has always happened that, in the general population of the world, three classes have been comprised, who, though variously modified, may be distinguished into those of hunters, shepherds, and agriculturists. When the earth is wholly occupied with these different communities, in each of which the population, according to the great law by which it increases, will soon reach the utmost limit of its food, it is manifest that the great standing cause of emigration will be in constant operation; and in this case there is little doubt that numbers will incur the risks of a removal for the sake of improving their condition.

The inhabitants of a country may emigrate individually, in which case they will be incorporated with the new community into which they enter, and their settlement will be made without violence; or a whole nation may emigrate, with a view of making their way to new settlements by the sword, and of driving out by force the inhabitants of the territory into which their irruption is made. Among civilized nations it is scarcely possible that this mode of emigration can take place. No government would countenance its subjects in any predatory irruption on the territory of another state; neither would the wealth acquired by civilized communities, nor the habits of order, industry, and peace, which wealth necessarily superinduces, at all consist with any such hostile enterprises against the repose of other nations. In an advanced state of society, therefore, the license of emigration is in some degree restrained; mankind emigrate individually, but not in large bodies, and in this manner they are quietly absorbed in the new communities into which they enter, and to the laws and manners of which they necessarily conform. But though the civilized communities of the world never violently emigrate into each other's territories, they frequently invade the domain of the savage, by obtruding new settlers on his uncultivated territories. These emigrating in considerable bodies, and being provided with every necessary implement either of cultivation or of war, take possession of the soil, which they cultivate for their support, and, gradually increasing in proportion as their improved modes of cultivation draw an increased produce from the soil, all the efforts of the original proprietors to dislodge them are found unavailing. From such small beginnings it is that, in modern times, all the flourishing communities of the new world have had their origin.

Amongst the barbarous nations of hunters and shepherds, emigration necessarily assumes the character of violence. The earth being already occupied with inhabitants, it is manifest that no large body of emigrants can effect a settlement in any territory without displacing an equal proportion of the original inhabitants. These, however, will not yield without a struggle; wars naturally commence, which are carried on with an inveteracy suited to the important object at stake; and while the conqueror occupies the vacant ground, the world is thinned of its superfluous inhabitants in these contests for room and food.

The want of subsistence, which thus excites in mankind a restlessness and an impatience of their condition, and finally impels them to emigration, appears, from the experience of all history, to be a most fruitful cause of war; and, in these struggles, the mere savage has little chance against the more formidable violence either of the pastoral tribes or of civilized communities. By the first he is driven from his ground whenever it can be occupied with advantage for the purposes of pasture; while the civilized inhabitants of the globe occupy his territories with new settlers, who, spreading cultivation over the desert, and establishing towns with all their refinements of arts and manufactures where there was formerly a wilderness, destroy the hunting grounds of the savage, and expel him, with the wild beasts, his natural prey, from these seats of industry. Thus driven farther into the woods, he is reduced to fight for his subsistence with other tribes in the same condition as himself, and with whom he has more chance of waging an equal war. Room and subsistence being indispensable to the further multiplication of the species, every combined movement among mankind in quest of these objects is the signal of discord; the savage tribes, confined to the more remote and unfrequented parts of the earth, mutually exterminate each other by their constant and ferocious hostility; and the pastoral nations carry on equally destructive contests with each other, or with more civilized communities. Barbarism and civilization are in this manner the natural enemies of each other; and a most inveterate war is the inevitable consequence of this hostility. On the issue of the contest the very existence of both parties is staked. To the vanquished nothing remains but to perish by famine or the destroying sword. If the barbarous invaders prevail, all traces of civilization are swept away—the form of society is changed—its institutions destroyed, and the nation itself reduced under the most degrading bondage. If, on the other hand, the barbarians are repelled, they have no refuge from destruction. There is no alternative between victory and death; and thus both parties mutually fight with the fury of desperation. But, where the resources of a civilized state are vigorously called forth for the common safety, those formidable inroads will be generally repelled, and the country saved from the ignominy of a barbarian yoke.

Emigrations by which the Roman empire was overthrown.

To this principle, namely, the disproportion between the increase of subsistence and of population, we may trace that spirit of emigration and of conquest which prevailed universally amongst all the pastoral nations of the ancient world. The character and manners of those rude tribes have been powerfully delineated by the eloquent historian of the Roman empire; and Mr Malthus has added a fine historical sketch of the rise and progress of those emigrations which, after a long train of political convulsions, terminated at length in the subversion of the Roman power. It appears that all that vast portion of the earth, from the Danube and the shores of the Baltic to the confines of China, was formerly occupied by a population of shepherds. These, though distinguished into separate nations, possessing a strong principle of unity in the common tie of their congenial manners, easily coalesced under an enterprising leader for any scheme of emigration or conquest. Deriving their subsistence from pasture and the chase, their ordinary life was one of constant migration, in which they were inured to fatigue, and instructed in the use of all warlike weapons; they were skilful horsemen, expert in archery and in throwing the lance, and extremely active in all their movements. In this wide ocean of barbarism, the stream of emigration was either impelled eastward, as accidental circumstances directed, against the flourishing empires of Asia, or westward against the Roman empire, within whose precincts the whole civilization of the western world was comprised; and alternately, as it reached either of these empires, their whole collected strength was found necessary to withstand the shock. Of the great empires of Asia, some were subverted by the formidable inroads of those wandering tribes; and in Europe the doubtful balance of the world's destiny frequently trembled between barbarism and civilization. At an early period Rome was assailed by the inroads of the barbarians, and an irruption of the Gauls had well nigh crushed her rising power. In after times the Cimbri, emigrating in quest of new settlements, were, after they had destroyed five consular armies, arrested in their victorious career by Marius, when the whole nation almost was exterminated. The subsequent contests of Julius Cæsar, of Drusus, Tiberius, and Germanicus, with the Gauls and Germans, still attested the superiority of the Roman arms, and impressed upon the barbarians a salutary terror of the Roman name. Repelled from the Roman frontier, their superfluous resources would naturally be consumed in intestine wars with each other for room and subsistence, until the power of population renewing the strength of those warlike communities, prepared them for fresh conflicts with the civilized world. Accordingly we find them, in the decline of the empire, renewing their irruptions on the Roman territory. During the successive administration of a series of feeble princes, the empire was assailed by new swarms, and the degenerate Romans had recourse to the dangerous policy of bribing the enemy whom they could no longer conquer. This fatal disclosure of wealth and weakness soon excited the cupidity of new enemies, who broke through the ill-guarded frontier, and spread terror to the gates of Rome. The country became one universal scene of rapine and oppression, and it was only by the vigour and activity of Aurelian, Probus, and Diocletian, that the tottering empire was saved from its final overthrow. During this interval the barbarians wasted their population in bloody hostilities with each other, until nature, more powerful to renovate than war to destroy, recruiting their numbers, enabled them to set out on new emigrations with undiminished strength. During the reign of Constantine, the whole power of the empire was again called forth to repel a new invasion of those destroying hordes. They were vanquished on every side, and driven into the mountains, where it is calculated that about 100,000 of them perished from cold and famine. Other invaders now arose, who were routed and dispersed with great slaughter by the warlike Julian, and pursued into the gloomy recesses of the German forests; but those signal successes obtained for the declining empire no relief from incessant attacks, and the reign of Valentinian was one continued contest with the invading hosts. "The fate of Rome," Mr Malthus observes, "was at length determined by an irresistible emigration of the Huns from the east and north, which precipitated on the empire the whole body of the Goths;" and the nations of Germany, goaded on by this powerful impulse, were driven *en masse* on the Roman provinces. "An emigration," Mr Malthus continues, "of 400,000 persons issued from the same coast of the Baltic which had poured forth the myriads of Cimbri and Teutones during the vigour of the republic. When this host was destroyed by war and famine, other adventurers succeeded. The Suevi, the Vandals, the Alani, the Burgundians, passed the Rhine never more to retreat. The conquerors who first settled were expelled or exterminated by new invaders. Clouds of barbarians seemed to collect from all parts of the northern hemisphere. Gathering fresh darkness and terror as they rolled on, the congregated bodies at length obscured the sun of Italy, and sunk the western world in night."

So long as such an extensive space of Europe and Asia was occupied by these pastoral tribes, the repose of the civilized world was constantly assailed by their barbarous invasions; and, in the course of their various expeditions, the finest countries of Europe were taken possession of and plundered. The same principle of increase which was the original cause of all these movements, still continued to operate with undiminished force; but while the central countries of Europe remained in possession of their recent conquerors, there was little chance of easily wresting from them what they had so hardly won; and the spirit of emigration being therefore checked and confined for a time within narrower limits by land, the barbarous nations of the north found vent for their overflowing numbers by sea. During the distractions which ensued in Europe subsequently to the reign of Charlemagne, their maritime enterprises were prosecuted with great vigour, and they spread their devastations over Lower Saxony, Friesland, Holland, Flanders, and other countries. They ravaged the coasts of France, pillaging and burning her finest towns, and at length obtained possession of some of her finest provinces. The British isles were for two hundred years exposed to their ravages; and, during the eighth, ninth, and tenth centuries, their plundering expeditions were directed against all the most powerful nations in Europe, until at length the improving powers of these countries, developed by civilization, and directed by policy, were found sufficient to repel all such irregular inroads. It was in this manner that the growing strength of the European states laid the foundation for that important change of manners among the northern nations, under the influence of which habits of emigration and plunder have been superseded by the peaceful pursuits of agriculture. From this period the repose of the civilized world has never been seriously endangered by the migrations of any barbarous nation; and it is not likely that such contests will ever be renewed. The pastoral tribes were formidable from the vast space over which they were allowed to range. They are now reduced within much narrower limits. Most of them have been reclaimed from their rude habits and trained to industry. What has been thus lost to savage life has been gained by civilization. The resources of the one have been increased as those of the other have diminished. It does not appear, therefore, from the present aspect of the world, that civilized man has any farther injustice to dread from his savage brethren. These views are eloquently enforced by Gibbon, in the philosophical and striking view of the leading causes which conduced to the fall of the western empire, with which he closes his history. "Such formidable emigrations," he observes, "can no longer issue from the north; and the long repose which has been imputed to the decrease of population, is the happy consequence of the progress of arts and agriculture. Instead of some rude villages, thinly scattered among its woods and morasses, Germany now produces a list of two thousand three hundred walled towns; the Christian kingdoms of Denmark, Sweden, and Poland, have been successively established; and the Hanse merchants, with the Teutonic knights, have extended their colonies along the coast of the Baltic as far as the Gulf of Finland. From the Gulf of Finland to the Eastern Ocean Russia now assumes the form of a powerful and civilized empire. The plough, the loom, and the forge, are introduced on the banks of the Volga, the Oby, and the Lena; and the fiercest of the Tartar hordes have been taught to tremble and obey. The reign of independent barbarism is now contracted to a narrow span; and the remnant of Calmucks or Uzbecks, whose forces may be almost numbered, cannot seriously excite the apprehensions of the great republic of Europe."

Character of the more modern emigrations.

In modern times, since the progress of improvement has restrained the license of those rude tribes, the spirit of emigration and conquest has chiefly appeared among the civilized inhabitants of the world, by whose encroachments the barbarous nations have been oppressed. The discovery of the immense continent of America, which was chiefly overspread with savage tribes, or with nations in the infancy of improvement, presented a vast outlet to the overflowing population of civilized Europe; and the reputed wealth of those newly discovered countries, which were found to contain abundance of the precious metals, soon attracted crowds of adventurers from every quarter. The first expeditions of the Spaniards to the New World were for the undisguised purposes of rapine and conquest. They were purely military, not so much with a view to settlement, as to plunder; and it was only after the first race of adventurers had perished, that the emigrants began to establish themselves permanently in the country. With this view they resorted to such measures of violence and cruelty, that in most cases they either extirpated the original inhabitants, or brought them under the most galling bondage; and in those parts of the country where they fled into the deserts beyond the reach of their oppressors, and where they subsist in savage independence, the cruel injuries which they originally suffered is still attested in their inveterate hostility to the Spanish settlers. The settlements of the European states in North America were not planned upon exactly the same principles of open violence. The savage tribes by which this portion of the continent was inhabited presented no such temptations to the avarice of civilized nations, and the first emigrants who were sent out had nothing else in view but to cultivate the country for their subsistence. Agriculture, and not conquest, was their original object. They offered no violence to the native tribes. All they required was a space of unoccupied territory on which to settle, which was generally procured without any difficulty. But as the colony grew and flourished, and began to require an extension of territory, the rude inhabitants of the country quickly perceived that they would soon be dispossessed of their hunting-grounds by the gradual increase of the new settlers. They had committed the capital error of allowing the colonists to take root in the country, and they now endeavoured to correct this error when it was too late. They accordingly entered into combinations for the purpose of exterminating the invaders of their country; and those infant establishments were alternately assailed by secret treachery or open violence. An equally inveterate warfare was in this manner begun with those who settled for the purposes of agriculture, as with those who had commenced their career with open violence; and the object of contest was the possession of the country. From the rapid multiplication of the new settlers, it was obvious that the land would be speedily overspread with their increasing numbers; and the whole being converted to the purposes of agriculture, there would be no room for the hunting tribes. This was the plain and obvious principle of the war which was now commenced. But the issue of a contest between the civilized inhabitants of the globe, assisted by the modern improvement of fire-arms, and the mere hunter of the desert, could not be for a moment doubtful. The arts and policy of Europe accordingly proved too powerful for the Indian savage. He has been gradually pushed back, by the progress of the European colonies, into his native deserts; and though he has occasionally disturbed their progress by his predatory inroads, yet the inveterate warfare in most cases subsisting between the aborigines and the new settlers, by saving all perplexing or fruitless negociations respecting the cession of territory, and by reducing the matter to the plain issue of force, has, upon the whole, favoured the progress of the civilized encroacher on the territory of the savage. The war of extermination which was commenced between the two classes, was sure to end in the destruction of the native inhabitants. A quicker process, indeed, could scarcely have been devised for clearing the country of its barbarous incumbrances; and, however cruel and unjust this may appear, such are unquestionably the harsh means by which the improvement of the North American continent has been brought about. The poor savage has been driven from his territory and his home, to make way for the industrious tiller of the ground. The boundaries of the wilderness have been gradually narrowed by the progress of cultivation; the country has been cleared of its forests and of its inhabitants by the same merciless process of destruction; and upon the ruins of this state of society the system of social improvement has been reared. To the doubtful frontier of the American territory, where civilized gives place to savage life, it is well known that crowds of adventurous emigrants resort, dispensing with the advantages and exempted from all the restraints of social life. Here they act in the double capacity of cultivators and huntsmen, partly civilized and partly savage, until, by the advance of new emigrants, they are gradually surrounded with improvement on every side, and are at length brought within the pale of order and law. Tired of this control, and anxious to resume their free and licentious habits, they dispose of their lands to emigrants of a more settled character, and again take their station on the verge of the desert, there to bear the brunt of savage hostility, to hunt and to cultivate, and by their resolute and ferocious habits to repress the inroads of the exasperated Indians, and to act the part of successful pioneers, in clearing the way for the great mass of the American population. It is in this manner that the country gradually assumes the aspect of civilization, that the fields are cultivated, and that the dwellings of men are seen to take place of the haunts of wild beasts. It is certain, indeed, that the policy of the American government, in regard to the native tribes, has uniformly been humane and enlightened; their original right of occupancy has always been respected, and the cession of their territory has generally been procured in lieu of some satisfactory equivalent offered and received, or a certain portion of it has been reserved out of the lands granted to new settlers for their subsistence. But the licentiousness and cruelties under which the Indians have been oppressed were committed by individuals beyond the precincts of law or government—they were, besides, glossed over under the specious disguise of legitimate hostility; and there was no one to plead the cause of the oppressed Indians. In these circumstances the power of government could be exerted with little effect in favour of the native tribes; and accordingly it is matter of history, that many of the finest parts of the American territory were with difficulty wrested from their original possessors, after a most severe and sanguinary struggle.

Notwithstanding the tendency of mankind to increase faster than food can be provided for them, and the rapid progress of cultivation among civilized nations, a great proportion of the earth is still occupied by savages, who subsist by hunting, and who allow the land to lie waste; or by pastoral tribes, who require a much larger space for their support than agricultural nations; and hence the tide of emigration naturally flows from the cultivated parts of the earth to desert or less cultivated tracts. The continent of America contains at present the largest space of unoccupied land that is to be found in any part of the earth; and it presents, accordingly, a vast outlet to the surplus population of the old and settled communities of Europe. So great also is the extent of this continent, ranging as it does over more than a hundred and twenty degrees of latitude, that the emigrant may choose the climate and the country most congenial to his previous habits. In South America, Chili, with a mild climate and a fertile soil, presents vast tracts of desert territory, well suited to the inhabitants of southern Europe; and on the boundless plains of Buenos Ayres a vast additional population might subsist. The mountainous tracts of Brazil, and the luxuriant valleys that intervene, are still mostly in a state of nature; and to the overflowing population of Spain and Portugal they present a sure asylum for ages to come. The tropical countries in America that approach nearer to the equinoctial line are not so well adapted to European emigrants, their health generally suffering under the enervating influence of the climate; and it is not likely therefore that the arts, the intelligence, and industry of the old world will ever flourish to a great extent in these uncongenial regions. But in North America, in the territory of the United States, or in the British colonies of the Canadas, Nova Scotia, New Brunswick, and their dependencies, every thing concurs to favour the views of the European emigrant. The territory of the United States, stretching from the Gulf of Mexico to the river St Lawrence, comprises great variety of climate, and tracts of singular fertility, on which may be produced all that is necessary for the comfort and enjoyment of man. The numerous streams which everywhere intersect the country, facilitate in a remarkable degree its internal intercourse, while it is further recommended to new settlers by the advantage of its free government, which dispenses equal protection to all. To the north the British settlements present a great outlet to the overflowing population of Europe, and especially of Great Britain. The Canadas, and particularly the upper country, abound in the most fertile tracts, skirted by the great northern lakes which flow into the ocean through the St Lawrence, or intersected by their numerous tributary streams. The winter is tedious and severe, with a dry atmosphere and a clear sky; and the climate, except in particular situations, is not unfavourable to European constitutions. In Nova Scotia and New Brunswick, the winters are still more severe than in the Canadas; and fogs and mists also prevail. But the country is healthy, and the soil yields abundantly European grain, vegetables, and fruit. In all those countries cultivation has made comparatively little progress, and there are in the interior vast tracts of unoccupied territory, which would yield subsistence to additional millions.

America the great outlet to emigration.

In its present condition, therefore, America presents a grand outlet to the surplus population of Europe. It is the natural asylum of all those who are flying in quest of subsistence from the over-crowded communities of the old world. The inhabitants of America have before them an untouched and fertile country, about 2000 miles in extent (counting from their most remote settlements to the Pacific Ocean), in which for centuries to come their population will have full scope to expand. Here there is an ample supply of fertile and unoccupied land, which yields abundance of food, while its cultivation gives rise to a constant demand for new labourers. Wages are consequently high, the labourer lives in comfort; and if he is industrious, he becomes in his turn a purchaser of land, from the savings which he accumulates. If from the rapid increase of population, the demand for labour should be satisfied, and wages should fall, this is the signal for new emigrations, and for the occupation of an additional portion of the uncultivated territory; and thus the abundance of land and the constant demand for labour in the western districts, maintains it at a high price in every part of the United States, as well as throughout the British colonies of North America.

Asia contains vast tracts of territory, either wholly uncultivated or occupied by pastoral tribes, which might be colonized with great advantage by a more civilized population. But those regions, from various causes, from their distance inland, from the disorderly state of society which prevails in most parts of Asia, and from dissimilarity of language and manners, are mostly inaccessible to European colonists. In the Asiatic dominions of Russia, population has been making in some parts a rapid progress; and settlers are gradually, though slowly, spreading over those wastes which were formerly occupied by Tartar hordes. In the vast steppes and meadows watered by the

Irkutsk, the Obi, and the Lena, range many vagrant tribes, that live by pasture or hunting; and here millions of additional inhabitants might easily subsist. But it is only from Russia that new settlers can be received; and centuries may elapse before the slowly increasing population of that empire overflow into such remote regions.

Great Britain has acquired on the continent of Asia the extensive empire of Hindustan and the large island of New Holland; and to both of these countries numerous emigrants resort. But Hindustan is exclusively the resort of the richer classes; the civil and military service of the East India Company affords employment to young men of talent and education; and now that India has been freely laid open, by the late act for regulating the company's affairs, to the capital and intelligence of Europe, numerous settlers from among the enterprising youth of Britain will no doubt be attracted to that land of promise. But to settlers of another description, to mechanics, labourers, or farmers, India holds out no encouragement whatever. On the other hand, it is entirely to this class of emigrants that the British colonies of New South Wales and Van Diemen's Land are so well suited. This great island of New Holland is begirt around four-fifths of its coasts by a circle of barren waste. But within this girdle the country improves, and presents abundance of fertile land, which might be occupied with great advantage by new settlers. Van Diemen's Land is still better adapted to colonists from Britain. It is situated between 40. 42. and 43. 43. south latitude, has a European climate, and a fertile soil. In this newly settled country, as in the United States and British America, provisions are abundant, labour is in great demand, and wages are high.

In Europe the state of things is altogether different; there the population has long pressed against the limits of subsistence; wages in many parts are consequently low, and the condition of the people wretched in the extreme. In Great Britain the misery of poverty has been of late years so deeply felt, that many have recommended that schemes of colonization should be undertaken at the public expense. A committee of inquiry was appointed by the House of Commons, who, after a laborious examination of evidence, published a report on the subject in 1827. This report contains an instructive detail of the present condition of the labouring classes in England, Scotland, and Ireland; from which it appears that in all these countries, especially the latter, population has greatly increased; there are more people than can be employed; the rate of wages is low; and the condition of the labourer is depressed. From the concurring evidence of all the witnesses who have appeared before the different committees of the House of Commons, the condition of the Irish labourers appears to be wretched in the extreme. Population is in Ireland pushed to the very verge of subsistence; the labourer, who has scarcely a bare support from the cheapest food, exists in hopeless degradation and misery; and the least failure of the supply involves thousands in actual starvation. Ireland is so oppressed by superfluous inhabitants, that they overflow into the adjacent countries; and neither England nor Scotland can shut out this contagion of misery. They are inundated by Irish labourers, who bring down the wages of labour, and thus the effect of Irish poverty is to deteriorate the condition of the working classes, not merely in their own, but in other countries.

Such being the condition of the labourer in Ireland, and in some degree also in Great Britain, it is manifest that if he can transport his labour from these overstocked markets to the understocked markets of the United States, or the British colonies in North America or New Holland, he will dispose of it to better advantage. He will unquestionably improve his own condition, while it is obvious, if there is too little either of subsistence or of employment in any country, the emigration of those who require to be employed and to be fed will leave a greater supply for those who remain behind; and hence it is extraordinary that an outcry should have been raised against the emigrants, by those who were enabled by their happier destiny to remain at home. To such length has this spirit been carried, that laws have been passed, obstructing emigration, as if it were an evil; and, with a view of still further discouraging all such schemes, the most exaggerated accounts have been studiously circulated of the distresses and difficulties in which the poor emigrant involves himself by rashly removing to a foreign land. In the Highlands of Scotland, emigration has always been viewed by the landed proprietors with the most extreme jealousy and aversion, although it plainly has its origin in the measures adopted by themselves for the improvement of their own estates. The first step to an improved mode of cultivation is to clear the land of all its useless inhabitants; and the discarded tenants are compelled to seek in a distant land that subsistence which they can no longer find at home. Emigration is the sad alternative which they embrace from necessity; they quit the cherished spot on which their family has been settled for ages, because they can no longer remain, and to refuse them this resource appears both cruel and unreasonable. Under the influence of those prejudices, a law was passed in 1803, for the ostensible purpose of securing to the emigrant good treatment during his voyage, but really with a view, it should seem, of obstructing it altogether. By this law, the most extravagant allowances are prescribed to him, both as to room and food, and these he is not at liberty to dispense with. Its effect is consequently to enhance the expense of the voyage, and to obstruct emigration, or, when this consequence does not follow, to waste the stock of the emigrant, by involving him in useless expenses, and to land him on a foreign shore with diminished resources. It tends, in this manner, like all the other laws which, in the management of private concerns, officiously substitute loose and inapplicable rules for the prompt sagacity of individual prudence, to injure those whom it is intended to serve. By other laws, emigration, to certain classes, is actually prohibited under severe penalties. An artificer who attempts to emigrate "with the intention of devoting his knowledge for the benefit of foreign countries," is liable to punishment, as well as any agent by whom he is encouraged to such an attempt; and, upon this very absurd law, two convictions actually took place at the Old Bailey in 1809; the one of a master, who had offered an artificer advantageous terms to emigrate to the United States, and the other of the artificer, who, having no work at home, had accepted of these terms. It deserves to be remarked, that the judge who tried the case, forsaking his own proper province of merely administering the law, commended highly its policy, and dwelt at great length on the mischievous crime with which the prisoners stood charged, as deservedly and severely punishable by law. It is justly observed by Dr Smith, that the industry of an artificer is his only inheritance, and that to prevent him from disposing of it to the best advantage is an unwarrantable act of power. The object of such regulations is to depress the art and industry of other nations, in order to monopolize for our own industry the market of the world. But this project, which originates in mercantile rivalry of the most pitiful description, is as unjust as it is impolitic. We may indeed prevent, by particular laws, the exportation and importation of certain sorts of produce. But no laws can bind up the inventive powers of man, nor can any partial enactments of particular countries retard the improvement of the world. If the general increase of wealth requires a supply of the finer manufactures, and the proper reward is offered, the art and industry necessary to produce them will be called forth, in spite of the regulations which any one state may pass to the contrary. The law, besides, admits of the following simple evasion: the artificer who intends to emigrate takes his passage as a labourer, and, in this character, he is suffered to depart without further question.

It is clear, that in all cases where there is a greater number of labourers than can be employed, where wages are consequently low, and general distress prevails, emigration is precisely the most effectual remedy for the evil; and that, in proportion as superfluous labourers are withdrawn from the over-crowded communities of Europe, those who are left behind will enter into more full employment and better pay, and will live comfortably in place of starving as before. Whatever may become of the poor emigrants themselves, the country from which they emigrate must be benefited by the quantity of labour thus withdrawn from the market. In place of seeking to arrest the progress of emigration, it would be wiser to encourage it, and rather to give facilities to those who wish to convey their labour from Europe, where the market is overstocked, to those countries where there is a greater demand for it. In later times, accordingly, sounder notions have begun to prevail on the subject of emigration; and it has even been proposed to encourage it on a great scale, by advances of money from the public treasury, or by allowing the parishes to pledge the poor rates in order to furnish the necessary funds. In 1819 the sum of L.50,000 was granted by parliament to aid in settling a small body of emigrants at the Cape of Good Hope. But the climate is unfavourable to European habits, while various other discouraging circumstances obstructed the prosperity of the settlers; so that this experiment of colonization was far from being successful. In 1823 and in 1825, two bodies of emigrants were settled in Canada at the public expense. They received lands and were located on them; and, according to the accounts of those who have since visited them, they have attained to great prosperity and comfort. The last colony consisted of 2024 persons; the expense of settling them was L.43,145, rather more than L.20 for each person; and the superintendent of the undertaking valued the produce of their first year's labour at L.11,272. The emigration in 1823 consisted of 568 Irish emigrants, and cost about L.22 for each emigrant; and it is certain that even this expense, under the careful management of individuals, might be reduced, and would probably not exceed L.13. It was stated by several of the witnesses before the select committee of the House of Commons, that, at an expense of L.60, a family of five persons might be established in such a state of comfort as to insure their happiness. Colonel Talbot, who settled between thirty and forty years ago in Canada, while it was yet a wilderness, and is now surrounded by 20,000 inhabitants, gives the same evidence; and he is farther of opinion that the settlers, if they were industrious, might repay the advances made to them, nay even the expense of their voyage to New South Wales.

The good effects of emigration, not only to the emigrant, but to those who are left behind, being in this manner apparent, it has been proposed that government should aid with the necessary funds, and that the experiment of emigration should be tried on a great scale. The emigration of those who are able to pay their own expenses, though it has been carried to a great extent, is said, and with truth only, to comprise the industrious well-doing class of labourers, who have realized some property, and who contribute to the prosperity of the community in which they live, and are therefore no burden; while it is the poor and starving labourer, who subsists at the expense of others, that it would be of the greatest advantage to send abroad; and it is on this account that many advocate the policy of a public advance of money for this purpose. The facts brought forward certainly afford all the encouragement that can be desired for some experiment of the nature proposed; which, if gone about with caution and vigilance, would establish the poor emigrants in ease and comfort, while it would tend generally to improve the condition of the labouring classes both in Great Britain and Ireland. For such objects it would no doubt be worth while to incur the hazard even of pecuniary loss. But though several successful experiments of emigration have been tried on a small scale, it is somewhat doubtful if they would succeed to a greater extent. A body of two thousand emigrants might be easily settled in the unoccupied lands of the Canadas, and other British colonies. They would be at once incorporated with the increasing population of these rising communities. But it might not be possible to make the same ready provision for 100,000 or 200,000 emigrants; and in this case we incur the danger of squandering the public money in a rash undertaking, and involving in misery those whom it was our intention to serve. Hitherto no great scheme of emigration has been set on foot at the public expense. Encouragements have, however, been offered of advances of money to individuals, to unmarried females, and also to families, desirous of emigrating to New South Wales and Van Diemen's Land. According to a return laid before the House of Commons, it appears that, up to the present time (June 1833), the emigrants to Australia who accepted of these terms consisted of 1200 unmarried females, and that they had received L.16,926; and of 819 families, consisting of 3109 persons, to whom was paid L.16,237. Several parishes have, however, contributed to send abroad labourers out of employment, who are supported from the poor-rates, and at a comparatively moderate expense have relieved themselves of the permanent burden of their maintenance; and such local schemes of emigration, conducted at the expense and under the superintendence of individuals, managed with economy and care, would probably be more successful than any great adventure of this nature, undertaken at the public charge. But the great majority of emigrants have hitherto gone abroad at their own expense.

The following is an account of the number of emigrants who have left this country from the year 1825 to the 31st of December 1832, as laid before the House of Commons.

	1825.	1826.	1827.	1828.	1829.	1830.	1831.	1832.
To the British Colonies............	8,741	12,818	12,648	12,084	13,307	30,574	58,067	66,339
Cape of Good Hope................	114	116	114	135	197	204	114	196
Australian Colonies..................	485	903	715	1,056	2,016	1,242	1,561	3,733
United States........................	5,551	7,063	14,526	12,817	15,078	24,887	23,418	32,872
Total...........	14,891	20,900	28,003	26,092	30,598	56,907	83,160	103,140

It has been already stated that the great cause of emigration is the want of subsistence, and that where a community is prosperous and happy, mankind will follow their natural propensity to settlement and rest. But this general cause is frequently aided by other causes, originating in those changes of manners to which the progress of society is constantly giving rise. In consequence of that great revolution which took place in modern manners when the feudal system was superseded in Europe by the progress of commerce and industry, the numerous retainers of the great landed proprietors were thrown loose upon society, and reduced to quit their former abodes in quest of a new settlement. Prior to the improvement of industry, there was no way in which the proprietors of the soil could consume their surplus produce, but in maintaining a retinue of idle dependents, who repaid, by their fidelity in war, the bounty on which they subsisted during peace. No equivalent existed for which they would exchange their revenues, which were accordingly wasted in the most profuse hospitality; and in these times a train of idle retainers was the never-failing appendage of wealth and greatness. But when commerce and industry began to supply the landed proprietors with a new equivalent in which their surplus produce could be expended, their idle retainers were gradually dismissed, and the surplus produce of the soil, by which they were supported, was now laid out by the landlord in expensive luxuries and refinements. In the more improved parts of the country, all those changes have already taken place. The land is invariably let for the highest rent that can be procured, and the superfluous population from which it has been freed is absorbed in the general mass of society. But in the Highlands of Scotland these changes are not yet fully accomplished. Traces are still to be discerned of that ancient state of manners which was formerly prevalent all over the country, but which is now fast disappearing before the progress of improved cultivation. Until about the year 1745, the landed estates in the Highlands of Scotland were occupied by tenants, who paid for the possession of the land rather in military services than in money; and though after this period these services were of little use to the proprietors, yet from habit, and the influence of old attachments, the tenantry were still continued on their lands. The obvious interest of the proprietor in letting his lands to the best advantage has gradually broken the force of these old feudal connections, and the hereditary occupants of the Highland estates are now ejected by the landlord, to make way for a more improved mode of cultivation, and for more profitable tenants. Under the old system, as many inhabitants were settled on the land as it could maintain; under the new system no more hands are maintained on it than can be profitably employed; and the superfluous labourers or tenants, who are thus removed from the spot which their families have possessed for centuries, naturally turn their views to America, where there are boundless tracts of unoccupied land ready to receive them. Their early habits and mode of life entirely disqualify them for mercantile business. Ejected from their hereditary possessions, they are in a manner outcasts in their native land, and, in search of some new place of rest, they voluntarily quit their kindred and their home.

Emigrations from the Highlands of Scotland.

The emigrations from the Highlands of Scotland have always kept pace with the progress of improvement, and from about the year 1773 they have been continued with little intermission. Of all those who were thus compelled to quit their native land, America became the natural asylum; and to different points of this extensive continent they were attracted by circumstances in a great measure accidental. The first emigrations were undertaken under all the disadvantages and anxiety of imperfect information; but these having succeeded, a more secure foundation was laid for future enterprises of the same nature, and the Highlanders who were disposed to emigrate naturally chose the spot where their friends were already settled. In this way they are scattered throughout different parts of the American continent. Some have formed settlements in the state of New York, on the Delaware, the Mohawk, and the Connecticut; while others have gone to Georgia and to North Carolina, or to the more northerly climate of Canada and Nova Scotia. Their choice of a settlement appears to have been dictated by the natural wish of being near their friends, by whose experience and advice they would be assisted through all the difficulties of a first establishment. A mode of conduct more rational, more calculated for social comfort and for ultimate success, can scarcely be imagined; and if the interest of the emigrant had been alone considered, no other plan would ever have been adopted.

Observations on Lord Se kirk's pl

The late Lord Selkirk appears to have viewed the decay of ancient manners in the Highlands, and the ejection of the unfortunate peasantry from their lands, with a deep and compassionate interest; and he assisted and advised them in their plans of emigration, and himself conducted and settled two bodies of emigrants in North America. But it is deeply to be regretted, that in the emigrations planned by Lord Selkirk, other views were mingled with the original and simple purpose of these expeditions. Instead of assisting the Highlanders in their own natural and rational plan of joining their friends already settled on the other side of the Atlantic, his purpose, as he himself states, was to detach them from those natural ties; to counteract the motives which induced them to follow their friends and relations, and to collect them into a new settlement, under the dominion of the mother country. After pointing out the strong inducements which the emigrants have to collect in particular spots, to which the presence of their friends and connections impart the attraction almost of another home, he observes, that, to overcome these motives, it is indispensable that "some strong inducement should be held out to the first party who will settle in the situation offered to them. To detached individuals," he continues, "it would be difficult to offer advantages sufficient to counterbalance the pleasure of being settled among friends, as well as the assistance they might expect from relations. But a considerable body of people connected by the ties of blood and friendship may have less aversion to try a new situation." Lord Selkirk objects to emigration where the adventurers are allowed to follow their own notions, and settle in detached bodies in different parts of the American territory, because it scatters the national resources, which he proposes to keep together, by inducing the emigrants to settle in the British colonies, "where," he observes, "they would be of national utility," and where all the peculiarities of their language and manners might be preserved. He seems also to imagine, that if the Highlanders were settled on the Canadian frontier, they would form an admirable outpost to guard the colony from the intrusion of American settlers, and from the worse plague of the American principles, of which he entertains a great dread, and against which he considers the inveterate loyalty of the Highlanders as an admirable barrier. In pursuance of those views, a colony of Highlanders was induced by Lord Selkirk to settle in Prince Edward's Island, in the Gulf of St Lawrence, where an establishment was formed, and where, in the course of about two years, a supply of subsistence was produced equal to the wants of the settlers. Another colony was afterwards conducted to the western parts of Upper Canada, and settled on Red River, where it encountered the most violent opposition from the deep-rooted jealousy of the *North-West Canadian Fur Company;* to counteract whose schemes Lord Selkirk purchased shares in the Hudson's Bay Company; and in the course of the rivalry which now took place, various acts of hostility and sanguinary outrage were committed. In one serious conflict which occurred, about twenty or thirty of Lord Selkirk's people lost their lives, and the settlement was nearly destroyed. From this calamity it slowly revived, and, by the accession of new settlers, its inhabitants are said to amount to about 500. In 1821, the Hudson's Bay Company and the North-West Company formed a coalition, which terminated their mutual hostilities.

To the plans of emigration set on foot by Lord Selkirk there is this strong and general objection, that they propose to accomplish objects in which the emigrant has not the most remote interest, and for which all the comfort, as well as the solid advantages, which he would derive from the intercourse of his relations and friends, are uselessly sacrificed. The sole purpose for which he quits his country is to procure a settlement in another on the most easy and advantageous terms; this is his only motive for embarking in so hazardous an enterprise; and whatever is unconnected with his ultimate prosperity and happiness is entirely foreign to the main object of his voyage. To settle among friends and relations, whose comfort and assistance is material to the emigrant, or in a country which has the benefit of a free and enlightened government, where he is sure of protection, and where, as much as possible, he may have all the helps of civilization to facilitate his progress, is wise and rational; and there is something unnatural, as well as revolting, in the notion of extinguishing all those social feelings which bind the emigrant to his friends and relations, and which revive, even on a foreign shore, the image of his native land. According to Lord Selkirk's plan, the emigrant is deprived of all those consolations; and he is tempted to try a new situation, for the vague and chimerical purpose of concentrating, for the benefit of the mother country, resources which would be otherwise scattered; or for the still more chimerical purpose of guarding the Canadian frontier from the inroad of American principles. These are political objects in which the emigrant has not the most remote interest. Formerly, the emigrants from the Highlands had almost the whole continent of North America open to their choice. They could settle among their countrymen and relations, amid the blessings of civilization and of regular government. According to Lord Selkirk's plan, they are thrown upon precisely the very worst portion of the American continent, withdrawn from the more genial climes of the South, exposed to the long rigours of a Canadian winter, and separated from their friends. The first body of emigrants who accompanied Lord Selkirk were settled on an island in the Gulf of St Lawrence, in a desolate spot, thirty miles from any habitation, in "circumstances scarcely more favourable," as he himself observes, "than if the island had been completely desert." His second colony was established on the continent, far to the westward of any settlement, and wholly without the precincts of civilization or regular government; and the fatal catastrophe by which it was overwhelmed is a suitable commentary on the original impolicy of choosing the desert for a settlement, and of relinquishing the protection of government, with all the other advantages of a more improved state of society. The happiness and comfort of the colonists, which is the fundamental principle of all colonization, was made subservient in those plans to other objects, in the highest degree absurd and chimerical; other interests were allowed to mingle with that great and radical interest; and useless hazards were incurred, hazards which were avoided so long as the emigrants were allowed to follow the sure and unerring instincts of their own individual prudence. (F.)

EMINENCE, in *Geography*, a little hillock or ascent above the level of the adjoining champaign country.

Eminence is also a title of honour given to cardinals. The decree of the pope, by which it was appointed that the cardinals should be addressed under the quality of *eminence*, bears date the 10th of January 1630. They then laid aside the titles of *illustrissimi* and *reverendissimi*, which they had before borne. The grand master of Malta was likewise addressed under the quality of *eminence*. The popes John VIII. and Gregory VII. gave the same title to the kings of France. The emperors have likewise borne it.

EMIR, a title of dignity amongst the Turks, signifying a prince. This title was first given to the caliphs; but when they assumed the title of sultans, that of emir remained to their children, as that of Cæsar among the Romans. At length the title came to be attributed to all who were judged to be descended from Mahommed by his daughter Fatima, and who consequently wear the green turban instead of the white. The Turks make an observation, that the emirs, before their fortieth year, are men of the greatest gravity, learning, and wisdom; but after this, if they are not great fools, they discover some signs of levity and stupidity. This is interpreted by the Turks as a sort of divine impulse in token of their birth and sanctity. The Turks also call the vizirs, pashas, or governors of provinces, by this name.

EMISSARY, in a political sense, a person employed by another to sound the opinions of people, spread certain reports, or act as a spy over other people's actions.

EMMANUEL, or Immanuel, a Hebrew word, which signifies "God with us." Isaiah (vii. 14), in that celebrated prophecy in which he declares to Ahaz the birth of the Messiah, who was to be born of a virgin, says, this child shall be called, and really be, Emmanuel, that is, *God with us.* The same prophet (viii. 8) repeats the same thing, whilst speaking of the enemy's army, which, like a torrent, was to overspread Judea. "The stretching out of his wings shall fill the breadth of thy land, O Emmanuel." The evangelist Matthew (i. 23) informs us, that this prophecy was accomplished in the birth of Christ, born of the virgin Mary; in whom the two natures, divine and human, were united, and so in this sense he was really Emmanuel, or God with us.

EMMERICH, a city of the Prussian Rhenish province of Julich-Cleeves, in the circle of Rees. It stands on the river Rhine, and contains two Catholic, a Lutheran, a Calvinist, and a Mennonite church, with 980 houses and 4450 inhabitants. It has linen and woollen manufactories, and enjoys considerable trade by the Rhine, and especially in leather. Long. 6. 7. 37. E. Lat. 51. 50. 17. N.

EMMIUS, Ubbo, born at Gretha in East Friesland in 1547, was a very learned professor, and chosen rector of the college of Norden in 1579. This seminary flourished exceedingly under his care; but it declined as visibly after he was ejected, in 1587, for refusing to subscribe the confession of Augsburg. The year afterwards he was made rector of the college of Leer; and when the city of Groningen confederated with the United Provinces, the magistrates appointed him rector of that college; which employment he filled with high reputation for nearly twenty years, until the college was erected into an university, when he became the first rector, and one of its chief ornaments by his lectures, till his infirmities prevented his public appearance. His wisdom was equal to his learning, so that the governor of Friesland and Groningen often consulted him, and seldom failed to follow his advice. He wrote, 1. *Opus Chronologicum*, Groningen, 1619, fol.; 2. *Vetus Græcia illustrata*, Leyden, 1626, 8vo; 3. *Rerum Frisicarum Historia*, Leyden, 1616, fol.; 4. *Historia Temporis nostri*, Groningen, 1732, 4to; and other works. He died in 1625.

EMMENAGOGUES, Εμμηναγωγα, in *Medicine*, such remedies as promote the menstrual discharge. They are thus called from εν, in, μην, month, αγω, *duco*, I lead, because the natural period of flowing is once a month.

EMOLLIENTS, in *Medicine* and *Pharmacy*, are such remedies as soften the asperity of the humours, and at the same time relax the rigidity of the solids.

EMOLUMENT is properly applied to the profits arising daily from an office or employment. The word is formed from the Latin *emolumentum*, which, according to some, primarily signifies the profits redounding to the miller from his mill. The patent, or other instrument, by which a person is preferred to an office, gives him a right to enjoy all the duties, honours, profits, and emoluments belonging thereto. *Emolument* is also used, with somewhat greater latitude, to signify profit or advantage in general.

EMOTION and PASSION are thus distinguished by Lord Kames, in his *Elements of Criticism*. "An internal motion or agitation of the mind, when it passeth away without desire, is denominated *an emotion;* when desire follows, the motion or agitation is denominated *a passion.* A fine face, for example, raiseth in me a pleasant feeling; if that feeling vanish without producing any effect, it is in proper language an *emotion;* but if the feeling, by reiterated views of the object, become sufficiently strong to occasion desire, it loses its name of emotion, and acquires that of *passion.* The same holds in all the other passions. The painful feeling raised in a spectator by a slight injury done to a stranger, being accompanied with no desire of revenge, is termed an emotion; but that injury raiseth in the stranger a stronger emotion, which being accompanied with desire of revenge, is a passion. External expressions of distress produce in the spectator a painful feeling, which being sometimes so slight as to pass away without any effect, is an emotion; but if the feeling be so strong as to prompt desire of affording relief, it is a passion, and is termed a *pity.* Envy is emulation in excess; if the exaltation of a competitor be barely disagreeable, the painful feeling is an emotion; if it produce desire to depress him, it is a passion."

EMOUY, AMOY, or HIAMEN, an island of China, near the south-east coast, belonging to the province of Fokien. It was formerly resorted to by Europeans before their commerce was restricted to Canton. It is about fifteen miles in circuit, and has a fort constructed between the island and the main. Here are several temples, one of them dedicated to the god Fo, with his statue of colossal size; and here also are the images of numerous other divinities, besides strange allegorical paintings. Long. 118. 22. E. Lat. 24. 30. N.

EMPALEMENT, an ancient punishment, which consisted in thrusting a stake through the fundament. The word comes from the French *empaler*, or the Italian *impalare;* or rather, both are derived from the Latin *palus*, a stake, and the preposition *in*, in or into. We find mention made of empaling in Juvenal. It was frequently practised in the time of Nero, and continues to be so in Turkey.

EMPEDOCLES, a celebrated philosopher and poet, was born at Agrigentum, a city in Sicily. He followed the Pythagorean philosophy, and admitted the doctrine of the metempsychosis. He constantly appeared with a crown of gold on his head, in order to maintain, by this outward pomp, the reputation which he had acquired of being a very extraordinary person. Yet Aristotle says that he was a great lover of liberty, extremely averse to state and command, and that he even refused a kingdom which was offered him. His principal work was a treatise in verse on the Nature and Principles of Things. Aristotle, Lucretius, and all the ancients, pronounce the most magnificent eulogiums on his poetry and eloquence. Empedocles taught rhetoric, and often alleviated the anxieties of his mind, as well as the pains of his body, with music. It is reported that his curiosity to visit the flames of the crater of Ætna proved fatal to him. Some maintain that he wished it to be believed that he was a god, and, in order that his death might be unknown, threw himself into the crater, and perished in the flames. If such were his expectations, however, they were frustrated; for the volcano, by throwing up one of his sandals, discovered to the world that Empedocles had perished by fire. Others report that he lived to an extreme old age, and was drowned in the sea about 440 years before the Christian era.

EMPEROR (*imperator*), among the ancient Romans, signified a general of an army, who, for some extraordinary success, had been complimented with this appellation. Thus Augustus, having obtained no less than twenty famous victories, was as often saluted with the title *emperor;* and Titus was denominated *emperor* by his army after the reduction of Jerusalem. Subsequently it came to denominate an absolute monarch or supreme commander of an empire. In this sense Julius Cæsar was called *emperor;* the same title descended with the dignity to Octavianus Augustus, Tiberius, and Caligula; and afterwards it became elective. In strictness the title *emperor* does not, and cannot, add any thing to the rights of sovereignty; its effect is only to give precedence and pre-eminence above other sovereigns; and as such, it raises those invested with it to the summit of all human greatness. In the east, the title and quality of emperor are more frequent than in Europe; thus, the sovereign princes of China, Japan, Mogul, &c. are all emperors. In Europe, the first who bore the title was Charlemagne, upon whom it was conferred by Pope Leo III. though he had all the power before.

EMPHASIS, in *Rhetoric*, a particular stress of the voice and action, laid on such parts or words of the oration as the orator wants to enforce upon his audience.

EMPHYSEMA, in *Surgery*, a windy tumour, generally occasioned by a fracture of the ribs, and formed by the air insinuating itself, by a small wound, between the skin and muscles, into the substance of the cellular or adipose membrane, and then spreading itself up to the neck, head, belly, and other parts, much in the same manner as butchers blow up their veal.

EMPIRE (*imperium*), in political geography, a large extent of land, under the jurisdiction or government of an emperor. In ancient history we read of four great monarchies or empires, namely, that of the Babylonians, Chaldeans, and Assyrians; that of the Medes and Persians; that of the Greeks; and that of the Romans. The first subsisted from the time of Nimrod, who founded it in the year of the world 1800, according to the computation of Usher, till that of Sardanapalus their last king in 3257, and consequently lasted above 1450 years. The empire of the Medes commenced under Arbaces, in the year of the world 3257, was united to that of the Babylonians and Persians under Cyrus, in 3468, and closed with the death of Darius Codomannus in 3674. The Grecian empire lasted only during the reign of Alexander the Great, beginning in the year of the world 3674, and terminating with the death of this conqueror in 3681, his conquests having been divided amongst his captains. The Roman empire commenced with Julius Cæsar, when he was made perpetual dictator, in the year of the city 708, and of the world 3956, forty-eight years before Christ. The seat of the empire was removed to Byzantium by Constantine, in the year of our Lord 334; and the East and West were then united under the title of the Roman empire, till the Romans proclaimed Charlemagne emperor, in the year 800. From this epoch the East and West formed two separate empires. That of the East, governed by Greek emperors, commenced in the year 302; and being gradually weakened, terminated under Constantine Palæologus in 1453. The western empire was afterwards known by the appellation of the empire, or German empire. Antiquaries distinguish between the medals of the Upper and Lower Empire. The curious only value those of the Upper Empire, which commenced with Cæsar or Augustus, and ended in the year of Christ 260. The Lower Empire comprehended near 1200 years, reckoning downwards till the destruction of Constantinople in 1453. Two ages, or periods, of the Lower Empire are usually distinguished; the first beginning where the Upper ends, namely, with Aurelian, and terminating with Anastasius, including 200 years; and the second beginning with Anastasius, and ending with the Palæologi, which includes 1000 years.

Empire, or *The Empire*, used absolutely and without any addition, signifies the empire of Germany, which is also called in juridical acts and laws the holy Roman empire. It had its beginning at the commencement of the ninth century, when Charlemagne was created first emperor by Pope Leo III. who put the crown on his head in St Peter's church on Christmas day in the year 800.

EMPIRIC, an appellation given to those physicians who conduct themselves wholly by their own experience, or by arbitrary modes, without studying physic in a regular way. Some even use the term in a still worse sense, for a quack who prescribes at random, without being at all acquainted with the principles of the healing art.

EMPRESS, the spouse of an emperor, or a woman who governs an empire.

EMPROSTHOTONOS, a species of convulsion, in which the head bends forward.

EMPYREUM, a term used by divines for the highest heaven, where the blessed enjoy the beatific vision. The word is formed of εν, *in*, and πυρ, *fire*, because of its splendour.

EMPYREUMA, in *Chemistry*, signifies a very disagreeable smell produced from burnt oils. It is often perceived in the distillation of animal as well as vegetable substances, when these are exposed to a quick fire.

EMS, a market-town of the duchy of Nassau, in Germany. It stands on the river Lahn, which runs to the Rhine. It is a celebrated place, on account of the warm springs, which are much frequented at the proper season, as well for cure as for relaxation and pleasure. There are no fewer than thirty-three warm baths. The water is of the heat of 37° of Reaumur. The country around is wild and romantic. The regular residents are only about 350.

EMULATION, a generous ardour kindled by the praiseworthy example of others, which impels us to imitate, to rival, and, if possible, to excel them. This passion involves in it esteem of the person whose attainments or conduct we emulate, and of the qualities or actions in which we emulate him, and a desire of resemblance, together with a joy springing from the hope of success. The word comes originally from the Greek ἁμιλλα, a *dispute* or *contest*; whence the Latin *æmulus*, and thence our *emulation*.

EMULGENT or Renal Arteries, those which supply the kidneys with blood; being sometimes single, sometimes double, on each side.

EMUNCTORY, in *Anatomy*, a general term for all those parts which serve to carry off the excrementitious parts of the blood and other humours of the body. Such are the kidneys, bladder, and most of the glands.

ENALLAGE, in *Grammar*, is when one word is substituted for another of the same part of speech: a substantive for an adjective; as *exercitus victor*, for *victoriosus*; *scelus*, for *scelestus*: a primitive for a derivative; as *Dardana arma*, for *Dardania*: an active for a passive; as *nox humida cælo precipitat*, for *præcipitatur*; and so on.

ENAMEL, in general, is a vitrified matter, betwixt the parts of which is dispersed some unvitrified matter; and hence enamel ought to have all the properties of glass except transparency.

Enamels have for their basis a pure crystal glass or frit, ground up with a fine calx of lead and tin prepared for the purpose, with the addition usually of white salt of tartar. These ingredients baked together are the matter of all enamels, which are made by adding colours to this matter, and melting or incorporating them together in a furnace.

For white enamel, Neri (*De Arte Vitriar.*) directs only manganese to be added to the matter which constitutes the basis; for azure, zaffer mixed with calx of brass; for green, calx of brass with scales of iron, or with crocus martis; for black, zaffer with manganese or with crocus martis, or manganese with tartar; for red, manganese, or calx of copper and red tartar; for purple, manganese with calx of brass; for yellow, tartar and manganese; and for violet-coloured enamel, manganese with thrice-calcined brass.

In making these enamels, the following general cautions are necessary to be observed: 1. That the pots must be glazed with white glass, and must be such as will bear the fire. 2. The matter of enamels must be very nicely mixed with the colours. 3. When the enamel is good, and the colour well incorporated, it must be taken from the fire with a pair of tongs. 4. The general way of making the coloured enamel is this: Powder, sift, and grind all the colours very nicely, and first mix them with one another, and then with the common matter of enamels; next set them in pots in a furnace, and when they are well mixed and incorporated, cast them into water; when dry, set them in a furnace again to melt; and when melted, take a proof of the enamel. If too deep coloured, add more of the common matter of enamels; and if too pale, add more of the colours.

Enamels are used either in counterfeiting or imitating precious stones, and in painting in enamel; or by enamellers, jewellers, and goldsmiths, in gold, silver, and other metals. The first two kinds are usually prepared by the workmen themselves who are employed in these arts; that used by jewellers and others is brought chiefly from Venice or Holland, in little cakes of different sizes, commonly about four inches diameter, having the mark of the maker struck upon it with a puncheon.

ENAMELLING, the art of laying enamel upon metals, as gold, silver, or copper, and of melting it on the fire, or of making divers curious works in it by means of a lamp. It signifies also to paint in enamel.

The method of painting in Enamel. This is performed on plates of gold or silver, and most commonly of copper, Enamelling.

enamelled with the white enamel, on which painting is executed with colours which are melted in the fire, where they take a brightness and lustre like that of glass. This painting is the most prized of all for its peculiar brightness and vivacity, which is permanent, the force of its colours not being liable to be effaced or sullied with time, as in other painting, and continuing always as fresh as when it came out of the workmen's hands. This method of painting is usual in miniature; but it is the more difficult the larger it is, by reason of certain accidents to which it is liable in the operation. Enamelling should only be practised on plates of gold, the other metals being less pure; copper, for instance, scales with the application, and yields fumes, and silver turns the yellow white. Nor must the plate be made flat; for in such case the enamel cracks; to avoid which accident the plates are usually forged a little round or oval, and not too thick. The plate being well and evenly forged, the operation is usually commenced by laying on a couch of white enamel (as we observed above) on both sides, which prevents the metal from swelling and blistering; and this first layer serves for the ground of all the other colours. The plate being thus prepared, the next step is to draw out exactly the subject to be painted with red vitriol, mixed with oil of spike, marking all parts of the design very lightly with a small pencil. After this, the colours (which must be previously ground with water in a mortar of agate extremely fine, and mixed with oil of spike somewhat thick) are to be laid on, observing the mixtures and colours which agree to the different parts of the subject; for which purpose it is necessary to understand painting in miniature. But here the workmen must be very cautious as to the quality of the oil of spike he employs to mix his colours with, for it is very subject to adulteration.

Great care must likewise be taken that the least dust imaginable mix not with the colours while the artist is either painting or grinding them; for the smallest speck worked up with the colour, when the work comes to be put into the reverberatory to be made red hot, will leave a hole, and so deface the performance.

When the colours are all laid, the painting must be gently dried over a slow fire to evaporate the oil, and the colours afterwards melted to incorporate them with the enamel, making the plate red hot in a fire like that which the enamellers use. Afterwards that part of the painting must be gone over again which the fire has in any degree effaced, strenghening the shade and colours, and committing it a second time to the fire, observing the same method as before, which is to be repeated till the work be finished.

Method of ENAMELLING *by the lamp.* Most enamelled works are wrought at the fire of a lamp, in which, instead of oil, is put melted horse-grease, which they called *caballine oil.* The lamp, which is of copper, or white iron, consists of two pieces; in one of which is a kind of oval plate, six inches long and two inches high, in which are put the oil and the cotton; whilst the other part, called the *box*, in which the lamp is inclosed, serves only to receive the oil which boils over by the force of the fire. This lamp, or, where several artists work together, two or more lamps, are placed on a table of proper height, under which, about the middle of its height, is a double pair of organ-bellows, which one of the workmen moves up and down with his foot to quicken the flame of the lamps, which by this means is excited to an incredible degree of vehemence. Grooves made with a gauge in the upper part of the table, and covered with parchment, convey the wind of the bellows to a pipe of glass before each lamp; and in order that the enamellers may not be incommoded with the heat of the lamp, every pipe is covered at six inches distance with a little tin plate, fixed into the table by a wooden handle. When the works do not require a long blast, the workmen only use a glass pipe, into which they blow with their mouth.

Encænia
||
Encaustic
Painting

It is incredible to what a degree of fineness and delicacy the threads of enamel may be drawn at the lamp. Those which are used in making false tufts of feathers are so fine that they may be wound on a reel like silk or thread. The fictitious jets of all colours used in embroideries are also made of enamel, and that with so much art, that every small piece has its hole to pass the thread through with which it is sewed. These holes are made by blowing them into long pieces, which are afterwards cut with a proper tool.

It is seldom that the Venetian or Dutch enamels are used alone; they are commonly melted in an iron ladle, with an equal part of glass or crystal; and when the two matters are in perfect fusion, the mass is drawn out into threads of different sizes, according to the nature of the work. The workmen take it out of the ladle while liquid with two pieces of broken tobacco-pipes, which they extend from each other at arm's length. If the thread is required still longer, then another workman holds one end, and continues to draw it out, while the first holds the enamel to the flame. Those threads, when cold, are cut into whatever lengths the workman thinks fit, but commonly from ten to twelve inches; and as they are all round, if they are required to be flat, they must, while hot, be drawn through a pair of pincers. They have also another iron instrument in the form of pincers for drawing out the enamel by the lamp when it is to be worked and disposed in figures. Lastly, they have glass tubes of various sizes, which serve to blow the enamel into various figures, and preserve the necessary vacancies therein, as also to spare the stuff, and form the contours. When the enameller is at work, he sits before the lamp with his foot on the step which moves the bellows; and holding in his left hand the work to be enamelled, or the brass or iron wires on which the figures are to be formed, he directs with his right the enamel thread, which he holds to the flame with a management and patience equally surprising. There are few things which cannot be made or represented with enamel; and some figures are as well finished as if done by the most skilful carvers.

ENCÆNIA, the name of three several festivals celebrated by the Jews in memory of the dedication, or rather purification, of the temple of Judas Maccabæus, Solomon, and Zorobbabel. This term is likewise used in church history for the dedication of Christian churches.

ENCAUSTIC and ENCAUSTUM, the same with enamelling and enamel.

ENCAUSTIC *Painting*, a method of painting made use of by the ancients, in which wax was employed to give a gloss to their colours, and to preserve them from injury by air or moisture.

This ancient art, after having been long lost, was restored by Count Caylus, a member of the Academy of Inscriptions in France; and the method of painting in wax was announced to the Academy of Painting and Belles-Lettres in the year 1753; but M. Bachelier, the author of a treatise *De l'Histoire et du Secret de la Peinture en Cire*, had actually painted a picture in wax in 1749; and he was the first who communicated to the public the method of performing the operation of inustion, which is the principal characteristic of the encaustic painting. The count kept his method a secret for some time, contenting himself with exhibiting a picture at the Louvre in 1754, representing the head of Minerva, painted in the manner of the ancients, which excited the curiosity of the public, and was very much admired. In the interval of suspense, several attempts were made to recover the ancient method of painting. The first scheme adopted was that of melting wax and oil of turpentine together, and using this composition as a vehicle for mixing and laying on the colours. But this method did not explain Pliny's meaning, as in this way of managing it the wax is not burnt. In another attempt, which was much more agreeable to the historian's description of encaustic painting, the wax was melted with strong lixivium of salt of tartar, and with this the colours were ground. When the picture was finished, it was gradually presented to the fire, so as to melt the wax, which was thus diffused through all the particles of the colours, so that they were fixed to the ground, and secured from the access of air or moisture. But the method of Count Caylus is much more simple. The cloth or wood which he designed as the basis of his picture is waxed over by only rubbing it simply with a piece of bees-wax; the wood or cloth, stretched on a frame, being held horizontally over, or perpendicularly before a fire, at such a distance that the wax might gradually melt whilst it is rubbed on, diffuse itself, penetrate the body, and fill the interstices of the texture of the cloth, which when cool is fit to be painted upon; but as water colours, or those which are mixed up with common water, will not adhere to the wax, the whole picture is to be first rubbed over with Spanish chalk or white, and then applied to it. When the picture is dry, it is put near the fire, by means of which the wax melts, and absorbs all the colours.

Mr J. H. Muntz, in a treatise on this subject, has proposed several improvements in the art of encaustic painting. When the painting is on cloth, he directs it to be prepared by stretching it on a frame, and rubbing one side several times over with a piece of bees-wax, or virgin wax, till it be covered with a coat of wax of considerable thickness. In fine linen this is the only operation necessary previous to painting; but coarse cloth must be rubbed gently on the unwaxed side with a pumice-stone, to take off all those knots which would prevent the free and accurate working of the pencil. Then the subject is to be painted on the unwaxed side with colours prepared and tempered with water; and when the picture is finished, it must be brought near the fire, that the wax may melt and fix the colours. This method, however, can only be applied to cloth or paper, through the substance of which the wax may pass; but in wood, stone, metals, or plaster, the former method of Count Caylus must be observed.

Mr Muntz has also discovered a method of forming grounds for painting with crayons, and fixing these, as well as water-colours employed with the pencil. On the unwaxed side of a linen cloth, stretched and waxed as before, lay an even and thick coat of the colour proper for the ground; having prepared this colour by mixing some proper pigment with an equal quantity of chalk, and tempering them with water. When the colour is dry, bring the picture to the fire, in order that the wax may melt, pass through the cloth, and fix the ground. An additional quantity of wax may be applied to the back of the picture, if that which was first rubbed on should not be sufficient for the body of colour; but as this must be laid on without heat, the wax should be dissolved in oil of turpentine, and applied with a brush, and the canvass should be again exposed to the fire, that the fresh supply of wax may pass through the cloth, and be absorbed by the colour; and thus a firm and good body will be formed for working on with the crayons. If cloth and paper are joined together, the cloth must be first fixed to the straining frame, and then the paper must be pasted to it with a composition of paste made with wheaten flour, or starch and water, and about a twelfth part of its weight of common turpentine. The turpentine must be added to the paste when it is almost sufficiently boiled, and the composition well stirred, and left to simmer over the fire for five or six minutes. Let wax be dissolved in oil of turpentine to the consistence of a thin paste; and when the cloth and paper are dry, let them be held near a fire, and with a brush lay a coat of the wax and turpentine on both sides of the joined cloth and paper, in such a degree of thickness that both surfaces may shine throughout without any appearance of dull spots. Then expose the cloth to the fire, or to the sun, by which means the oil will evaporate, and the wax become solid, and be fit to receive any composition of colour for a ground, which is to be laid on as above directed in the case of cloth without paper.

Almost all the colours which are used in oil painting may also be applied in the encaustic method. Mr Muntz objects, indeed, to brown, light pink, and unburnt *terra di Sienna*, because these, on account of their gummy or stony texture, will not admit such a cohesion with the wax as will properly fix them; but other colours which cannot be admitted in oil painting, as red lead, red orpiment, crystals of verdigris, and red precipitate of mercury, may be used here. The crayons used in encaustic painting are the same with those used in the common way of crayon painting, excepting those which in their composition have too great tenacity; and the method of using them is the same in both cases.

The encaustic painting has many peculiar advantages: though the colours have not the natural varnish or shining which they acquire with oil, they have all the strength of paintings in oil, and all the airiness of water-colours, without partaking of the apparent character or defects of either. They may be looked at in any light and in any situation, without any false glare; the colours are firm, and will bear washing; and a picture, after having been smoked, and then exposed to the dew, becomes as clean as if it had been but just painted. It may also be retouched at pleasure without any detriment to the colours; for the new colours will unite with the old ones, without spots, as is the case in common size painting: nor is it necessary to rub the places to be touched with oil, as in oil pictures; it is not liable to crack, and is easily repaired if it should chance to suffer any injury. The duration of this painting is also a very material advantage; the colours are not liable to fade and change; no damp can affect them, nor any corrosive substance injure them; nor can the colours fall off in shivers from the canvass. However, notwithstanding all these and other advantages enumerated by the Abbé Mazeas and Mr Muntz, this art has not yet been much practised. Many of these properties belong to a much higher species of encaustic painting afterwards discovered in England, the colours of which are fixed by a very intense heat; nor are the colours or grounds on which they are laid liable to be dissolved or corroded by any chemical menstruum, nor, like the glassy colours of enamel, to run out of the drawing on the fire. What this method consists in will appear from the following account communicated in a letter from Josiah Colebrook to the Earl of Macclesfield, president of the Royal Society in 1756.

"The art of painting with burnt wax," says he, "has long been lost to the world. The use of it to painters in the infancy of the art of painting was of the utmost consequence. Drying oil being unknown, they had nothing to preserve their colours entire from the injury of damps and the heat of the sun. A varnish of some sort was therefore necessary; but they being unacquainted with distilled spirits, could not, as we now do, dissolve gums to make a transparent coat for their pictures. This invention therefore of burnt wax supplied that defect to them; and with this manner of painting the chambers and other rooms in the houses were furnished. This Pliny calls *encaustum*, and we *encaustic painting*.

"The following experiments, which I have the honour to lay before your lordship and the society, were occasioned by the extract of a letter from the Abbé Mazeas, translated by Dr Parsons, and published in the second part of the forty-ninth volume of the *Philosophical Transactions*, No. 100, concerning the ancient method of painting with burnt wax revived by Count Caylus.

"The count's method was, 1. To rub the cloth or board designed for the picture simply over with bees-wax: 2. To lay on the colours mixed with common water; but as the colours will not adhere to the wax, the whole picture was first rubbed over with Spanish chalk, and then the colours are used: 3. When the picture is dry it is put near the fire, whereby the wax melts, and absorbs all the colours.

"*Exp.* 1. A piece of oak board was rubbed over with bees-wax, first against the grain of the wood, and then with the grain, to fill up all the pores that remained after it had been planed, and afterwards was rubbed over with as much dry Spanish white as could be made to stick on it. This, on being painted (the colours mixed with water only), so clogged the pencil, and mixed so unequally with the ground, that it was impossible to make an even outline, but was so much thicker in one part than another, that it would not bear so much as the name of painting; neither had it any appearance of a picture. However, to pursue the experiment, this was put at a distance from the fire, on the hearth, and the wax melted by slow degrees; but the Spanish white, though laid as smooth as so soft a body would admit before the colour was laid on, on melting the wax into it, was not sufficient to hide the grain of the wood, nor show the colours by a proper whiteness of the ground; the wax, in rubbing on the board, was unavoidably thicker in some parts than in others, and the Spanish white the same.

"To obviate the inequality of the ground in the first experiment,

"*Exp.* 2. A piece of old wainscot (oak board) one fourth of an inch thick, which, having been part of an old drawer, was not likely to shrink on being brought near the fire. This was smoothed with a fish skin, made quite warm before the fire, and then, with a brush dipped in white wax melted in an earthen pipkin, smeared all over, and applied to the fire again. That the wax might be equally thick in all parts of the board, a ground was laid (on the waxed board) with levigated chalk mixed with gum-water (viz. gum-arabic dissolved in water). When it was dry, I painted it with a kind of landscape; and pursuing the method laid down by Count Caylus, brought it gradually to the fire. I fixed the picture on a fire screen, which would preserve the heat, and communicate it to the back part of the board. This was placed first at the distance of three feet from the fire, and brought forwards by slow degrees till it came within one foot of the fire, which made the wax swell and bloat up the picture; but as the chalk did not absorb the wax, the picture fell from the board, and left it quite bare.

"*Exp.* 3. I mixed three parts white wax, and one part white resin, hoping the tenacity of the resin might preserve the picture. This was laid on a board heated with a brush, as in the former; and the ground was chalk prepared as before. This was placed horizontally on an iron box charged with a hot heater, shifting it from time to time, that the wax and resin might penetrate the chalk, and hoping from this position that the ground, bloated by melting the wax, would subside into its proper place; but this, like the other, came from the board, and would not at all adhere.

"*Exp.* 4. Prepared chalk four drams, white wax, white resin, of each a dram, burnt alabaster half a dram, were all powdered together and sifted, mixed with spirit of molasses instead of water, and put for a ground on a board smeared with wax and resin, as in *Exp.* 3. This was also placed horizontally on a box-iron, as the former. The picture blistered, and was cracked all over; and though removed from the box-iron to an oven moderately heated, in the same horizontal position, it would not subside nor become smooth. When it was cold, I took an iron spatula made warm, and moved it gently over the surface of the picture, as if I were to spread a plaster. (This thought occurred from the board being prepared with wax and resin, and the ground having the same materials in its composition, the force of the spatula might make them unite). This succeeded so well as to reduce the surface to a tolerable degree of smoothness; but as the ground was broke off in many places, I repaired it with flake white, mixed up with the yolk of an egg and milk, and repainted it with molasses spirit, instead of water, and then put it into an oven with a moderate degree of heat. In this I found the colours fixed, but darker than when it was at first painted; and it would bear being washed with water, not rubbed with a wet cloth.

"*Exp.* 5. A board, that had been used in a former experiment, was smeared with wax and resin, of each equal parts; was wetted with molasses spirit to make whitening or Spanish white, mixed with gum water, adhere. This when dry was scraped with a knife to make it equally thick in all places. It was put into a warm oven to make the varnish incorporate partly with the whitening before it was painted, and it had only a small degree of heat; water was only used to mix the colours. This was again put into an oven with a greater degree of heat; but it flaked off from the board: whether it might be owing to the board's having had a second coat of varnish, the first having been scraped and melted of, and that the unctuous parts of the wax had so entered its pores that it would not retain a second varnish, I cannot tell.

"*Exp.* 6. Having miscarried in these trials, I took a new board, planed smooth, but not polished either with a fish skin or rushes. I warmed it, and smeared it with wax only; then took *cimolia* (tobacco-pipe clay) divested of its sand, by being dissolved in water and poured off, leaving the coarse heavy parts behind. After this was dried and powdered, I mixed it with a small quantity of the yolk of an egg and cow's milk, and made a ground with this on the waxed board. This I was induced to try, by knowing that the yolk of an egg will dissolve almost all unctuous substances, and make them incorporate with water; and I apprehended that a ground thus prepared would adhere so much the more firmly to the board than the former had done as to prevent its flaking off. The milk, I thought, might answer two purposes; first, by uniting the ground with the wax; and, secondly, by answering the end of size or gum-water, and prevent the colours from sinking too deep into the ground, or running one into another. When the ground was near dry, I smoothed it with a pallet knife, and washed it with milk and egg where I had occasion to make it smooth and even. When dry, I painted it, mixing the colours with common water. This, on being placed horizontally in an oven only warm enough to melt the wax, flaked from the board; but held so much better together than any of the former that I pasted part of it on paper.

"*Exp.* 7. Flake-white, or the purest sort of white-lead, mixed with egg and milk crumbled to pieces in the oven, put on the waxed board, as in the last experiment.

"The bad success which had attended all the former experiments led me to consider of what use the wax was in this kind of painting, and it occurred to me that it was only as a varnish, to preserve the colours from fading.

"In order to try this,

"*Exp.* 8. I took what the bricklayers call *fine stuff* or *putty;* to this I added a small quantity of burnt alabaster, to make it dry; this it soon did in the open air; but before I put on any colours, I dried it gently by the fire, lest the colours should run. When it was painted, I warmed it gradually by the fire, to prevent the ground from cracking, till it was very hot. I then took white wax three parts, white resin one part; melted them in an earthen pipkin, and with a brush spread them all over the painted board, and kept it close to the fire in a perpendicular situation, that what wax and resin the plaster would not absorb might drop off. When it was cold, I found the colours were not altered, either from the heat of the fire, or passing the brush over them. I then rubbed it with a soft linen cloth, and thereby procured a kind of gloss, which I afterwards increased by rubbing it with a hard brush; which was so far from scratching or leaving any marks on the picture, that it became more smooth and polished by it.

"After I had made all the foregoing experiments, in conversation with my honoured and learned friend Dr Kidby, a fellow of this society, I said I had been trying to find out what the encaustic painting of the ancients was; upon which he told me, that there was a passage in Vitruvius *De Architectura* relative to that kind of painting, and was so good as to transcribe it for me from the 7th book, chap. 9, *De minii temperatura.* Vitruvius's words are: *At si quis subtilior fuerit, et voluerit expolitionem miniaceam suum colorem retinere, cum paries expolitus et aridus fuerit, tunc ceram Punicam liquefactam igni, paulo oleo temperatam, seta inducat, deinde postea carbonibus in ferreo vase compositis, eam ceram apprime cum pariete, calefaciendo sudore cogat, fiatque ut peræquetur, deinde cum candela linteisque puris subigat, uti signa marmorea nuda curantur. Hæc autem καυσις Græce dicitur. Ita obstans ceræ Punicæ lorica non patitur, nec lunæ splendorem, nec solis radios lambendo eripere ex his politionibus colorem.*

"Which I thus translate: 'But if any one is more wary, and would have the polishing [painting] with vermilion hold its colour, when the wall is painted and dry, let him take Carthaginian [Barbary] wax, melted with a little oil, and rub it on the wall with a hair pencil; and afterwards let him put live coals into an iron vessel [chafing-dish], and hold it close to the wax, when the wall, by being heated, begins to sweat; then let it be made smooth; afterwards let him rub it with a candle and clean linen rags, in the same manner as they do the naked marble statues. This the Greeks called καυσις. The coat of Carthaginian wax thus put on is so strong, that it neither suffers the moon by night, nor the sun-beams by day, to destroy the colour.'

"Being satisfied, from this passage in Vitruvius, that the manner of using wax in *Exp.* 8 was right, I was now to find if the wax-varnish, thus burnt into the picture, would bear washing. But here I was a little disappointed; for rubbing one corner with a wet linen cloth, some of the colour came off; but washing it with a soft hair-pencil dipped in water, and letting it dry without wiping, the colour stood very well.

"A board painted as in *Exp.* 8 was hung in the most smoky part of a chimney for a day, and exposed to the open air in a very foggy night. In the morning the board was seemingly wet through, and the water ran off the picture. This was suffered to dry without wiping: and the picture had not suffered at all from the smoke or the dew, either in the ground or the colours; but when dry, by rubbing it, first with a soft cloth, and afterwards with a brush, it recovered its former gloss.

"Suspecting that some tallow might have been mixed with the white wax I had used, which might cause the colours to come off on being rubbed with a wet cloth, I took yellow wax which had been melted from the honeycomb in a private family, and consequently not at all adulterated: to three parts of this I added one part resin, and melted them together.

"*Exp.* 9. Spanish white, mixed with fish glue, was put for a ground on a board, and painted with water-colours only. The board was made warm; and then the wax and resin were put on with a brush, and kept close to the fire till the picture had imbibed all the varnish, and looked dry. When it was cold, I rubbed it first with a linen cloth, and then polished it with a hard brush.

"In these experiments I found great difficulties with regard to colours. Many water-colours being made from the juices of plants, have some degree of an acid in them; and these, when painted on an alkaline ground, as chalk, whitening, *cimolia,* and plaster, are totally changed in their colours, and from green become brown; which contributes much to make the experiments tedious. I would therefore advise the use of mineral or metallic colours for this sort of painting, as most likely to preserve their colour: for although I neutralized Spanish white, by fermenting it with vinegar, and afterwards washed it very well with water, it did not succeed to my wish.

"These experiments, and this passage from Vitruvius, will in some measure explain the obscurity of part of that passage in Pliny which Dr Parsons, in his learned comment on the encaustic painting with wax, seems to despair of.

"*Ceris pingere* was one species of encaustic painting. Ενκαυστον, *inustum,* may be translated, "forced in by the means of fire; burnt in:" for whatever is forced in by the help of fire can be rendered into Latin by no other significant word that I know of but *inustum.* If this is allowed me, and I think I have the authority of Vitruvius (a writer in the Augustan age) for it, who seems to have wrote from his own knowledge, and not like Pliny, who copied from others much more than he knew himself, the difficulty with regard to this kind of painting is solved, and the encaustic with burnt wax recovered to the public.

"What he means by the next kind he mentions, *in ebore cestro, id est viriculo,* I will not attempt to explain at present.

"The ship-painting is more easily accounted for, the practice being in part continued to this time; and is what is corruptly called *breaming,* for brenning or burning.

"This is done by reeds set on fire, and held under the side of a ship till it is quite hot; then resin, tallow, tar, and brimstone, melted together, and put on with a hair-brush while the planks remain hot, make such a kind of paint as Pliny describes; which, he says, *nec sole, nec sale ventisque corrumpitur.* As they were ignorant of the use of oil painting, they mixed that colour with the wax, &c. which they intended for each particular part of the ship, and put it on in the manner above described.

"In the pictures painted for these experiments, and now laid before your lordship and the society, I hope neither the design of the landscape, nor the execution of it, will be so much taken into consideration as the varnish, which was the thing wanted in this inquiry: and I think that will evince that the encaustic painting with burnt wax is fully restored by these experiments; and, though not a new invention, yet having been lost for so many ages, and now applied further, and to other purposes, than it was by Vitruvius, who confined it to vermilion only, may also amount to a new discovery, the use of which may be a means of preserving many curious drawings to posterity; for this kind of painting may be on paper, cloth, or any

Encaustic Painting.

other substance that will admit a ground to be laid on it. The process is very simple, and is not attended with the disagreeable smell unavoidable in oil-painting, nor with some inconveniences inseparable from that art; and as there is no substance we know more durable than wax, it hath the greatest probability of being lasting."

Still, however, there seem to have been some defects or inconveniences attending these and other subsequent attempts; for we find the ancient or some similar method of painting in wax remaining a desideratum upwards of twenty-five years after the publication of the preceding experiments; when in 1787 a method was communicated to the Society of Arts by Miss Greenland, for which she was rewarded with a prize. The ground of her information she had received at Florence, through the acquaintance of an amateur of painting, who procured her the satisfaction of seeing some paintings in the ancient Grecian style, executed by Signora Parenti, a professor at that place, who had been instructed by a Jesuit at Pavia, the person who had made the greatest discoveries in that art. Miss Greenland's friend knowing she was fond of painting, informed her what were the materials the paintress used, but could not tell her the proportions of the composition; however, from her anxiety to succeed in such an acquisition, she made various experiments, and at last obtained such a knowledge of the quantities of the different ingredients as to begin and finish a picture, which she afterwards presented to the society for their inspection.

Her method is as follows: "Take an ounce of white wax, and the same weight of gum mastich powdered. Put the wax in a glazed earthen vessel over a very slow fire; and when it is quite dissolved, strew in the mastich, a little at a time, stirring the wax continually until the whole quantity of gum is perfectly melted and incorporated: then throw the paste into cold water, and when it is hard, take it out of the water, wipe it dry, and beat it in one of Mr Wedgwood's mortars, observing to pound it at first in a linen cloth, to absorb some drops of water that will remain in the paste, and would prevent the possibility of reducing it to a powder, which must be so fine as to pass through a thick gauze. It should be pounded in a cold place, and but a little while at a time, as after long beating the friction will in a degree soften the wax and gum, and, instead of their becoming a powder, they will return to a paste.

"Make some strong gum-arabic water; and when you paint, take a little of the powder, some colour, and mix them together with the gum water. Light colours require but a small quantity of the powder, but more of it must be put in proportion to the body and darkness of the colours; and to black there should be almost as much of the powder as colour.

"Having mixed the colours, and no more than can be used before they grow dry, paint with fair water, as is practised in painting with water colours, a ground on the wood being first painted of some proper colour, prepared in the same manner as is described for the picture; walnut tree and oak are the sorts of wood commonly made use of in Italy for this purpose. The painting should be very highly finished, otherwise, when varnished, the tints will not appear united.

"When the painting is quite dry, with rather a hard brush, passing it one way, varnish it with white wax, which is put into an earthen vessel, and kept melted over a very slow fire till the picture is varnished, taking great care the wax does not boil. Afterwards hold the picture before a fire, near enough to melt the wax, but not make it run; and when the varnish is entirely cold and hard, rub it gently with a linen cloth. Should the varnish blister, warm the picture again very slowly, and the bubbles will subside. When the picture is dirty, it need only be washed with cold water."

Enceinte || Endian.

The opinion given by the society upon the above is, "The method made use of by Miss Greenland provides against all inconveniences; and the brilliancy of the colours in the picture painted by her, and exhibited to the society, fully justifies the opinion, that the art of painting in wax, as above described, highly merited the reward of a gold pallet voted to her on this occasion."

ENCEINTE, in *Fortification*, is the interior wall or rampart which surrounds a place, sometimes composed of bastions or curtains, either faced or lined with brick or stone, or only made of earth. The enceinte is sometimes only flanked by round or square towers, which is called a *Roman wall*.

ENCEPHALI, in *Medicine*, worms generated in the head, where they cause so great pain as sometimes to occasion distraction.

ENCHASING, INCHASING, or *Chasing*, the art of enriching and beautifying gold, silver, and other metal work, by some design or figures represented thereon in bas-relief. It is performed by punching or driving out the metal, in order to form a figure, from withinside, so as to stand out prominent from the plane or surface of the metal. In order to this, a number of fine steel blocks or puncheons of divers sizes are provided; and the design being drawn on the surface of the metal, the inside is applied to the heads or tops of these blocks, directly under the lines or parts of the figures; then the metal, sustained by the block, being struck by a hammer, yields, and the block makes an indenture or cavity on the inside, corresponding to which there is a prominence on the outside, which stands for part of the figure; and thus the workman proceeds to chase and finish all the parts by the successive application of the block and hammer to the several parts of the design. It is wonderful with what beauty and justness artists, by means of this simple piece of mechanism, represent foliages, grotesques, animals, histories, and the like.

ENCLITICA, in *Grammar*, particles which are so closely united with other words as to seem part of them, as the *que* in *virumque*, &c. There are three enclitic particles in Latin, viz. *que, ne, ve.*

ENCRATITES, in *Ecclesiastical History*, heretics who appeared towards the end of the second century. They were called *Encratites*, or *Continentes*, because they gloried in abstaining from marriage, and the use of wine and animal food.

ENCYCLOPÆDIA, a term nearly synonymous with CYCLOPÆDIA, but adopted in preference to it in denominating the present work, as being more definite and of better authority. According to the observation of that learned printer Mr Bowyer, the preposition EN makes the meaning of the word more precise. For *Cyclopædia* may denote "the instruction OF a circle," as *Cyropædia* is "the instruction OF Cyrus," whereas in *Encyclopædia*, the preposition determines the word to be from the dative of *cyclus*, "instruction IN a circle." And Vossius, in his book *De Vitiis Sermonis*, has observed, "that *Cyclopædia* is used by some authors, but *Encyclopædia* by the best." Some account of the history and merits of the different Encyclopædias which have appeared will be found in the General Preface to this work.

ENDEMIC or ENDEMICAL DISEASES are those to which the inhabitants of particular countries are subject more than others, on account of the air, water, situation, and manner of living.

ENDIAN, a town of Persia, in the province of Kuzistan, occupying both banks of the river Tab, which is here 240 feet broad. It is surrounded by numerous walls, nowhere more than three feet thick, and is nearly two miles in circuit. It contains from 4000 to 5000 inhabitants, and carries on trade with Bassora and with the countries to the east. Lat. 30. 18. N

ENDLESS, something without an end; thus authors mention endless rolls, the endless screw, and the like.

ENDOR, in *Ancient Geography*, a town of Galilee, four miles to the south of Mount Tabor, in the tribe of Manasseh, where the Pythoness was consulted by Saul.

ENDORSED, in *Heraldry*, an ordinary, containing the eighth part of a pale, which Leigh says is only used when a pale is between two of them.

Endorsed, in *Heraldry*, is said of things borne back to back, more usually called *Adossé*.

ENDORSEMENT, in *Law* and *Commerce*. See Indorsement.

ENDOWMENT, in *Law*, denotes the settling a dower on a woman; though sometimes it is used figuratively, for settling a provision upon a parson on the building of a church; or the severing of a sufficient portion of tithes for a vicar, when the benefice is appropriated.

ENDRACHT'S Land, or Concord, is an extensive, low, and sterile tract on the west coast of New Holland, in which is a spacious bay, lately called by the name of the English navigator Dampier, and which was formerly denominated Shark's Bay.

ENDRIE, a town of Asiatic Russia, in the district of Eastern Caucasus. It is situated on the river Akatsch, after it has left the mountains and spread into the plain, nearly about twenty miles from the Caspian Sea. It contains several mosques, an Arminian church, and two synagogues; and is the joint property of several Russian princes, who acknowledge the Russian authority. The inhabitants are chiefly Mahommedans, who allow the most complete toleration to the Georgian and Arminian Christians, and also to the Jews. The latter carry on an extensive commerce. The surrounding country is inhabited by savage tribes, who make frequent inroads on the peaceable inhabitants, and carry off slaves, whom they plunder and sell to the highest bidder, or keep till they are ransomed. Endrie is the seat of this extensive traffic, and is acknowledged as a free town by all the natives of the Caucasus; and it is a great commercial resort. It was formerly called Baal or Balek, and afterwards Endrie, from a governor by whom it was bravely defended against the Arabs. In 1722 it was sacked by the Russians.

ENDYMION, in fabulous history, a shepherd, son of Æthlius and Calyce. It is said that he required of Jupiter to grant to him the privilege of being always young, and sleeping as much as he chose; whence came the proverb of *Endymionis somnum dormire*, to express a long sleep. Diana observed him naked as he slept on Mount Latmos, and was so struck with his beauty that she came down from heaven every night in order to enjoy his company. Endymion married Chromia, daughter of Itonus, by whom he had three sons, Pæon, Epeus, and Æolus, and a daughter called *Eurydice*. The fable of Endymion's amours with Diana, or the moon, arose from his knowledge of astronomy; and as he passed the night on some high mountain in order to observe the heavenly bodies, it came to be reported that he was courted by the moon. Some suppose that there were two persons of this name; the son of a king of Elis, and the shepherd or astronomer of Caria. The people of Heraclea maintained that Endymion died on Mount Latmos; and the Eleans pretended to show his tomb at Olympia in Peloponnesus.

ENEMY, in *Law*, an alien or foreigner, who publicly invades the kingdom.

ENERGUMENS, in *Ecclesiastical History*, persons supposed to be possessed by the devil, and concerning whom there were many regulations among the primitive Christians. They were denied baptism and the eucharist; at least this was the practice of some churches: and though they were under the care of exorcists, yet it was thought a becoming act of charity to let them have the public prayers of the church, at which they were permitted to be present.

ENERGY, a term of Greek origin, signifying the power, virtue, or efficacy of a thing. It is also used figuratively, to denote emphasis of speech.

ENERVATING, the act of destroying the force, use, or office, of the nerves, either by incision, by weakening them with debauchery, or by some other violence.

ENESEI, or Yenesei, a river of Siberia. It has its rise in the mountains of Central Asia, which border on Chinese Tartary, and, taking a northern direction, flows into the Frozen Ocean, after a long course through the plains of Siberia, in long. 82. 14. E. lat. 72. 20. N.

ENESEISK, or Yeneseisk, a town of Siberia, in the government of Tobolsk, situated on the right bank of the river Yenesei. It is of considerable size, is fortified, and has a jurisdiction over an extensive tract, from which a tribute of furs is paid to government. It has several manufactories, of which the most remarkable are those for working up the sea-horn and mammoth teeth into various beautiful articles. It is one of the most antique places in Siberia, the old Russian style of building being still kept up, in which the roofs of the houses project twelve and fifteen feet beyond the walls. In one of the churches here there is a massive candelabrum suspended from the centre. Its weight is a thousand pounds, and its value above L.5000. Long. 91. 50. E. Lat. 58. 16. N.

ENFANS Perdus, the same with forlorn hope.

ENFIELD, William, LL.D. an elegant and justly admired writer, was born in the year 1741, at Sudbury. His original destination was for the sacred office of the ministry, and he was educated amongst the Protestant dissenters at Daventry, where the high polish which he gave to his compositions distinguished him from many of his contemporaries. The congregation of Benn's Garden of Liverpool made choice of him for their minister in the year 1763, when he was not more than twenty-two years of age; and in this situation he was soon taken notice of as an amiable member of society, and an engaging preacher. Whilst he resided in Liverpool, he published two volumes of sermons, duodecimo, as well as a collection of hymns and family prayers, which met with a very favourable reception. In the year 1770 he was appointed tutor and lecturer in the belles-lettres at Warrington academy, which he filled for some years with general approbation and unwearied diligence. He was the compiler of many useful books, amongst the most popular of which we may rank his *Speaker*, consisting of pieces for recitation selected from the best and most approved English authors. At the beginning of this collection there is an excellent essay on elocution. The *Preacher's Directory*, the *English Preacher*, a collection of sermons in 9 vols. 12mo, from the most celebrated authors, and Biographical Sermons on the principal characters in the Old and New Testament, with a number of single sermons on particular occasions, were also the productions of his pen. The controversy relative to literary property likewise engaged his attention, and on this he wrote a quarto pamphlet. He also published, in one volume quarto, *Institutes of Natural Philosophy*, theoretical and experimental; and during the time of his residence at Warrington, as teacher in the academy, the university of Edinburgh conferred upon him the degree of LL.D. When that academy was dissolved in 1783, Dr Enfield continued for two years at Warrington in the capacity of private tutor, after which he was chosen pastor of the Octagon meeting-house at Norwich, in the year 1785. He at length gave up his private tuition, and entirely devoted his time to literary labours, and the peculiar duties of his pastoral charge. About this time he lost his eldest son, who had been appointed to the office of town-clerk of Nottingham. This event would have been productive of very serious effects on his health and spirits, had it not been for the consolations of religion and philosophy, which are sufficient to support the human mind under the pressure of the severest calamities. He undertook and executed the laborious task of abridging Brucker's *History of Philosophy*, which, in 1791, he published in 2 vols. 4to. It has been generally acknowledged that the tenets of the different sects of philosophers were never before exhibited to the world with such perspicuity and elegance; qualifications for which Dr Enfield was undoubtedly eminent. He contributed largely to the Biographical Dictionary published under the inspection of Dr Aiken and others.

An unsuspected distemper hastened the termination of his useful life, and, on the 3d of November 1797, he expired in the fifty-seventh year of his age. That general love of mankind which Dr Enfield possessed, falls to the lot of but few; nor does it often happen that an individual dies so universally lamented. It was essential to him to be amiable in every station and condition of life. His posthumous sermons, in 3 vols. 8vo, had a very numerous list of subscribers; a strong proof of the estimation in which he was held by all who knew him, either personally or by report. In these discourses he treats chiefly on moral topics, which he discusses with the nicest discrimination, and in a train of the most pleasing and manly eloquence.

Enfield, a village of the hundred of Edmonton, in the county of Middlesex, nine miles from London. There are the remains of an ancient royal palace, in which Edward VI. kept his court, and where Elizabeth rested on her way to London in order to assume the crown. Near to it was Enfield chase, disforested in 1779, divided between several parishes and the crown, and now occupied by several country seats of the more opulent traders of London. The parish is extensive, and its population amounted in 1801 to 5881, in 1811 to 6884, in 1821 to 8227, and in 1831 to 8812.

ENFILADE, in the art of war, is used in speaking of trenches, or other places, which may be scoured by the enemy's shot along their whole length. In conducting the approaches at a siege, care must be taken that the trenches be not enfiladed from any work of the place.

ENFINE', formerly Antinoe, a city of Egypt, built by Adrian in honour of his favourite Antinous. It is situated towards the middle of the Saïd, or Upper Egypt, and still contains several stately monuments of antiquity. In ancient times this city was very magnificent. See article Egypt.

ENFRANCHISEMENT, in *Law*, the incorporating of a person into any society or body politic.

ENGANO, or Pugniatan, an island in the Eastern Seas, lying off the south-west coast of Sumatra, being about thirty miles in circumference, and nearly eighteen miles in length. It is covered with trees, and has always a verdant appearance. The natives are taller and fairer than the Malays; the men have black hair, which they cut very short, while it is worn long by the women, and neatly turned up; and they are extremely savage in their manners, the men going entirely naked, and the women having no other covering than a slip of plantain leaf round the waist. Their houses are of a conical form, resembling bee-hives, supported on posts, and standing singly amidst their plantations; and their canoes are formed of two planks sewed together, pointed at each end, and provided with outriggers. An attempt was made by the Dutch in 1645 to commence an intercourse with these people; but it ended in a shameful act of treachery, by which they trepanned about sixty or seventy of the natives, many of whom died after arriving at Batavia. In 1771 another attempt was made by the English settled in Sumatra to gain some acquaintance of the people, but it failed. Long. 102. 20. E. Lat. 10. 20. S.

ENGASTRIMYTHI, in Pagan theology, the Pythias or priestess of Apollo, who delivered oracles internally, without any action of the mouth or lips. The ancient philosphers, and others, are divided upon the subject of the engastrimythi. Hippocrates mentions this peculiar manifestation as a disease; others will have it a kind of divination; others again attribute it to the operation or possession of an evil spirit; and others to art and mechanism. Scottus maintains that the engastrimythi were poets, who, when the priests could not speak, supplied the defect by explaining in verse what Apollo dictated in the cavity of the sacred tripod.

ENGEN, a bailiwick in the circle of the Lake of the Duchy of Baden, in Germany, containing one market town, with eighteen hamlets and 9500 inhabitants, the capital of which is situated on the river Aach, is of the same name, and contains 211 houses and 1204 inhabitants.

ENGENDERING, a term sometimes used for the act of producing or forming any thing. Thus meteors are said to be engendered in the middle region of the atmosphere, and worms in the belly.

ENGHIEN, a city of the circle of Mons, in the province of Hennegau, in Flanders, with 3054 inhabitants, employed in making lace, lace thread, and fine linen. Long. 3. 55. E. Lat. 50. 40. N.

ENGINE, in *Mechanics*, is a compound machine, including one or more mechanical powers, as levers, pulleys, screws, and the like, made in order to raise, cast, or sustain any weight, or produce any effect which could not be easily effected otherwise. The word is formed, through the medium of the French, from the Latin *ingenium*, by reason of the ingenuity required in the contrivance of engines to augment the effect of moving powers.

ENGINEER, taken generally, is a term applied to those who are employed in devising or forming engines or machines, and in directing their applications. In a more restricted and appropriate sense, it denotes two very important professions; the one that of the *military*, the other that of the *civil* engineer.

The *Military Engineer* is an officer whose business it is to delineate the plans and direct the formation of military works, and to regulate attacks and defences. Those branches of knowledge which more particularly relate to his profession are treated, in this work, under the heads of Artillery, Fortification, Gunnery, and War.

The *Civil Engineer* is a person who applies the principles of mechanical and physical philosophy to the construction of the machines and public works by which the arts and accommodations of civil life are rendered more efficient, extensive, and secure. The subjects which more immediately belong to his important calling are treated in this work under the heads of Bridge, Carpentry, Docks, Gas Lights, Harbours, Light-houses, Navigation, Navigation Inland, Railways, Roads, Tunnels, Water-works, &c.; and also under the heads Dynamics, Hydrodynamics, Machinery, Mensuration, Resistance of Solids, Strength of Materials, &c.

ENGLAND,

The southern division of the island of Great Britain. In treating of this grand division of the British empire, we shall divide the subject into three Parts; the first comprehending the History of England, the second the Statistics of that country, and the third some account of its Government and Laws.

PART I.

HISTORY.

The history of England, till the period of the Saxon Conquest, has been fully treated of in the first chapter of the article Britain. After that event the country relapsed into a state of obscure barbarism, nearly as great as that from which it had been rescued by the Romans. The provincial Britons had profited by their intercourse with that great people. From the latter they had learned many of the arts of civilized life, and during the period of their subjugation they had erected a considerable number of cities, towns, and villages; but these were subsequently levelled with the ground by barbarian invaders, and the natives were frequently involved in the same ruin with their habitations. We are informed by one historian that a mighty conflagration began on the western coast, and gradually extended itself over the whole island. To escape from the exterminating swords of the Saxons, the Britons sought refuge in their native fastnesses; and thus the spark of civilization which had been struck out amongst them, and which, in more auspicious circumstances, might have kindled into a generous flame, was totally extinguished.

About the year 700, the island of Great Britain was divided into no fewer than fifteen sovereignties. Of these, eight were Saxon; but the union of the two Northumbrian principalities reduced the number to seven; and from this circumstance, as well as from some vague alliance amongst these petty states, historians have designated the whole by the name of the Heptarchy. They ruled over a considerable portion of England, and whilst they waged a fierce and endless war with every other kingdom in the island, they also maintained amongst themselves a continual struggle for the superiority. It would appear that one state usually exercised an undefined power over all the others; and the prince who possessed this equivocal ascendency had the title of *Bretwalda*, or wielder of the Britons, bestowed upon him. The history of this period is not characterized by any event which would lead us to take an interest in the fluctuating fortunes of the various states. Our information relating to the earliest portion of the Saxon rule is also scanty; but what we do possess is not of such a nature as to awaken any feelings of regret that more minute particulars have not been transmitted to us. Details of the shedding of kindred blood, and acts of oppression, treachery, and cruelty, exercised towards the natives by the fierce invaders of their soil, are not calculated to interest human feelings. The re-introduction of Christianity, however, in some degree alleviated the darkness of the picture. The exact date of its first appearance in Britain is uncertain, but it had made some progress before the close of the second century. It disappeared however, with the other traces of civilization, when the Saxons commenced their devastations. It was in the year 596 that Gregory the Great sent over St Augustin, with forty other missionaries, to convert the Saxons; and their arrival in Kent marks a new era in its history, and probably in that of the country. At this period Kent was governed by Ethebert, an able and powerful monarch, and the third who bore the title of Bretwalda. He received kindly the deputies of Rome, and became a convert to their doctrine; an example which his subjects were not slow in following. From this period the spread of the Christian faith over the island appears to have been rapid; for we find that in about a century after the arrival of St Augustin it was professed and believed throughout Anglo-Saxon Britain. That it conferred many temporal benefits upon the community, cannot be doubted. But, however its divine precepts may have influenced the conduct and ameliorated the lot of individuals, crimes upon a great scale continued to be perpetrated as formerly. It may have mitigated the horrors of war, but battle followed on battle with as uniform a succession, and native blood flowed as freely, as heretofore. The continual struggle amongst the Anglo-Saxon principalities for the supremacy was however fast coming to a crisis. It is evident that such a state of affairs could not continue for any length of time, and that it must necessarily end in the establishment of a regular hereditary magistracy in the island. This took place partially at the beginning of the eighth century, in the person of Egbert, king of Wessex, who was a lineal descendant, and the only surviving prince, of the house of Cerdic, the founder of that kingdom. The great talents which he early exhibited had given offence to Brihtric, king of Wessex, who, jealous of his popularity, projected his destruction. Egbert, however, eluded his vengeance, and fled for protection to Offa, king of Mercia, a monarch illustrious for the talents he displayed and the prosperity he enjoyed, but whose name is stained with perfidy and blood. Thither the vindictive Brihtric pursued the youthful fugitive, who was finally compelled to cross the channel and to seek shelter beneath the broad shield of the victorious Charlemagne. France, governed by that renowned sovereign, excelled all the states of the West in civilization and the arts of government, as well as those of war. Trained in such a school, therefore, and early disciplined by adversity, he was undergoing an admirable probation for wielding with judgment and moderation the perilous sceptre which was destined to be transferred into his hands. The death of Brihtric, who perished by the machinations of his queen, recalled the fugitive from his exile. In Wessex the claim of Egbert was at once acknowledged, while his accession to the throne of his celebrated ancestor, an event highly popular in itself, was ennobled by a victory, the omen of many a future triumph.

A. D. 800. At this period the island, though nominally under a hexarchy, was rapidly verging to a triarchy, from several of the smaller states becoming gradually blended and identified with their more powerful neighbours. Wessex had been enlarged by the incorporation of Sussex; and various favourable circumstances conspired to concentrate in the hands of Egbert a well-organized power, which he was prepared to wield when summoned by any great emergency. For several years, however, after his accession to the throne, his sword remained in its sheath; and this propitious period of tranquillity afforded him an opportunity of turning his undivided attention to the affairs of government. His administration was as mild as it appears to have been politic; circumstances which completed the attachment of his subjects, and consolidated his growing strength. It was upon the unfortunate Britons of the west that he first made trial of his military prowess. About the year 809 the struggle between him and the natives commenced. The latter made a strenuous but unavailing resistance; and Egbert carried the havoc of war and the flames of destruction from the east to the west. In a few years the greater part of modern Wales, as well as the people who occupied the northern shore of the estuary of the Severn, acknowledged his authority. The king of Mercia, whose strength had been augmented by the appropriation of the petty sovereignties of Kent, Essex, and East Anglia, was now the only rival for the supreme authority whom Egbert had to fear or to contend withal. Their power was nearly equally balanced, for what Wessex wanted in numerical force was compensated by discipline and skill. War had now become inevitable; neither would brook a superior, and only one Bretwalda could be acknowledged. The conflict began, therefore, and was speedily brought to a termination. In an obstinate and bloody battle the king of Mercia was totally defeated, and Egbert became lord of the ascendant. State after state was annexed to Wessex; Mercia was invaded and subdued; and in nineteen years after he had first drawn the sword, Egbert was acknowledged over the greater part of the island as the eighth Bretwalda.

The authority of Egbert, however, still continued doubtful; and the Anglo-Saxon power was as yet very far from being consolidated. The fortunes and immunities of those composing the several states were not dependent upon one common legislature; and in regard to the details of government, the whole principalities remained as distinct from each other as before. Wales still continued to annoy him; and it was not until he had marched an army to Snowden that North Wales quietly submitted to that of the Saxon Bretwalda. But new and more formidable enemies than any he had yet encountered had begun to threaten England, and trouble the tranquillity which it in some measure enjoyed. These were Scandinavians, recognised in France by the name of Normans, and in England by that of Danes. Familiarized, from their maritime situation, to the dangers of the ocean, this people, like the Saxons of old, spent the greater portion of their time upon its waves. A pernicious law of succession, which consigned the whole patrimony to the eldest son, drove the younger branches of families to seek their fortunes by means of their ships and their swords. It was only in this manner that they could acquire riches and renown; and such pursuits were peculiarly agreeable to a people who unhappily preferred the acquisitions of rapine to the fruits of laborious industry. It was the custom of these pirates to set sail for some distant province in squadrons, under the command of chieftains called *Vikingr*, or Sea-Kings. After pillaging the coast where they landed, they collected the spoil and returned to their own country, where they disencumbered themselves of their booty and prepared for fresh expeditions. Three descents upon England are recorded as having taken place in the eighth century, but these attempts produced no permanent alarm. Towards the termination of Egbert's reign, however, the numbers of the pirates greatly increased, whilst their visits were annually renewed; and for two centuries to come the country was destined to be a prey to these fierce and fearless invaders.

After making several successful inroads into various parts of England, in 835 they landed on the coast of Cornwall, where they succeeded in seducing the Britons from their allegiance. The king of Wessex met the united forces of the enemy at Hengstone Hill, and gained a bloody but decisive victory, which restored the glory of his arms. This was the last exploit of Egbert, who died the year following, after a reign as prosperous as it was long, and which, allowing something for the condition of society at the period, may also be termed glorious.

Ethelwolf succeeded his father on the throne of Wessex; but an unfortunate arrangement, by which the former king bequeathed all his dominions except Wessex to a younger son, greatly weakened the power of his successor, and lessened the influence of the Bretwalda. Ethelwolf had been a monk, and appears to have been better adapted for the cloister which he had left than the throne which he now ascended. The history of his reign presents little of interest or variety. It is merely an account of the atrocities of the Danes, who made repeated descents upon England, laying waste the country, plundering towns, and despoiling the rich monasteries, where treasure was supposed to have been accumulated. No defeat, however signal and decisive for the time, was capable of permanently expelling them from the island; and although routed and compelled to flee for shelter to their ships one year, they returned the next with persevering audacity. In the meanwhile Ethelwolf found leisure to perform a pilgrimage to Rome; and in passing through France on his journey homewards, he espoused Judith the daughter of Charles the Bald, king of the Franks. But he was not permitted to enjoy undisturbed domestic tranquillity. On his return to England he found his son Ethelbald at the head of a formidable conspiracy, which threatened him with deposition and exile. The two parties, however, came without bloodshed to terms of accommodation. It was agreed that Ethelwolf should possess the eastern states appertaining to Wessex, whilst the kingdom of Wessex proper, which belonged of right to the head of the family, should be enjoyed by Ethelbald, but, it would appear, with a nominal subjection to his father. Ethelwolf survived these arrangements only a few years, having died in 858.

After his demise Ethelbald continued to occupy the throne of Wessex; whilst Ethelbert, a younger brother, succeeded to the government which had been left vacant by the death of his father; but both these princes died in a few years, and left their thrones to their brother Ethelred, who assumed the sceptre at a most unpropitious period. Not only was the kingdom divided against itself, but the Danes, acting now in a well-organized confederacy, and terrible from their numbers as well as from the frequency of their inroads, threatened the total annihilation of the Saxon dynasty and the subjugation of the island. In the reign of Ethelred ancient chroniclers present us with little else than accounts of battles fought and towns sacked, prolonged by all the sickening minutiæ of rapine and bloodshed. The conflicts were numerous and sanguinary; and in one of these, which took place at Merton in the year 870, the king received a wound of which he soon afterwards died.

By the death of Ethelred the throne of Wessex devolved upon Alfred, the fifth and favourite son of Ethelwolf. As an account of this extraordinary individual has already been given under the head of Alfred, it is unnecessary to recapitulate the events of his life. He was succeeded by his son Edward, who ascended what may now almost be termed the throne of England, in the year 901. Alfred had been called to the crown in preference to the children of his elder brother, who were considered at the time as too young to be entrusted with the government. Their pretensions being also set aside at his death, Ethelwold, one of the rejected princes, attempted by violence to seize hold of the royal authority. He formed an alliance with the Danes and other enemies of Edward; but in a battle with the men of Kent he met his fate, and the island was once more rescued from a destructive competition for the crown.

Previously to this event the Danes had contrived, by a union with some of the disaffected provinces, to obtain a kind of permanent footing in the country. They possessed the north of England from the Humber to the Tweed, and the eastern districts from the Ouse to the sea. Emboldened by their strength, they invaded Mercia, but were met by Edward, who obtained over them a decisive victory, which effectually restored his supremacy. The most remarkable individual after Edward was his sister Ethelfleda, upon whom the mantle of Alfred seems to have descended. She governed Mercia, and vigorously seconded her brother in fortifying the country against the common enemy. Upon her death in 920 the Anglo-Saxon monarchy received additional security from the final incorporation of Mercia with Wessex. After various successes over his northern and other enemies, Edward the elder expired at Farrington in Berkshire, in the year 924. This monarch would appear to greater advantage were he not viewed in such close proximity to Alfred the Great, the brilliancy of whose reign was calculated to eclipse that of his successor, had the latter been even a greater man than he actually was. Edward, however, was a great man, and every way worthy to wield the sceptre of his father, which he did with uncommon judgment and success.

He was succeeded by his son Athelstane, whom historians, on the faith of an old song, are in the habit of styling illegitimate; but a contemporary poetess has recognised his mother as the partner of Edward's throne, a circumstance which fairly balances the former authority. There is one argument in favour of his legitimacy, which, as far as we are aware, has been overlooked; it is the exceeding partiality evinced towards him by his grandfather Alfred. It seems improbable that an individual, whose moral rectitude and ardent piety were so conspicuous as those of Alfred, should have singled out as his especial favourite one whose birth was a public scandal; that he should also have invested him with the insignia of knighthood whilst yet a child, and looked upon him as the future hope of Britain, more especially as, supposing the youth to have been a natural son, the legitimate children of his father had a preferable right to the throne. Viewing the matter in this light, the truth of the hypothesis that Athelstane was the fruit of a union sanctioned by law and religion appears highly probable, even allowing that the distinction of natural from legitimate children was at that period somewhat faint. It does not appear to have been so in the mind of Alfred the Great.

Athelstane was thirty years of age when his father expired; and Mercia immediately, and Wessex shortly afterwards, recognised him as king. Opposition was, however, experienced in other quarters; but he ultimately succeeded in seating himself firmly upon the throne, and fully justified the early popularity he enjoyed with his grandfather. In the person of Athelstane the Anglo-Saxon sovereign became a character of dignity and consequence in Europe. His connections with the most respectable potentates on the Continent gave to his reign a political importance, and he is moreover entitled to be considered as the first monarch of England.

The sovereignty of the whole island appears to have been the object of Athelstane's ambition. In his military enterprises he was completely successful, and compelled the princes of the Scots, Cambrians, and Britons, to swear fealty to him, in the same manner as the Saxon vassal was accustomed to swear to his lord. But his prosperity was interrupted by a powerful confederacy formed against him, which threatened not only to emancipate Northumbria from his authority, but even to overwhelm his hereditary government. The confederates were Constantine king of the Scots, and Anlaff the son of Sigtryg or Sihtric, who was king of Northumbria at the time of Athelstane's accession. Anlaff had received the hand of Athelstane's sister; but he drove her from his court, for which barbarous conduct the Anglo-Saxon monarch stripped him of his kingdom and ejected him from the island. Anlaff had fled to Ireland, whence he returned with a large fleet, in order to retaliate the insult of his expulsion. The remaining malcontents were the Welsh princes who had been humbled into submission, the Danes who inhabited the eastern coast from Tweed to Thames, the petty states of Cambria, and a constantly increasing host of lawless pirates and freebooters from Scandinavia.

A.D. 937. Athelstane prepared with firmness and energy to meet the storm which threatened him with destruction. The armies met at Brunanburgh in Northumbria, and a battle was fought, celebrated in Saxon and Scandinavian poetry. The confederates were routed with great slaughter, and Anlaff and Constantine effected their escape with great difficulty. So complete was the overthrow, and so decisive the victory, that the remainder of Athelstane's reign was undisturbed by the rebellion of his subjects or the invasion of a foreign enemy. The throne of his ancestors was now effectually secured to him; and the Britons were so completely humbled, that to him belongs the glory of having been the founder of the English monarchy. The fame of his accomplishments, his talents, and his successes, was not confined to the insulated kingdom which he governed; it extended throughout all Christendom. With several foreign courts he maintained a friendly correspondence; and three princes, who afterwards became eminent in Europe, were fostered under his care, and restored by his aid or influence. These were Haco of Norway, Alan of Bretagne, and the son of his sister, Louis d'Outremer, so called from his residence in England. A concern in the death of a brother named Edwin is generally ascribed to him, but the story is somewhat doubtful; and if the other events of Athelstane's life, his public services and private virtues, be allowed to have any influence upon our judgment, it must be pronounced as improbable. Athelstane died in the year 940, regretted by his subjects, amongst whom he was revered as a prince alike distinguished for wisdom, justice, and benevolence.

Having left no issue, he was succeeded by his brother Edmund, who perished by the dagger of an assassin six years afterwards. The life of this king is not characterized by any events of importance. He was succeeded by his brother Edred, whose reign was short, and distinguished by no remarkable circumstance, except the complete incorporation of Northumbria with the rest of the Anglo-Saxon kingdom.

Edred died in 955, and left the throne to Edwin, who is usually styled Edwy, the eldest son of Edmund the Elder. The name of this monarch is intimately connected with that of the celebrated Dunstan, abbot of Glastonbury. The life of that individual having been already given under the head of DUNSTAN, we shall only mention here a few circumstances which are indispensably necessary to the complete chain of historical events. The reign of his uncle Edred had been looked upon by Edwy as a usurpation, and when he himself ascended the throne, the counsellors of the former monarch became the objects of his antipathy. He discarded them altogether, and surrounded himself with a host of young courtiers, more ready to emulate the vices of their master than to suggest prudent measures of government. At their instigation Edwy imposed unjust taxes upon his subjects, despoiled the clergy, and committed other unseemly acts. Dunstan, having been one of the leading advisers of Edred, was most probably obnoxious to the young king; and at his coronation a circumstance occurred which brought the hostile parties immediately into collision. On that day Edwin, after the ceremony, withdrew from the festive board at which the nobles and clergy were regaling themselves, and retired to his own apartments. This indecorous act appears to have displeased the assembly; and Odo, archbishop of Canterbury, deputed Dunstan and another individual to bring back the king to join in their carousals. Dunstan penetrated into the private apartments of his sovereign, whom he found in company with Ethelgiva or Elgiva, his wife or mistress; the mother of the latter was also present. The two deputies forcibly tore the king from the company of the ladies, and brought him back to that of the nobles. This daring and insolent conduct of the monk towards the newly-consecrated monarch drew down upon him the royal vengeance. At the instigation of Elgiva, Dunstan was deprived of his honours, and condemned to exile. During his absence, Odo contrived to take Elgiva from her husband's residence, and send her a prisoner to Ireland, where her face was branded with red-hot irons, for the purpose of obliterating her charms; but in vain. They revived with the healing of the wounds; but on her return to England she was pursued by the opposite party, who falling in with her at Gloucester, actually hamstrung the unfortunate fair one. In a few days death released her from the vengeance of her enemies and from her own sufferings.[1] In the meanwhile a conspiracy was formed against the now unpopular Edwy; and at the head of it was his brother Edgar, who, supported by the Northumbrians and Mercians, drove the unfortunate monarch beyond the Thames. His sufferings and humiliation, however, were of short duration, for he died in 959, ere he had attained the full age of manhood. By some historians he is said to have been assassinated; others state that he pined to death for the loss of his throne, and his Elgiva, whom he tenderly loved; but all agree that his demise was as miserable as it was premature. His youth was the source of all his calamities, for it seems certain that he was only sixteen or seventeen years of age when he assumed the sceptre. He had also the misfortune to live at a very critical period. It was the commencement of that struggle between seculars and regulars which was to be maintained for many centuries thereafter. The intrusion of Dunstan into the king's private chamber was the earnest of many a bold step upon the part of the clergy. It is thus memorable as being one of the earliest instances in our history, of the putting forth of that overwhelming strength with which the church of Rome was armed, and which was destined ere long to exercise so preponderating an influence over the political affairs of every court in Christendom, whose haughtiest monarchs were soon taught to tremble at the thunder of the Vatican.

The death of Edwin put his brother and rival Edgar in peaceable possession of the whole Anglo-Saxon territory. His reign was tranquil, neither foreign enemy nor domestic broils having interrupted its quiet, so that posterity has styled him "the peaceful." The only event of a warlike character ascribed to him is an invasion of Wales. In his personal character he was distinguished alike for his religious zeal and for his licentiousness. A few facts relating to each of these may be stated here. He espoused the cause of the monks, and, during the sixteen years of his reign, erected a vast number of Benedictine monasteries. He recalled Dunstan from exile, placed the bold saint at his right hand as chief counsellor, and conferred upon him the see of Canterbury. In this situation that celebrated ecclesiastic prosecuted his ambitious schemes connected with the order to which he belonged with redoubled vigour. He expelled the clergy from the monasteries, and supplied their places with Benedictines, making the rule of their founder everywhere predominant throughout the nation.

We now find the church so intimately mixed up with political affairs, that some account of it is necessary for the elucidation of history. Although religious individuals had been collected in monasteries from the period of Augustin's landing in Kent, yet the order of Benedictines seems to be the most ancient example of monastic rule. Each congregation of recluses lived according to its own internal regulations, nor were the several monasteries consolidated into one community before the time of Dunstan. The Scottish or Irish, the Pictish and British churches, though in communion with Rome, were still independent of the papal see; and it was the object of the popes to suppress this independence of the different national churches; a cause which was warmly espoused by Dunstan. His policy was to enforce clerical celibacy; to expel at least all the married clergy from canonries and prebends in cathedrals, in order to make way for Benedictines; and to reduce all monasteries to the rule of the founder of that order. The opposition he encountered was formidable, and the cause of the clergy was espoused by the laity. Amongst the latter the secular priests found many powerful partizans, and the schisms of the church at last degenerated into factions amongst the people. But Dunstan was impetuous, and determined to carry through the reformation which he had begun, for he looked upon himself in the light of a reformer; and although the extension of his own power and that of his order may have been so blended with his zeal for the service of God as to deceive even himself, yet there seems no reason to doubt his sincerity. That there were many clerical abuses to be corrected, is consistent with the history of religion in all ages. The Danish invasions, and other national calamities, dispersed the clergy amongst the laity, with whose vices they doubtless became contaminated. The necessities of his situation compelled the prelate to be a statesman and an intriguer. He made some progress during the reign of Edred; in that of Edwy we have seen him checked; but in the present one, invested with the highest ecclesiastical dignities, and backed by the power of his sovereign, he appears before us under auspices which enabled him to carry his loftiest projects into execution. And he was not slow in seizing the opportunity. Not content with the ordinary engines of intrigue and supple policy, he drew upon the superstitious feelings of the time, and arrogated to himself divine intuition and the power of working miracles. He succeeded in deceiving that unenlightened age, and perhaps also himself.

The foregoing remarks may afford a key to some of the more prominent events of Edgar's reign. A national synod was held, at which the king publicly expressed his sentiments in favour of the Benedictine cause. It followed as a consequence of this, that the unfortunate seculars were ejected if they refused to comply with the enactments made by Dunstan and his party, under the sanction of the sovereign; whilst monks were everywhere received with honour, and the erection of monasteries was for a time a royal mania. During the sixteen years of his reign Edgar built no less than forty-eight of these establishments.

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[1] There is no direct proof that this atrocity was perpetrated under the sanction of the Archbishop of Canterbury; and it is impossible to implicate Dunstan in the guilt, for he was in Flanders at the time. The deed, however, was done by the adherents, and praised by the encomiasts, of the archbishop.

In the midst of all this holy zeal, however, he found leisure for the indulgence of his licentious appetites. On one occasion he violently carried off a young lady educated in a convent, and made her his concubine. For this offence he was reproved by Dunstan, and compelled to do penance during seven years; but the mortifications imposed were not of a very severe character. His second marriage was connected with circumstances of a very tragical nature. The beauty of a young and noble lady having been praised to him, he commissioned Ethelwold, a favourite minister, to visit her residence, and report upon her charms. The deputy was himself captivated with the lady. He represented her in an unfavourable light to his sovereign, and married her himself; but Edgar, not being satisfied with the report, paid a personal visit to Elfrida, and, fascinated by her beauty, he procured the destruction of her husband, and espoused the bereaved lady himself.[1]

In extenuation of these delinquencies, he has been allowed the honourable distinction of having warmly patronized trade with foreigners. His commuting the tribute from Wales into three hundred wolves' heads, and his reformation of the coinage, also redound to his credit. By his orders a numerous fleet constantly guarded the kingdom from invasion, and he regularly visited his provinces in order to countenance the execution of the laws. His reign was glorious, and he seems to have converted his prosperity into ostentatious pomp. It is stated that eight kings, amongst whom were Kenneth of Scotland, and his son Malcolm of Cimbria, did him homage by rowing his barge down the river Dee.

Edgar died in 975, in the thirty-second year of his age, and was succeeded by Edward, surnamed the Martyr, his eldest son. A younger brother, Ethelred, by Elfrida, disputed the crown with Edward; but the latter was finally established upon the throne through the influence of Dunstan. His reign was chiefly occupied with disputes between the two clerical systems before mentioned, Elfrida having, on account of her son Ethelred, espoused the cause of the seculars, in opposition to Dunstan, who headed the regulars, and who was also the means of supplanting her son. The monks gained a complete victory over the seculars, who were now totally expelled from their convents. During this reign occurred that tragical circumstance which has afforded modern historians an opportunity of accusing the primate of murder. A council of nobles had been summoned to meet at Calne. During the proceedings, and just as the wily Dunstan had pronounced these words, "I confess I am unwilling to be overcome; I commit the cause of the church to the decision of God," the floor fell instantly down, and numbers of his opponents were killed and wounded. The primate, and probably his partizans, escaped unhurt, a circumstance which can only be accounted for by supposing that their seat remained unmoved. Some historians charge Dunstan with having secretly loosened the floor from the walls, and affirm that during the debate the temporary props which supported it were withdrawn according to his directions. This is very improbable; but there can be little doubt that he interpreted the occurrence as a divine judgment upon his enemies, and thus wrought upon the prejudices of that superstitious age. Several heinous crimes are laid to the charge of the queen dowager, but the last was the darkest and most atrocious of all. Edward, in one of his hunting excursions, visited Corfe Castle, in Dorsetshire, where Elfrida resided with her son Ethelred. He was received with the utmost cordiality, and invited to enter the castle, but declined, requesting at the same time to see his brother, and also the favour of some refreshment. Whilst in the act of raising a cup of wine to his lips, he was mortally stabbed in the back by the orders of his stepmother. On account of his violent death he has been surnamed the Martyr.

Edward was succeeded in 978 by Ethelred, the unconscious cause of his untimely fate. When the latter attained the crown he was only in his boyhood, and throughout a long life he never rose above it. This is one of those reigns which it is painful to narrate. It was the saddest which the descendants of Alfred yet had seen, and presents a strong contrast to that of his father. Edward compelled kings to be his watermen. His son by Elfrida became the sport of traitors; and having five times purchased his crown from the roving Danes, he was forced at last to make an ignominious surrender of it to a foreign invader.

For more than a century the Northmen had formed the chief part of the population of Northumberland and East Anglia, and they now stretched their power to the utmost in order to place one of their chiefs upon the Saxon throne. In 980, and for ten years thereafter, England was insulted by a series of inroads, which, although unimportant of themselves, were calculated to excite some alarm amongst the people, when the latter contemplated on the one hand the power and audacity of the Danes, and on the other a pusillanimous monarch and an unguarded country. But these petty aggressions were followed, in 991, by the appearance of a formidable armament upon the English coast. The invaders advanced without opposition as far as Malden, where they gained a victory, and their retreat was disgracefully purchased by a bribe of ten thousand pounds. Repeatedly afterwards did the Northmen play the same game, and Ethelred make the same debasing submission, by purchasing a momentary respite from their ravages. But the very means which were employed to rid the kingdom of these invaders one year, insured their return the next. Treason, famine, and disease, also aggravated the calamities which overwhelmed the nation. Amongst the instances of defection, that of Alfric, earl of Mercia, demands particular attention. On account of his misconduct he had been deprived of his government, but had recovered it again through the influence of his friends. In 992, a meeting of the witenagemote took place at London, where it was resolved to put the kingdom in a posture of defence, by constructing a powerful fleet, and manning it with picked men. This was accordingly done, and the command of it conferred upon Alfric, with another nobleman and two prelates. Their commission was to surprise the Danes at some part where they could be surrounded; but this judicious scheme was foiled by the treachery of the commander, who not only gave the Danes notice of the intentions of the English, but consummated his perfidy by secretly joining them. He urged an immediate flight; but in the pursuit his vessel was taken, though the traitor himself escaped. The king revenged himself upon Alfric, by ordering his son Algar to be deprived of his eyes; an act as barbarous as it was useless.

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[1] Dr Lingard, in his *History of England*, vol. i. p. 333, states that he is disposed to doubt this tale as improbable. "Malmesbury," says the learned and able historian, "on the faith of an ancient ballad, has transmitted to us a story probably invented by his (the king's) enemies." The story *may* possibly have been invented by his enemies, but where is the evidence, direct or indirect, that this was the case? Dr Lingard goes on to say, "it is improbable in itself, and supported by questionable evidence." Now, where lies the improbability? The tragical character of the transaction is in perfect keeping with that of the times in which it was committed; and as for the perpetrator himself, does not the abuse of the nun prove that, in order to gratify his unhallowed desires, even the religion, for the propagation of which he displayed such unbounded zeal, offered no impediment. Was the law of nature with regard to moral evil stronger in his mind than that which religion had imposed? This is much to be doubted. Nay, it may be surmised that the erection of so many monasteries was a voluntary penance which his conscience dictated him to perform, in extenuation of such crimes as those that are laid to his charge. The evidence is also said to be questionable; but if historians, and the learned Doctor along with the rest, unhesitatingly embody as historical facts the events and transactions related in similar compositions, we see no reason for making an exception with respect to the legend before us, because it happens to stand in the way of a favourite hypothesis. If we take one we must take all, exceptions being made where there is direct contradiction by more authentic evidence, which is not the case in the present instance. Sir James Mackintosh observes, "William of Malmesbury, who might have known the counsellors of Edward the Confessor, relates the incident on the authority (not to be despised) of a Saxon song. The same story is told by a later chronicler called Brompton (*Dec. Scrip.* 865), at great length, and with particulars characteristic of barbaric manners."

This bold exertion on the part of the invaded compelled the Danes to transfer their arms from the south to the north of England, where they extended their ravages; but in 994 appeared two new and more powerful chieftains, Sweyn, king of Denmark, and Olave, king of Norway. With ninety-four ships they sailed up the Thames, and, although repulsed at London, they succeeded in ravaging several counties. But another humiliating subsidy redeemed England from their grasp; and, what is more astonishing still, Olave was honourably received at the court of Ethelred, where he pledged his word never to molest England more. This promise is only remarkable inasmuch as it was faithfully kept. The army of his companion Sweyn, however, continued to occupy the country, to which in course of time it became almost naturalized. That it should remain inactive was not to be expected; but that with impunity it should have been allowed to despoil provinces, displays a want of firmness, courage, and national spirit, which seems unnatural to the island, and can only be accounted for by supposing the existence of a weakness almost amounting to imbecility in the sovereign or his counsellors.

In 1002, Ethelred having lost his first wife, who bore him ten children, married a Norman princess, who assumed the name of Elgiva. The same year became memorable in the history of England for the perpetration of a crime of as black a dye as ever darkened the annals of any people. This wicked act, which rose out of a mischievous policy, is known by the name of the Massacre of the Danes. On the 13th of November, the festival of St Bride, the unsuspecting Northmen, with their wives, children, and all belonging to them, were cruelly put to death by a royal warrant. The details of this fearful transaction are too horrible to be related. Suffice it to say, that no place, however sacred, saved the victims from their pursuers; and that when they fled to the churches for shelter, they were slaughtered in crowds around the altars. One painful episode is interwoven with this tale of blood. Gunhilda, the sister of Sweyn, king of Denmark, who was wedded to an English earl, saw her husband and children massacred before her eyes, and was herself afterwards beheaded. It is related by all historians, that in the agonies of death she foretold the vengeance which would descend upon the English nation for the barbarous act which it had committed; and the prediction was realized, as we shall hereafter see.

The calamities of England seemed now to thicken as the atrocities of its ruler grew darker. Common pity for the failings of humanity would lead us to pardon Ethelred's pusillanimity; but this dark deed has affixed a blot to his scutcheon too deep for time ever to wash away. Sweyn was not slow in revenging the fate of his countrymen; and, through negligence and perfidy on the part of England, he succeeded in ravaging the island, for several years. almost with impunity. In 1007, thirty-six thousand pounds of silver abated his thirst of revenge. Two years afterwards the most powerful armament which had yet obeyed the flag of England was collected at Sandwich; but treason again paralyzed its operations. The captains abandoned their vessels, which were steered up the Thames by the mariners. "Thus," say the annalists, "perished all the hopes of England." The surrender of sixteen counties, and forty-eight thousand pounds, stayed for a short period the rapacity of the Northmen. The picture which the now fallen and devoted England presents, it is painful to contemplate. Accumulated treasons and defeats had unnerved the courage of the natives; whilst the numerous victories of the Danes had swelled their pride, and inspired them with a preposterous idea of their warlike powers. Many fortified cities withstood all their assaults; but the open country was abandoned to their rapacity. Systematic destruction and spoliation was their principle; and the fields, deserted by the husbandmen, ceased to yield the necessary supplies of food, so that the Danes themselves were compelled to quit the island in search of provisions. Taxation, direct and annual, which must be traced to this period, weighed also upon the energies of the people, and materially increased the now almost universal discontent. In the midst of this ignominious submission and disaffection, it is pleasing to record instances of magnanimity, and painful to reflect that these were so few in number. The Archbishop of Canterbury having been made a prisoner by the Danes, was offered his liberty for a moderate ransom, on condition that he would advise Ethelred to pay them heavy sums of money as a largess. "I have no money," he replied, "and I will not advise the king to dishonour himself." Still they persisted; but the dauntless prelate remained unshaken. The barbarians condemned him to death; and he was immediately assailed with bones, horns, and other remains of a feast in which they had been indulging. "Gold, bishop; give us gold," they exclaimed, as they dragged him forth; but he remained unmoved, and having been felled to the earth with the rude missiles which were showered upon him, he received a mortal stab from the hand of a man whom he had himself baptized.

Sweyn made his last incursion into the country in 1013. Terrified at the universal disaffection, Ethelred fled at last to Normandy, whence he returned on hearing of Sweyn's death, which occurred shortly afterwards. The latter was succeeded by his son Canute; for the Danes would now appear to have put in a claim for the sovereignty of the whole country. Ethelred was recalled by the English chiefs, who exacted a promise from him that he would govern with less tyranny than formerly; and pledges were also interchanged between the Danes and English. But a contest soon ensued between the two parties; and although Ethelred succeeded in repeating upon a small scale that system of treacherous massacre for which he had so severely suffered, yet Canute maintained his superiority in open warfare, and took a barbarous revenge upon the hostages in his hands, for the murder of his friends. Treason again added a fearful contribution to the accumulated evils which surrounded the unfortunate Ethelred. His son Edmund, surnamed, from his hardihood, Ironside, vainly attempted to make head against the Danes; for Canute penetrated to York, where he was joined by the Earl of Northumbria and a number of the people. The country was now a prey to two contending armies; but just at this crisis it was relieved from its greatest enemy, Ethelred, who died towards the end of 1016, worn out by care and disease.

Edmund Ironside was immediately chosen king by the English; and if the exertions of one man could have saved the country, this achievement would have been performed by the new king. During his short reign, for it extended to only a few months, he gave proofs of bravery and ability equal to any exigency, and worthy of a happier fortune. The first struggle between him and Canute was for the possession of London, which was held by the English. During the siege Edmund fought two battles in the provinces, one of which took place at Searston, and is celebrated by our annalists. Twice the darkness of night came to the relief of the exhausted armies, which had both suffered severely; but the dawn of the third morning showed the result to be in favour of the English. Canute, however, had taken advantage of the night, and marched upon London. Not long afterwards another battle was fought, in which Edrie, a traitor thrice steeped in infamy by his defection, played the game of victory into the hands of Canute. After this calamitous event the greatness of Edmund's soul became more conspicuous. Although a numerous army had again rallied around his standard, he shuddered to lavish more of his country's blood in this murderous warfare, and challenged Canute to decide their quarrel by single combat. Whether this proposal was accepted or not, is matter of uncertainty; but at all events a pacification was shortly afterwards agreed upon, and England was divided between the rivals; the north being given up to Canute, whilst Edmund retained possession of the south. The latter, however, died shortly afterwards; and there is reason to believe that he perished through the machinations of the perfidious Edrie.

Edmund left two sons, infants; but by the unanimous voice of the nation Canute obtained the sovereignty of England. This remarkable prince was only twenty years of age when he assumed the reins of government. His qualities as a monarch were of a very high order, not unalloyed, however, with the ferocity natural to the Northmen of the period. The first object of his policy was the removal of the children of the two preceding kings. Some of the sons of Ethelred were slain, and the rest consigned to banishment; whilst those of Edmund were sent over to Sweden, for the purpose of being dispatched. But their fate was averted by the prince to whom they were conveyed. He sent them both to the king of Hungary, by whom they were educated in a manner befitting their station. One died in his youth, the other married the daughter of Henry, the emperor of Germany; and their issue was Edgar Atheling, who will be mentioned hereafter.

Canute divided the kingdom into four governments. He retained Wessex to himself. East Anglia was conferred on a chief named Thurchil, who had formerly distinguished himself; and Eric and Edric were continued in Northumberland and Mereia. But the latter shortly afterwards received the full reward of his crimes and perfidy. At a Christmas festival celebrated in London, he had the audacity to boast of his services, when Canute ordered him to be cut down, and his body thrown into the Thames. The Danish king had embraced Christianity, and also taken to wife Emma, widow of Ethelred. The profession of the former removed the main barrier between his English and Danish subjects; and his espousal of a royal female was no doubt intended to conciliate the affections of the Saxons; and it seems to have had a considerable effect in this respect. The other events of this reign will be found related under the head of CANUTE. He died at Shaftesbury in 1035, and was interred at Winchester. By his wife Emma he had a son and daughter; the former called Hardicanute, or Canute the Hardy. But previously to his marriage he had by another lady two sons, named Sweyn and Harold. The former was installed in the sovereignty of Norway, and the latter ascended the throne of England.

Harold was not entitled to the crown; for it had been provided in the marriage settlement of Emma, that the issue of Canute by her alone should reign; yet he being on the spot, succeeded in obtaining the sceptre as well as the treasures of his father. Edward the son of Ethelred, certainly the legitimate sovereign of the kingdom, made an attempt to obtain it, but proved unsuccessful. His brother Alfred renewed the enterprise, which proved fatal to him and to most of his followers. This prince received a letter, which purported to be from his mother, inviting him to come over and take possession of his father's dominions. The proposition was flattering, and in an unlucky moment he yielded to it. Having landed with six hundred followers, he was treacherously made prisoner, along with his companions. Every tenth man was set at liberty, a few more were reserved as slaves, and the remainder were massacred and mutilated with the most capricious cruelty. Prince Alfred himself was deprived of his eyes; and this shocking barbarity soon afterwards terminated in his death. The unfortunate sufferer was the dupe of a forgery; and the whole villanous transaction seems to have been planned by Harold, and executed by his minions, particularly Earl Godwin. This remarkable individual, according to the only account of him which we possess, was the son of a Saxon herdsman. In his youth he had assisted Ulfr, a Danish chieftain, to make his escape to the ships of Canute. The Northman took him under his charge, and by successive steps he rose to the dignity of a Jarl, and to the possession of power little less than sovereign during three reigns. The atrocious deed of blood above related is the only event of importance associated with the name of Harold the First. He died in 1040, and was succeeded by Hardieanute, his brother by the half blood.

This sovereign reigned about two years; and the little that is recorded of him is of a very mixed character. He came over from Denmark, breathing revenge against the murderers of Alfred, and even went so far as brutally to insult the lifeless remains of Harold. Godwin stood prominently forward as an object of punishment, but a splendid present turned aside the shaft of vengeance. Others also escaped by appealing to his avarice, which seems to have been his ruling passion. Edward the son of Ethelred was kindly and honourably received at his court—a noble act of generosity; yet the author of it died of intemperance at the nuptial feast of a Danish lord.

Edward, surnamed the Confessor, the surviving son of Ethelred, was chosen king of England in 1042. He was a weak and feeble prince, and incompetent to the task of vigorous government; yet the commencement of his reign was characterized by an act of severity. He despoiled his mother Emma of her property, and deprived her of her influence. These proceedings were prompted by the antipathy which she bore to the king, and by her lukewarmness in not punishing the murderers of her son Alfred, of whose blood it was even whispered she was not entirely guiltless. The weak and irresolute character of the king threw the power entirely into the hands of the three noblemen who divided the Saxon territory amongst them, Siward earl of Northumberland, Leofrie earl of Mercia, and Godwin earl of Kent, whose daughter, Editha, Edward had been induced to marry. Godwin was by far the most powerful of the three; for besides his own territory in Wessex, his two sons, Sweyn and Harold, held large domains northward of the Thames. In 1051 he at last presumed to bid defiance to his sovereign and son-in-law. Edward, who had sojourned a long time in Normandy, where he was well treated, when he ascended the throne invited the guardians and friends of his youth to accompany him to England. They accordingly flocked to him in great numbers, and received ample preferment. One of them, named Robert, obtained the primacy, at that time the station of highest dignity and power. Amongst those who resorted to England was Eustace count of Boulogne, who had married Edward's sister. At Dover, one of Godwin's towns, a foolish affray took place between the followers of the count and the English. This circumstance gave vent to the popular jealousy of the people against foreigners. Godwin assembled a force, and claimed the surrender of Eustace; but the latter was supported by the king, who ultimately succeeded in driving Godwin and his sons into exile. The star of Godwin seemed now to have fairly set; but just at this moment there arose another of far more disastrous omen to the Saxon line. William duke of Normandy came to England with many of his followers, on a visit to his cousin Edward. He was received with great honour, and loaded with presents when he returned to his own country.

Had the illustrious stranger never risen to be ruler of England, his first visit to it would probably have been passed over by historians with a simple relation of the event. But his singular fortune has induced some writers to find in it a clue to his subsequent proceedings. It is impossible to conjecture what may have passed in his mind upon this occasion. On the one hand he saw, that in the course of a few years, the crown would soon become vacant, for its possessor was now stricken in years, and, moreover, childless. On the other hand, there stood in the way of his claim to it, first of all, Edward, the son of Edmund Ironside; then his son Edgar Atheling, a weak prince, however; and afterwards the brothers of Edward's queen. Under such circumstances his vaulting ambition may have led him to indulge in aspirations to the crown; but only a vague probability of ultimate success must have been awakened in a mind possessed of such high reflecting powers as that of William the Conqueror. Too many obstacles stood in the way of his fostering any sanguine hopes of acceding to the throne of England; and it is certain that the objects of his first visit were pacific. It appears highly probable that his politic foresight might induce him to take measures for securing the crown after the death of Edward the son of Ironside, which took place some years subsequently to his visit to England; and a conjecture may be hazarded that it was immediately after the demise of his brother's son that the Confessor made a promise to William of leaving him the crown. That such a promise was given was afterwards alleged by the Conqueror, as we shall see when he comes before us as a claimant of the sovereignty. In about a year after this the Godwins were restored to their honours and estates; and Editha, who had been repudiated by the king, was called from her prison to the throne. She was innocent of any participation in her father's guilt. The annalists of the time represent her in the most amiable light, and as incapable of devising evil either against her husband or any other individual. On his re-instalment in his earldom and possessions, Godwin succeeded in inducing the king to outlaw Archbishop Robert and all the Frenchmen; and not long after he died ripe in years and in crimes. In 1055 Siward followed him to the grave; and two years afterwards expired Leofric, the wise and powerful duke of Mercia, who was succeeded in his dukedom by his son Algar. Tostig, brother of Harold, received the earldom of the former; but in a few years afterwards (1065), he was deposed for his cruelties, and his sovereignty conferred upon Morcar, son of the Duke of Mercia.

Soon after these transactions, the pacific monarch of England began to sicken. When he saw his end approaching, he ordered the magnificent church of St Peter at Westminster, which he had built, to be consecrated with solemnity and splendour. He died two days after, on the 4th or 5th of January 1066, in the twenty-fourth year of his reign, and was interred in the church which he had so recently dedicated. He left no issue; for he had taken a vow of continence for life. Edward Atheling, the only surviving son of Edmund Ironside, had landed from Hungary with his wife and children, for the purpose of being proclaimed heir to the crown; but shortly after his arrival in London he expired, bequeathing his claim to his son Edgar.

Edward the Confessor presents himself to us only in one character, that of a royal monk. His piety and gentleness might have adorned a cloister, but, unallied with those sterner virtues which fit a monarch for wielding the sceptre with firmness and energy, they rendered him unfit for ruling, except under the influence of able counsel, which he had the good fortune to possess during the greater part of his reign. Abject superstition will unnerve even a strong mind, and to a weak one it imparts a character of childlike feebleness, and forms such an individual as Edward. But he had many amiable qualities, which would have redeemed even greater weaknesses than those with which he is chargeable. He loved his people much; he was averse to the imposition of taxes, some of which he abolished; and his charities were frequent and extensive. His subjects repaid his attentions by lamenting his loss as a national misfortune, and consigning his memory to the veneration of posterity.

The day which witnessed the funeral of Edward, saw the coronation of Harold, the son of Godwin. A report had been circulated that the Confessor had appointed him his successor, which greatly conciliated the chiefs; indeed the only opposition which he experienced was from his own unnatural family. On Edgar Atheling, the last surviving prince of the house of Cerdic, was conferred the earldom of Oxford, in lieu of the crown. Tostig, the brother of the king, was a competitor for the crown. Harold Hardrada, king of Norway, promised him his support, and the politic duke of Normandy did the same. In Flanders he was permitted to raise an army, with which he landed in Northumberland; but he was defeated by Morcar, on whom the earldom of the province had been conferred. The discomfited Tostig fled to Malcolm, king of Scotland, where he was well received. The Caledonian monarch had himself been sheltered at the English court during the usurpation of Macbeth, and was established on the throne of his ancestors by the aid of England. As a grateful return for the attentions he had received in that country, he always readily welcomed the malcontents who fled from it. The arrival of his Norwegian ally recalled Tostig from his exile. They joined forces at the mouth of the Tyne, and marched upon York, in the neighbourhood of which city the Saxon army sustained a defeat. But this was only a prelude to the grand struggle. Harold, the king, notwithstanding the necessity under which he lay of watching the south-eastern extremity of the island from a still more formidable rival, collected a considerable army, and marched with promptitude and secrecy to meet Tostig and his Norwegian ally. So rapid had been the movements of the king that he took the enemy in some degree by surprise. They, however, retired upon Stamford-bridge on the Derwent, where they drew out their line of battle. The contest which ensued was bloody, and long of doubtful issue. For a while the firm array of the Norwegians bade defiance to all the efforts of the English cavalry, which, accustomed to charge in detached masses, fell in this dispersed state almost harmless upon the bristling rampart of Scandinavian spears. The king of Norway, conspicuous by his blue tunic and glittering helmet, made the most heroic exertions; but victory forsook his standard; a fatal dart pierced his throat, and he fell lifeless to the ground. Tostig assumed the command, and after a desperate effort to turn the fortune of the day, he perished, with the flower of the Norwegian army. This victory, which is memorable on account of the dreadful slaughter that distinguished it, was gained on the 25th of September 1066. It must be recorded to the honour of Harold, that twice he offered peace and pardon to his rebellious brother, once before and once during the heat of battle, when the Norwegian had fallen, but both times these offers were refused. Three days after this conflict William duke of Normandy landed in England, and Harold had to prepare for another desperate struggle to retain the crown. It will now be necessary to examine how far the pretensions of the new competitor for it were legitimate.

This celebrated claimant to the sceptre of England was the descendant of Rollo, a renowned Vikingr or Sea-King, who flourished at the beginning of the tenth century. Rognvalldr, the father of Rollo, was one of those earls appointed by Harold Harfager, or the fair-haired, to guard his conquests. He had two sons, Thorer and Rolfr, better known by his more celebrated name of Rollo.[1] The progenitor of William the Conqueror was expelled from his country on account of a violation of the law which forbade freebooters, under pain of death, to destroy cattle on the Norwegian shore. Driven from his paternal shores, he resolved to seek for a kingdom elsewhere; and after much successful valour he succeeded in establishing a Scandinavian state in France. Rollo proved himself a prince worthy of a kingdom, and his acquisition in course of time assumed the name of Normandy. His exertions for the improvement of his dominions, the civilization of the rude Northmen, and the humanizing of their minds to the love of order, justice, and the arts of peace, class him with those illustrious individuals who have proved themselves benefactors of the human race. He died in 931, and was succeeded by his son William. After two others, Robert the Magnificent, or the Devil as he was perhaps more appropriately designated, succeeded. He was father to the duke, who now appears before us as a competitor for the English throne. William was an illegitimate child by a damsel of humble condition, of whom his father was enamoured, but could not wed during the lifetime of his duchess, the sister of Canute. Like their northern progenitors, the nobles of the Norman duke were careless of the distinction between concubinage and wedlock, so that on the death of Robert in 1035, William, although then only eight years of age, was triumphantly placed upon the ducal throne, which he filled with renown for fifty-three years.

The circumstance of numerous Norman barons having settled in England during the reign of Edward the Confessor, who was the grandson of a duke of Normandy, has already been noticed; as also the visit paid by William to the childless monarch. It was afterwards asserted by the Duke of Normandy, that upon one occasion, probably that to which we have already alluded, Edward had bequeathed to him the crown of England. He also alleged a testamentary bequest, as well as Harold. Both were alike destitute of any claim founded on the modern principles of hereditary descent, but both by consanguinity made out a species of right to inherit; William as the grand uncle of Emma the king's mother, and Harold as the king's brother-in-law. The claims of the champions were therefore nearly balanced, and seem to have contented their partizans; the sword alone could decide to whom the real title should belong.

In the mean time the claim of Harold suffered considerably on account of a circumstance which occurred a short time before the demise of the late king. The Saxon had been shipwrecked in France, but obtained leave to proceed to Normandy by alleging that he was intrusted with some communications to Duke William. That prince received him kindly, and imparted to him the hopes which he cherished of obtaining the English crown. He received a promise of aid from Harold, and by an artifice succeeded in making him swear fealty to his cause. Underneath the missal on which the Saxon had sworn were concealed various sacred relics, such as the bones of saints and martyrs, and thus he had unconsciously bound himself by the most solemn oath. When the struggle came, Harold urged the plea of compulsion as releasing him from any obligation to keep his vow. Abhorrence of oath-breakers, however, is characteristic of a superstitious age; and whilst the circumstance materially weakened the cause of Harold, it strengthened in a corresponding degree that of his rival. There is also every reason to believe that it was the principal means of enabling William to obtain from the holy see a declaration in favour of his enterprise. At such a period a bull from the pope was itself worth an army, and this the adventurer not only obtained, but also a consecrated standard, a ring, and a lock of his holiness's hair.

William now set busily to work in preparing the means of offensive aggression. When his purpose was known, he was speedily joined by all the young knights of the neighbouring countries who sought fortune or renown, and by all the freebooters whom the hope of spoil allured to his standard. With an armament more formidable than the western nations had yet witnessed, he accordingly put to sea. Annalists have greatly exaggerated the number of his troops; for altogether they did not probably much exceed twenty-five thousand men. With this army he landed without opposition at Pevensey, in the county of Sussex, as has already been observed. He made no stay at that place, however, but proceeded immediately to Hastings to procure provisions. Harold, apprised of the arrival of his most dreaded enemy, flew to attack him. William, informed of his victory and advance, was counselled by some to remain in his entrenchments, and not to hazard an open engagement. But the mind of the future conqueror was not liable to the agitations of fear. He had thrown his life upon a cast, and was resolved to stand the hazard of the die. In this emergency the conduct of Harold has been severely censured. He appropriated to himself all the spoils of the late battle, which added to his unpopularity; whilst the death of his brother was by common report imputed to him. On his march against William, a considerable portion of his army deserted him, and their place had to be supplied by raw and undisciplined levies. When the two rivals were near enough to interchange messages, the Norman offered Harold the choice of abdication, of single combat, or of appeal to the pope. These propositions being rejected, he was then offered Northumberland for himself, whilst Kent would be conceded to his brother Gurth; but the latter proposal shared the fate of the former one; upon which William declared his intention of giving battle to his rival, whom he looked upon and designated as a liar and a perjured wretch, excommunicated by the holy father. He even expressed astonishment that an individual conscious of such guilt as that with which Harold was chargeable should venture his person in battle. We are told that such a feeling also prevailed in the English army, and that the king was advised by his brothers Gurth and Leofwin to withdraw, whilst they would lead on the battle. Harold, however, only smiled at their apprehensions, and expressed his resolution of commanding the army in person.

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[1] In the *History of England* by Sir James Mackintosh (vol. i. p. 90), the following sentence occurs:—"One of the sons of Roguevald, called in the Icelandic poems *Hrolpt*, better known to us by the name of Rollo, had, for reasons unknown to our authorities, been excluded from all share in his father's domains, and had no resource but piracy." The reason of his exclusion was in all likelihood his being a younger son. We have already noticed, that amongst the Northmen of this period an absurd law obtained, by which all but the eldest son were excluded from any participation in the property left by the father. By this pernicious arrangement the younger branches of families were driven to seek their fortune upon the sea. It is certain that Roguevald left two sons; it is also next to certain that he would observe the law of the land as it then existed. Now, the question comes to be, which of the two was the first born. There is no direct evidence upon the point, but the circumstance of Thorer's name having always the precedence when the brothers are mentioned together, and also that of Rollo's piratical exploits, whilst there is no mention made of his brother in that capacity, seem to determine the point that the progenitor of a future royal family of England was the youngest son;—and thus the difficulty is explained.

On the morning of Saturday the 14th of October William advanced to the attack of the Saxons, after having solemnly heard mass and received the sacrament. The previous night is also said to have been passed in devotion, whilst songs and revelry resounded throughout the Saxon camp. The spot which Harold had fixed upon for this important contest was a piece of rising ground about eight miles inland from Hastings. It was open towards the south, and was covered at the back by an extensive wood. On the front of the declivity the troops were arranged in one compact mass, in the centre of which floated the royal banner, with the king and his two brothers near it. On an opposite hill stood William in front of his warriors, with the relics upon which Harold had sworn hung round his neck, and the consecrated standard waving by his side. After a short address to animate his soldiers, he advanced upon the enemy, shouting the national war-cry " God is our help;" whilst the cry of " Christ's rood, the holy rood," rose from the adverse ranks. The impetuous onset of the Normans was received by the English with their battle-axes, with which they broke the lances and cut the coats of mail, on which their opponents placed great reliance. The confidence of the Normans began to waver, and the left wing, both horse and foot, actually gave way. With eager rashness the English pursued, and thus exposed themselves to the hazard of being cut off; for William with dauntless fortitude and presence of mind had succeeded in rallying his fugitive bands. The attack was renewed, and again the English repulsed it. The duke had now recourse to an artifice which ultimately proved the destruction of the enemy's army. By a feigned flight he allured a body of them from their strong position, and, whilst the latter too eagerly pursued, he turned upon them with his cavalry, and hewed them in pieces. Twice was this stratagem repeated, and each time with perfect success. Still the main body of the English presented an unbroken rampart of shields, against which the mass of Norman chivalry for a long time was hurled in vain.

During the conflict both leaders gave proofs of personal bravery and skill worthy of the crown which the one was combating to retain and the other to wrench from his grasp. William had three horses killed under him, and hand to hand he had grappled on foot with his adversaries. A little before sunset Harold, both of whose brothers had already fallen, received an arrow in the eye, which penetrated to the brain. His fall relaxed the vigour of the English. Their lines were penetrated, their standard taken; and a panic having seized upon them, they broke and dispersed through the wood, whilst darkness closed upon the spoils of the field and the hopes of the Saxons.

Thus ended the battle of Hastings, memorable in various respects, first, as introducing a new dynasty of monarchs to rule the southern part of Britain; and secondly, as opening up to the inhabitants of the island the means of a more extensive intercourse with the continent than they had ever yet enjoyed. By this means were introduced into Britain those modes of life, manners, customs, and institutions which were at the time considered as characteristic of civilization and refined society; and henceforth England was destined to take a large share in the transactions and fortunes of the continental powers, perhaps ultimately for the mutual benefit of all parties.

On the morning after the battle, the victors, having stripped the bodies of the slain, pranced wantonly over them with their horses. The mother of Harold, like another Andromache, begged the corpse of her son from the conqueror; but whether her maternal request was complied with or not is a matter of great uncertainty; for upon this point our annalists are either contradictory or ambiguous. By one party it is asserted that the corpse of the fallen monarch was interred upon the beach; by another that it was given up when demanded, its weight in gold having been offered as a ransom. Perhaps both are correct; for it is probable enough that it was first buried on the shore, and afterwards exhumated at the request of the mother. Without entering into any speculation connected with the Norman conquest, we may simply remark, that in order to interest the reader of English history, and excite commiseration and pity for Harold, he has, by a number of historians, been invested with talents, virtues, and accomplishments which he did not possess in a degree sufficient to command the entire affection of his countrymen during his life; whilst his death has also been deplored with unnecessary regret, as a sort of national loss. Where the stakes are equal, and the game a fair trial of strength and dexterity, sympathy will always side with the loser. Over his opponent Harold had the advantage of fighting for his native land against a foreign invader; but it must be observed that his own aggrandisement and the independence of the nation were inseparably connected, and that in pursuing the one he was combating for the other.

Before entering into the subsequent history of the conqueror's proceedings, it will be necessary to pause and take a rapid glance at the Anglo-Saxon institutions before they were supplanted by the system which the successful invasion of the Normans was destined to introduce.

The Anglo-Saxon king, without possessing despotic sovereignty, was in dignity, property, and power elevated far above the level of the rest of the nation. He was elected by the assembly called the *wittena-gemote*, a meeting of wise or prudent men. This was the great council of the nation, and seems to have resembled what our modern parliament would be if lords and commons mingled together and debated in one house. It was composed of the prelates, earls, and a great many thanes or considerable proprietors of land, a class similar to our modern gentry; so that the Saxons may be said to have possessed the elements of a free and popular government, though as yet in a rude and chaotic state. This supreme judicial and legislative assembly was convened by the king, and held its meetings on the great festival days of the church, such as Christmas. But these were not confined to such seasons, being called together according as circumstances required. Besides electing the king, and presiding at his coronation, they assisted him in making laws and treaties, in military preparations, in administering justice, and the other affairs of government. Their power was considerable, but it depended in a great measure upon the character and capacity of the sovereign. The highest officer in the kingdom was the ealdorman; he was chief of a shire, and had great judicial powers. An eorl was the next dignity, which remained separate from the former until towards the close of the Anglo-Saxon period, when the title of ealdorman seems to have been superseded by that of eorl; under them were other officers, whom it is unnecessary to particularise. There was of course a wittena-gemote to every kingdom; and when all the principalities merged in Wessex, and gave rise to a single one for the whole country, the monarch occasionally held *shire-gemotes*, or county meetings, where the laws made by the king and his counsellors were proclaimed, and being acknowledged and sworn to, became binding on the whole nation.

The Anglo-Saxons were divided into freemen and slaves. But there was a third class, such as bordars, cottars, and others, who were cultivators of the soil, and, ranking probably in the lowest order of freemen, were scarcely reduced to the degrading level of slaves. As far as has yet been ascertained, the class which was subject to the most complete thraldom was small in comparison with those who enjoyed superior privileges, probably about one in seven. The Anglo-Saxons paid some attention to the cultivation of the land, which was held by various tenures, and liable to certain burdens, which varied in kind and quantity. Military service, which consisted in providing a certain number of armed men when public safety required them, was one of these. The other two great services were the constructing or repairing of bridges, fortresses, and walls. Besides these, the sub-proprietors of land were more or less liable to many other burdens. With regard to their conveyances, we have several of their grants of land without any pecuniary consideration; of their conveyances on purchase; of their deeds of exchange; of their testamentary devises, and their leases. These were, in the early periods of Anglo-Saxon history, short and simple; but in grants of a more recent date the general words are nearly as numerous as in our present deeds.

The supreme legal tribunal was the wittena-gemote, which, like the present House of Lords, was paramount to every other. There were also shire-gemotes and burgh-gemotes, so many yearly meetings of which were strictly enjoined upon those who composed them. Much of their judicial proceedings rested upon oaths, and perjury was therefore severely punished. For the various breaches of the law the punishments were commonly pecuniary. In the case of murder, the amount, which was partly levied by the state as a penalty, and partly granted to the family of the deceased as a satisfaction for the loss of their relative, was proportioned to the rank of the murdered man. Persons accused of crimes had occasionally to pass through an ordeal of hot water or hot iron, of which they had their option.

There were many popular institutions which rendered the king subordinate to the community. The meetings of the people at the various courts, from the folkmote of the hundred, to the wittena-gemote of the nation, contributed to foster the principles of equal law and of popular government. From the Anglo-Saxons we derive our language, the names of the most ancient officers among us, and those of the greater part of the divisions of the kingdom, and of almost all our towns and villages.

In their domestic habits the Anglo-Saxons were social, and loved the pleasures of the table. Their food was that mixture of vegetable and animal diet which always marks the progress of civilization. Ale and mead were their favourite drinks, and wine was an occasional luxury. They had become so far acquainted with the conveniences of civilized life as to display both variety and vanity in adorning their persons. Their dwelling-houses seem to have been small and inconvenient, although they were both expensive and magnificent in their ecclesiastical buildings. Amongst the Anglo-Saxons females were very respectfully treated, and occupied the same independent rank in society which they now enjoy. The trades and mechanical arts had made considerable progress, and even foreign commerce was carried on and considered as a highly honourable calling. With regard to their circulating medium, it may be shortly stated, that they had their pounds, shillings, pence, and farthings, exactly as we have at present. Learning, except amongst ecclesiastics, was neglected; and with regard to literature, little can be said with certainty, for the monuments of this kind which they have left us, except what is historical, have not yet been examined with sufficient care.[1]

The conquest of England did not altogether terminate with the battle of Hastings. London and other important towns were put in a posture of defence, whilst a numerous fleet had assembled at Dover to interrupt the proceedings and distract the attention of the invader. Edgar, the legitimate heir to the throne, appears to have been either crowned or acknowledged as sovereign at London, where the two powerful earls Morcar and Edwin, with the loyal inhabitants, resolved to make a desperate stand against the advancing foe. William, however, instead of attacking the city, chose rather to lay waste the country, which he did most effectually, consigning to the flames what could not be forcibly removed. He now appears before us in a character somewhat new. Formerly he had combated for the crown against an individual who, according to all modern notions of legitimacy, had no more right to it than himself; but in the present instance he was attempting to snatch it from the brow of him who alone had a hereditary claim to wear it. On this account the atrocities committed by his troops are justly contemplated with horror, whilst the disposition to palliate them is proportionally lessened.

William, however, was the candidate favoured by the see of Rome, and the bishops interfered in his behalf. Stigand, the metropolitan, was the first to throw himself on the mercy of William, whom he met as the conqueror crossed the Thames at Wallingford, and swore fealty to him as his sovereign; others followed his example, as did Edgar, Edwin, and Morcar upon the part of the nobility. The crown was offered to him, and he was formally invested with it in Westminster Abbey, on Christmas 1066. During the ceremony a tumult arose which made the stout heart of the conqueror to tremble beneath its iron mail; and, had an English force, led by any competent commander, and capable of making head against the Normans, appeared at the moment, it might have cost him his crown and his life. Whilst, by loud acclamations, both English and Normans expressed their willingness to have William for king, his troops set fire to the houses, and commenced the plunder of the city. The coronation service was hastily concluded, and the insurrection quelled without much difficulty, although the English looked upon it as a bad omen, and William as a most unfortunate occurrence. It was his interest to propitiate the affections of the people whom he had now been appointed to govern, and he anxiously wished to do so. In explanation of this occurrence, it is usually alleged that the Normans mistook the acclamations of those who shouted within the church for an alarm of the English to rise in revolt. But if this had been the case, why did they not instantly fly to the rescue of their king, instead of spreading themselves about and firing and pillaging the city? His safety was surely their first care; for had he fallen, their fate was inevitable. The whole unquestionably originated in the desire of the troops for sack and pillage.[1]

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[1] Turner's *Anglo-Saxons*, vol. ii. *passim.* Mackintosh's *England*, vol. i. p. 71.

Hitherto William had been called the Bastard; from this period he obtained the surname of the Conqueror, a term which at the time was employed to designate a person who had sought and obtained his right, as well as a subjugator. It was necessary for William to maintain a strong military force in order to compel the obedience of his subjects; and he could only feel himself secure surrounded by his trusty Norman barons. But the duration of their services being limited to a certain term, they naturally expected to be released from their engagements, and re-conveyed to their country, when the period of servitude had expired. In order to encourage them to remain, he put into their hands the strongholds and principal towns of the kingdom, whilst all the conquered territory of the English, which he had at his command, was likewise distributed amongst them. Having thus put his dominions in a secure posture, he embarked for Normandy, carrying along with him Morcar, Edgar, and Edwin, and leaving the chief management of affairs in England in the hands of William Fitzosbern, a Norman baron, and Odo, bishop of Bayeux, the son of his mother by a plebeian husband. During the absence of the Conqueror, the Saxons began to mutter threats of vengeance, and even went so far as to enter into a conspiracy to cut off the Normans as their forefathers had done the Danes. It appears, from the testimony of several credible annalists, that the oppression which the English suffered at the hands of the insolent soldiery was most galling, and called loudly for retaliation. These alarming rumours crossed the channel, and reached the ears of William, who hastened from his continental dominions, and, landing in England in December 1067, made a sort of second conquest of that country. The Saxons of Devonshire, joined by the neighbouring Britons in Cornwall, had thrown off their allegiance to him, and against them he first turned his arms. They made a gallant stand; but William having reduced Exeter, succeeded in breaking the spirit of resistance for a time. About this period, Edgar, with his mother and two sisters, having embarked for Hungary, were driven by a tempest upon the coast of Scotland. That country was at the time governed by Malcolm, surnamed Ceanmore, who gladly received the fugitives, and made them a return for that kindness which he had himself experienced under similar circumstances at the English court. Many Saxon nobles followed Edgar, who, with subsequent emigrations of disaffected Normans, founded the greater number of the Scottish noble families. Malcolm afterwards married Matilda, the eldest sister of Edgar.

William the Conqueror now turned his attention to the north, where his authority had not yet been properly established. From the heart of Mercia to the confines of Scotland a spirit of open insubordination prevailed, and was fostered by Edwin, who had been at one time promised the hand of William's daughter, but was afterwards refused it. The insurrection became formidable; but it was soon quelled, and this served more and more to confirm the power of the Normans. William penetrated as far as York, which opened its gates to him, scattered the isolated and feeble bands who opposed his march, and reduced all the important towns on his way. During this expedition he also fortified a number of castles. The tranquillity thus produced was, however, of short duration. At Durham the English succeeded in massacring the whole Norman force established there, excepting two men. York followed the example of Durham, and rising upon the garrison, killed the governor, with many of his retainers. Shortly after this event, the sons of Harold, the late king, landed from Ireland with the intention of making an effort to recover the crown; but they were utterly defeated in two engagements, by Brian, son of the Earl of Bretagne.

A new and formidable auxiliary of the malcontents had now however arrived in the Humber; this was a powerful Danish armament. Edgar Atheling, several illustrious Saxons, and crowds of the English, having joined them, they successfully assaulted York; but William, apprised of their descent, hastened to the scene of war. His usual good fortune attended him; and the Danes were compelled to quit the country without crossing arms with the Normans in any conflict worthy the name of a battle. Hints have occasionally been thrown out that they were bribed by the Conqueror; but of this circumstance there is no direct evidence. Upon another point, however, all historians are agreed, namely, that, piqued by these repeated insurrections, the king, in a transport of passion, had sworn to extirpate Northumbria. This merciless vow was performed nearly to the letter. Unbounded license was given to the soldiery, who ravaged the country with fire and sword. The destroying angel could scarcely have left a more desolate wilderness behind. An historian, William of Malmesbury, who wrote sixty years after the event, thus describes it: "From York to Durham not one inhabited village remained; fire, slaughter, and desolation made it a vast desert, which continues to this day." The dead remained unburied; famine, with pestilence in its train, stalked throughout the neighbouring provinces; whilst confiscation brought up the rear of this terrible visitation, and completed the ruin of the country and its inhabitants, gleaning whatever the sword had not destroyed. Such atrocities as these imprint a blot upon the escutcheon of William which it is impossible to obliterate. To his authority the rebel chieftains were compelled to submit; and having thus in the most summary manner crushed rebellion in this quarter of his dominions, he returned southwards, clearing the provinces of the disaffected as he proceeded, and repairing or building castles for the subjection of the country.

William was now undisputed master of England. The conquest of the country, properly speaking, only began with the battle of Hastings. It was not until seven years thereafter, when he carried the terror of his arms to York, that the country was completely subdued. Before that period not one half of England acknowledged his authority. But the spirit of the Saxons was now fairly broken, and finding themselves pursued with such extirpating vengeance, many of them sought refuge amongst the hills and forests, whilst others emigrated to foreign lands. A party of them under Hereward, a resolute chief, attempted to make a stand in the island of Ely, immediately after the northern massacre. This land of fens and marshes was the last asylum of Saxon independence; and Morcar, with some bishops and the remainder of the most conspicuous Saxons, repaired thither. For a while William disdained to notice the efforts of Hereward; but at last he invaded his circumscribed territory, and, scattering his little band, compelled him to fly. This bold and patriotic chieftain afterwards gave in his submission, and being allowed to retain his paternal possessions, the end of his days proved happy. His daring exploits had endeared him to his countrymen, and conferred on him a romantic celebrity. His actions were the theme of many a Saxon song; and even the Normans did homage to his warlike virtues. He was the last of the Saxons who drew the sword in the cause of national independence.

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[1] Although not mentioned by our historians, contemporary annalists establish and illustrate the fact that the armies of the continent at this period were in a great measure composed of mercenaries, who followed war as a profession, and hired themselves out to the best paymaster. These individuals were different from those who followed the banners of the barons according to the feudal system. They were little better than hired banditti, and were very numerous in the Low Countries, whence William had sprung. That the force with which he invaded England contained vast numbers of these condottieri, is not only probable, but appears nearly certain, when we contemplate the methods of furnishing out an army in those days. The plunder of the provinces which they overran or conquered seems to have been looked upon by them as not only allowable, but as forming part of their reward. That the affair at William's coronation arose from their rapacity for pillage, which they looked upon as a right, there can be little doubt; and they chose the most fitting time for successfully carrying their project into execution: a time when their leaders were withdrawn, and in attendance at the ceremony going on within the church. They had previously broken out in the same way at Dover.

William having now quieted the tumults at home, turned his attention to Malcolm, king of Scotland, whom he compelled to submit. The affairs of the church also occupied him for a time; and several changes were effected, not, it may well be believed, to the advantage of the Saxon prelates. One of them, the Archbishop of Canterbury, was deposed, and his place supplied by Lanfranc, who, although a worthy man, was the creature of William, and in bondage to Rome. In the meanwhile, Edgar Atheling had sought and obtained the friendship of the Conqueror, who, to his honour, ever afterwards maintained this weak and almost imbecile youth in ease and affluence at his court.[1] William now ventured upon another visit to Normandy, where we shall leave him engaged in petty contests, and take a view of the state of England after its subjugation.

By the introduction of a foreign sovereign, a foreign hierarchy, and a foreign nobility, the native population suffered severe depression. To supply the liberal grants of land and places of honour and trust to his followers, the English were of course sacrificed; and thus they were compelled to become the servants or dependents of their conquerors. Contempt and oppression became their heritage. Their farms were pillaged, their females violated, their persons imprisoned, and other indignities heaped upon them, at the caprice of the petty tyrants who were set over them. The principal favourites of the Conqueror had another distinction conferred upon them in addition to the grants of land. This was the earldom or command of the several counties. Two legal revolutions occurred or were completed during the reign of William; the separation of the ecclesiastical from the civil judicature, and the introduction or consummation of the feudal system, for an account of which the reader is referred to the proper head. He effected various other judicial changes which were ultimately beneficial to the community. The crown revenues were a continuation of those which the Anglo-Saxon kings enjoyed; but they appear to have been considerably increased by the various changes which took place, and also very carefully collected; for from an ancient historian we learn that the king's daily income amounted to above one thousand pounds, a sum almost incredible when we reflect that gold was then three times and silver ten times the value which they possess in modern times.

During the visit of William to his continental possessions, the Norman barons rebelled against him, and were joined by some Saxon chiefs. The king hastened across seas with a band of auxiliaries, and made an easy conquest of the insurgents. The remaining events of his reign are not sufficiently important to require a minute recital. The most remarkable is the revolt of his son Robert, who had been promised the duchy of Normandy when William first invaded England. The French monarch fomented the hostilities between the father and son, which existed for several years, and closed with a most romantic incident. Robert, being besieged in the castle of Gorberoi, engaged a knight enveloped in complete armour, and unhorsed him, at the same time inflicting a wound in his arm. When about to pursue his advantage, Robert recognised in the fallen warrior the voice of his father. A reconciliation was finally effected by the tears and entreaties of Matilda, the mother of this Norman Absalom.

Whilst engaged in a desolating warfare against Philip, king of France, William came before the town of Montes in July 1087, and ordered it to be burned. He rode to view the scene, and galloping among the smouldering ruins, his horse reared and plunged so violently as severely to wound the rider, who was at the time very corpulent and unwieldy. He was carried in a dangerous state to the vicinity of Rouen, where he breathed his last, on the 9th of September. On his death-bed the conscience of the Conqueror appears to have stung him deeply; for he ordered that several prisoners in England, amongst whom was Odo his half-brother, should be set at large; and that restitution should be made for what he had violently destroyed. But these atonements were inadequate to expiate the crimes of which he had been guilty.

The character of William has been drawn in the Saxon chronicle by an Englishman, who was his contemporary, and lived at his court. From this document we learn that the king was very wise, very rich, and "more worshipfull and strong than any of his fore-gangers." It is added, that "he was mild to good men who loved God, and stark beyond all bounds to those who withstaid his will;" and the chronicler goes on to show that he exercised a passionate as well as politic tyranny. That, in fact, he surpassed his contemporary rulers in capacity for command, the events of his life bear ample testimony. All those qualities which fit an individual for directing and controlling the minds of men in troubled times he possessed in an eminent degree. In extenuation of his perfidy and cruelty, it may be urged that these detestable qualities were not more characteristic of him than of the age in which he lived; and that he is conspicuous for them above his competitors only because, from the vigour of his mind, and the great transactions in which he interested himself, he was their superior in every thing else. In a happier state of society, when moral restraint is generally recognised, and influences the development of the mental constitution of man, his glories would not probably have appeared more stained with blood than those of Cromwell and other warriors who have attained the seat of successful ambition and uneasy power. Neither these palliatives, however, nor his death-bed penitence, can atone for irrevocable crimes, or erase from the page of history such deeds as the Northumbrian massacre.

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[1] Sir James Mackintosh, in his *History of England* (vol. i. p. 108), gives a somewhat different account of this youth, but upon what authority is not stated; ours is Mr Turner, who quotes from William of Malmesbury. There is considerable ambiguity in the passage; for Sir James (p. 102 of the same work) says that Malcolm Ceanmore "married the Princess Margaret, after the *death of her brother Edgar*." Now the king of Scotland espoused this princess several years before the events noticed in p. 108, so that one or other of these statements must be erroneous; for none of our historians makes mention of *two* contemporary princes named Edgar belonging to the royal house of Wessex.

Much has been written concerning the Norman conquest, for it is a subject of inexhaustible interest. That it became ultimately of incalculable benefit to the country, whatever may have been the suffering immediately consequent upon the event itself, no one can doubt who reflects upon the fluctuating condition of England, its oscillation between foreign bondage and native independence, its internal broils and never-ending distractions, previously to the invasion of the Normans, with the consolidated strength which it internally displayed, and the dignified bearing which it outwardly assumed, after it was conquered by them. Insurrections, though not unknown afterwards, were of less frequent occurrence, and far less alarming, than before; and from the period of the invasion of William, no foreign enemy dared to set his foot upon the soil with impunity. Amongst the financial innovations of his reign was the composition of the Doomsday Book, for an account of which the reader is referred to the article under that head.

The Conqueror left three sons by his wife Matilda. Robert, the eldest, was installed in the duchy of Normandy; whilst William, surnamed Rufus or the Red, from his complexion, obtained the throne of England, and was crowned on the 26th of September 1087. An attempt was made by his half-uncle Odo to dethrone him, and to set up his brother Robert in his stead. But William, alarmed at the formidable demonstrations which were made against him, appealed to the English for aid, and his call was most loyally obeyed. The Normans who had invaded England were compelled to fly, and William carried the war into Normandy, where a reconciliation was effected in the year 1091. The king of England had acquired several continental fortresses, of which he was still to retain possession. It was also stipulated between the brothers, that on the decease of either, the survivor should succeed to the dominions of the other. Henry, the younger brother, who suffered by the treaty, held out several strong places in Normandy; but they joined their forces together, and besieged him in St Michael's Mount, whence he was compelled to fly from want of water.

Robert accompanied his brother to England, where he had been promised possessions as an equivalent for the fortresses which he had yielded up in Normandy. But William did not find it convenient to fulfil the terms of the treaty; upon which his brother, who had again crossed the channel, sent over two heralds for the purpose of declaring him a false and perjured knight. In order to defend his honour, the king followed them into Normandy; but his transactions there belong rather to his own individual history than to that of the country which he governed. The possession of his brother's dominions was a leading object of William's ambition; and he gradually acquired an ascendency in Normandy, which he repeatedly invaded, obtaining new cessions at each adventure. Robert finally mortgaged the whole country to him for three years, at an equivalent of ten thousand merks.

The other events of William's reign were, an invasion of Wales, which was crowned with the usual success; and a war with Scotland, in which the monarch of that country was slain. His government of England was most unpopular. For the gratification of his own appetites, and the enriching of worthless favourites, he plundered the country with impunity. During the life of Lanfranc, his undisciplined rapacity was checked by the wisdom and influence of that excellent prelate. His death, however, removed every restraint, for the king supplied his place by the appointment of an able but remorseless counsellor, who, according to the king himself, was capable of braving the execrations and the vengeance of mankind, in order to gratify his master's desires. Many bishoprics, including amongst these the see of Canterbury, were kept vacant by the king for several years, until a severe illness convinced him of the necessity of appointing a primate. The individual whom he fixed upon was Anselm, one of the most learned and meritorious men of his age. This individual at first demurred to accept the archbishopric, dreading the violence of the king; but the earnest solicitations of his friends at last induced him to comply, and he thus became primate of England. William, as long as his illness was of a dangerous character, showed himself penitent and submissive. He commanded all his prisoners to be released, all his debtors to be forgiven, and all offences to be remitted; and he solemnly vowed that if he recovered he would govern the land in righteousness. But no sooner was he convalescent than he showed that his profession of amendment was only a matter of convenience, and extorted from an unforgiving spirit by the terrors of death. Anselm, as was usual in such cases, brought a voluntary present to his master as an acknowledgment for the dignity which had been conferred upon him; but the gift, not corresponding to the avaricious views of the monarch, was refused, and the unfortunate primate was ever afterwards persecuted by him with the most unrelenting tyranny. Anselm at last sought shelter in Rome, where he continued until William's demise.

The death of the monarch, like his life, was violent. Whilst hunting in the New Forest, he was accidentally struck by an arrow, which buried itself in his breast, and he expired on the spot. The shaft is believed to have been shot at random, and to have come from the bow of Walter Tyrrel, a French knight, who immediately made his escape. This event happened on the 2d of August in the year 1100.

Henry the First, surnamed Beauclerk or the Scholar, ascended the throne of England three days after the death of his brother, the preceding monarch. The compact which had been made between William and Robert was set aside; but the latter, considering himself as aggrieved, invaded England. The formidable demonstrations made by his brother, however, intimidated him, and a pacification was at last effected at the accession of Henry; and the latter propitiated the favour of his subjects by many wise acts. He removed the unpopular agents of his unfortunate brother, particularly Flambard, the obnoxious minister formerly alluded to, and also abolished the oppressive exactions which the latter had enforced. Anselm was recalled, and the clergy conciliated, whilst the people had restored to them the Anglo-Saxon laws and privileges as amended by Henry's father. He also gratified the nation by espousing Matilda, or Maud, daughter of Malcolm, king of Scotland, by Margaret, the sister of Edgar Atheling.

The king now turned his attention to the punishment of the outlaws who had thrown off his authority. Amongst these were included several noblemen, and particularly Robert de Belesme, the most powerful subject in England, and a man haughty, rapacious, and deceitful. He had secured himself within the walls of Shrewsbury, but at the arrival of Henry before this place he made a humiliating surrender, upon which his life was spared, but he was condemned to perpetual exile. Some time after these events Robert unexpectedly arrived in England, where he was received with apparent affection by his brother, but very soon discovered that he was in reality a captive. The purpose of his visit was to intercede with Henry in favour of the rebels; but instead of compounding for their liberation, he was reduced to solicit his own, which he obtained by consenting to pay an annuity of three thousand merks. After his return to Normandy he entered into terms of friendship with the outlaw Belesme, who possessed numerous castles in the country. Intelligence of this having reached Henry, he renounced the alliance by which he had bound himself to keep the peace with Robert. This compact was similar to that which had subsisted between William and Robert, and a second time the latter became a brother's dupe. Henry invaded Normandy, and a decisive conflict before the walls of Tinchebrai, on the 27th of April 1106, decided the fate of Robert. His army was completely routed, and he himself taken prisoner and sent to England, where he remained in close confinement till his death, which happened in 1135. The cruel fate of this prince has served as a foil to the virtues which he possessed, and shed over them an artificial or spurious lustre. There can be no doubt, however, that his qualities as a warrior were brilliant, and his mind would seem to have been forgiving and conciliatory. Perhaps an amiable weakness in the latter respect was the ultimate cause of his misfortunes. Amongst the prisoners taken at Tinchebrai was Edgar Atheling. Either from his inherent weakness precluding any thing like fear on his account, or from a desire to retain the golden opinions of the Saxons, Henry pardoned him, and from this period the descendant of Alfred intrudes himself no more upon the page of English history.

Robert had a son about five years of age named William, whom a faithful vassal succeeded in conveying to the French court. As the age of this prince advanced, the hopes of his partizans proportionally increased. Henry, after obtaining possession of Normandy, had succeeded in tranquillizing it, and restoring peace and order; but as his nephew grew up, the claims which he possessed to the duchy of his father became more and more popular, and disturbed the quiet both of his uncle and the country. Henry should have at once yielded his paternal inheritance to the young prince; and the withholding of it was an act of injustice which harassed his life and dishonoured his name. The Norman barons, along with the king of France, took part with the injured youth; but this coalition terminated with the battle of Brenville, which was fought in the year 1119. Louis, the French king, had four hundred, and Henry of England five hundred knights. Both princes displayed great bravery during the engagement, which ended, with comparatively but little bloodshed, in favour of the English. William of Normandy made his escape; and the pope, who paid a visit to Henry at Gisors, effected a reconciliation between him and Louis, without touching upon the main cause of quarrel, namely, the difference between the English monarch and his brother Robert, or rather his nephew William, the father being now politically dead.

Matters having been once more pacifically arranged, and the ambition of Henry gratified, he set sail for England towards the end of November 1120. Upon this occasion a most calamitous event occurred in his family, namely, the loss of his only son William. The prince, with a large retinue of gay young knights and noblemen, embarked shortly after his father. Festivity, riot, and intoxication prevailed on board; but in the midst of this feasting and debauchery, the care of the vessel being forgotten altogether, she struck upon a rock near Harfleur, and went down. Of three hundred individuals who were on board, only one escaped to record the dismal fate of his companions. Prince William would have been saved but for the shrieks of his natural sister, which recalled him to the wreck with the boat in which he was proceeding towards shore; and it sunk under the multitudes who crowded into it.

This sudden calamity revived the hopes of Henry's nephew William, and disturbed all the arrangements of the king in Normandy. A new war was kindled in that country; but it terminated in 1124 in favour of the English monarch. The discomfited youth, however, received a new favour of fortune. Louis of France bestowed upon him the hand of his sister-in-law; and along with her he received several of the provinces nearest to Paris, which had been united to Normandy by conquest. Soon afterwards he was invested with the earldom of Flanders, which had been left vacant by the assassination of Charles the Good in 1127. In the meanwhile, Henry had endeavoured to perpetuate the succession in his own family, by marrying a second time, after the death of Matilda, his first wife, who had brought him a son and daughter. The premature fate of the former we have already noticed; and the latter, named Matilda, had espoused the Emperor of Germany. The marriage of the king proved to be without issue; and his daughter having recently become a widow, was invited to England, for the purpose of settling upon her the succession to the throne. In a general assembly of the prelates and chief tenants of the crown she was proposed by her father and acknowledged by the meeting as heiress presumptive; and shortly after this transaction her father privately married her to the Count of Anjou. This secret negociation drew forth loud complaints from the barons; and many of them declared that the duplicity of the king had released them from the obligation of their oath. This doubtless disturbed the serenity of the king's reign; but another and more important cause of disquietude arose from the increasing power and fame of his nephew in Flanders. However, the death of that prince soon afterwards removed all uneasiness on his account, and restored at least the prospect of tranquillity. But this was not realized; for a quarrel with his son-in-law retained him in Normandy, and embroiled the last years of his reign, which was now drawing towards a close. Robert, the unfortunate duke of Normandy, died at Cardiff Castle in Wales, in the eightieth year of his age and twenty-eighth of his captivity, a great part of which had been spent in total blindness; for an unsuccessful attempt to escape had provoked his brother to deprive him of sight. All the historians of the period do not mention this circumstance, and some state that the prisoner enjoyed every indulgence; so that the point is doubtful, and for the honour of humanity we leave it in this state. In about a year thereafter, he was followed to the grave by king Henry, who died of a surfeit of lampreys, on the 1st of December 1135, in the sixty-seventh year of his age and thirty-fifth of his reign.

The character of Henry has been drawn by both friends and enemies, his contemporaries. The former extol him as wise, rich, and brave; and the latter execrate him as cruel, avaricious, and incontinent. By joining the two characters together, we will form a pretty fair estimate of the monarch. He was undoubtedly an able statesman and a courageous soldier, whilst his resolute attack upon the popular system of rapine which disgraced Europe at the time is entitled to very high praise. He punished offences severely; but his administration of justice was highly beneficial to the country; and hence arose his title of the Lion of Justice. On the other hand, the immorality of his private life, his exactions, his cruelty to his brother and others; his dissimulation, for even his favourites distrusted him; and his avarice, for he hoarded gold like a miser; render his character exceedingly equivocal as a man, whatever estimate we may form of him as a sovereign. His reign offers little worthy of praise, excepting what has been noticed above. It was moreover so agitated, that he passed only five years of untroubled tranquillity in England.

It was the darling plan of Henry that his beloved daughter Maud should be his successor. By her second husband she had three sons, one or other of whom their uncle no doubt looked upon as the future monarch of England. But the claims of the ex-empress of Germany were waived, and Stephen earl of Boulogne, son of Adela, the daughter of William the Conqueror, succeeded to the throne. He was crowned upon the 26th of December 1135, and soon made himself very popular. According to custom, he immediately issued a charter, which promised of course good government and ample redress of grievances. His courts at the solemn festivals were held with extraordinary magnificence. He repulsed the invasion of David king of Scotland, who received a severe defeat at the Battle of the Standard, which was fought near Northallerton; he subdued his enemies in Normandy; and, by a yearly pension, he pacified the husband of the lady whom he had supplanted upon the throne. Robert earl of Gloucester, natural son of Henry, and the great supporter of Maud's rights, perceiving all hostility to be unavailing, at last swore fealty to the king. For the first two or three years of his reign, Stephen sat secure upon the throne; but he was doomed to be overtaken by a series of calamities. These arose partly from the inevitable consequences of his usurpation, and partly from his defects as a sovereign. That passion for depredation and conflict which the preceding monarch had subdued, again broke out. Every one built his own castle and maintained his own band of mercenary ruffians, who sallied forth day and night to plunder the surrounding country, and drag into dungeons such as they expected would give a high ransom for their freedom. A contemporary chronicler has drawn a horrible picture of the atrocities thus committed with impunity; for the mildness of Stephen's character, and probably the recollection of his own conduct in obtaining the crown, induced him to be forbearing and indulgent. His popularity rapidly declined; and in the fourth year of his reign it appears to have altogether ceased. In 1139 Matilda, with a few attendants, landed in England, for the purpose of recovering her lost inheritance. She was joined by Robert earl of Gloucester, with a hundred and fifty knights, who commenced a warfare which nearly hurled Stephen from the throne. After many conflicts, which were only characterized by the misery attendant upon them, the army of the Empress Matilda or Maud defeated that of Stephen near Lincoln, in the year 1141. The king was captured after a brave resistance; and Matilda was soon afterwards crowned queen of England at Winchester. The clergy, although they countenanced the accession of Stephen, now acknowledged her prior claim; and the queen, proceeding to London, was joyfully hailed by the citizens.

But her popularity was of short duration. By her arrogance and contemptuous conduct towards the friends of Stephen, she soon alienated the affections of the people, and was at last compelled to fly from the city and to establish her head-quarters at Oxford. In one of the numerous struggles which followed, the Earl of Gloucester was taken prisoner, which put the fortunes of the belligerents nearly upon a level. The king and the earl were exchanged for each other; and as both parties had now a commander upon whom they could depend, the conflict was perpetuated, with increasing misery to the nation. For some years the balance of power hung nearly in equipoise between them. Stephen reduced Oxford, but Robert defeated him at Wilton; and this miserable warfare continued, until, on the death of her brother Robert, Matilda returned to Normandy in 1147, when a breathing time of two years intervened.

In the meanwhile Henry, the son of Matilda, was advancing in years and in fortune. By his uncle David, king of Scotland, he had been knighted at the age of sixteen; a year thereafter he obtained from his father the cession of the duchy of Normandy; and at the death of that prince he succeeded to the earldom of Anjou. In 1152, by a politic marriage, he annexed the extensive duchy of Aquitaine to his dominions. This aggrandizement of her son's power having elevated the hopes of Matilda and those of her partizans, Prince Henry landed in England; but in consequence of the death of Eustace, the oldest son of Stephen, the two parties agreed to terms of peace. Stephen adopted Henry, and appointed him as his successor, one of the best acts of his troubled reign. They lived in harmony with each other for about a year, when Stephen died on the 25th of October 1154. He reigned nineteen years, during the greater part of which time England exhibited a scene of misery unequalled since the invasion of the Danes. The cause of these calamities we have already alluded to. The character of Stephen is not so deeply stained with atrocities as that of some of his predecessors, probably because it was not so determined. In comparison with them, the grasp which he held of the sceptre was as feeble as his right to seize it at all was equivocal.

Henry II. or Plantagenet, the son of Matilda, ascended the throne without a dissenting murmur. He was crowned, along with his queen Eleanor, at Westminster, on the 19th of December 1154, in presence of an immense concourse of people. The prospect which opened up to this young sovereign was more glorious than that of any of his forerunners in England, or his contemporaries in other countries. An unprecedented mass of power was concentrated in his hands. A third part of France, including almost the whole western coast from the borders of Picardy to the mountains of Navarre, acknowledged his authority. These possessions, along with England, comprehended the most warlike portion of Europe; and had the ambition of the individual who ruled over them been commensurate with his power, the humiliation, if not entire subjugation, of France would not have been reserved for the Henries and Edwards of after times. Although by no means destitute of a passion for power, Henry possessed a love of literature, which led him to eschew the cloudy and troubled atmosphere of war. The civil discord which prevailed during the reign of his predecessor had inflicted numerous evils on the nation, and to the alleviation of these Henry devoted the first years of his reign. He issued a new coinage, of standard weight and purity; he drove beyond seas the foreign mercenaries who had harboured in England during the reign of Stephen; he seized the royal castles which had been usurped, and demolished those which had been reared for the purpose of systematic plunder. By these vigorous steps of reformation Henry secured the effective administration of justice in his English dominions. One of the leading features of his character was restless activity. On foot or on horseback he was perpetually in motion; and the moments which he could spare from more important concerns were usually devoted to the chase.

Some of the leading events of Henry's reign are associated with the name of Thomas a Becket, who has been portrayed as a saint and martyr, or a hypocrite and traitor, according to the religious bias of the historian who happened to draw the picture. Under the article **Becket** an account of this celebrated prelate will be found; and it is only necessary in this place to allude to those events of his life which are identified with the history of his country. One of Henry's first measures was the promotion of this individual to the chancellorship of England, in which capacity he vigorously seconded the measures of reform which the king had undertaken. His administration has been characterized as alike beneficial to the country and to the sovereign, who loaded his favourite minister with honours and emoluments. By the advice of Becket, Henry proposed a treaty of marriage between his eldest son and the daughter of Louis king of France. On this occasion the chancellor undertook a journey to Paris, displaying upon the occasion a pomp and parade transcendently elaborate. Henry himself followed; and although a rupture ensued between the sovereigns about the city of Toulouse, which belonged of right to the king of England, their enmities terminated with the marriage of their children whilst the infants were as yet in the cradle. We have now arrived at that period of Becket's life in which his conduct has been the subject of a kind of historical crusade. In 1161 Theobald the archbishop of Canterbury died, and Becket was recommended as his successor by the king. The clergy of England, however, resisted the nomination, declaring it to be unseemly for a man who was rather a soldier than a priest, and whose life had been devoted to hunting and falconry, to be appointed an archbishop. More than twelve months elapsed between the nomination and appointment, during which time Becket still retained the chancellorship, and evinced no change in his feelings or way of living, which was eminently worldly. He even went so far as to smile at the idea of metamorphosing the gay and pompous Chancellor of England into the Archbishop of Canterbury; and he appears himself to have thought that the choice arose from Henry's confidence that he would become the pliable instrument of his will in ecclesiastical affairs. If the king anticipated such a consummation, never were the hopes of man more miserably disappointed. For no sooner was Becket invested with the primacy, than a change took place in his manners, more strongly contrasted with his former life than were the two offices which he had held. Instead of a train, which in splendour and fastidious pomp had rivalled the retinue of kings, he chose a few monks the most conspicuous for their humility and mortification. Instead of the oriental magnificence and gorgeousness of apparel with which he loved to dazzle the eyes even of courtiers, he selected as his chosen garment the roughest sackcloth. His sports and revels were exchanged for deeds of penitence and humiliation. And thus far his conduct appears to have been commendable; but did his future behaviour warrant a belief that this sudden change was attributable to the sincere conviction of a pure and lofty spirit, which had changed its views regarding the relative value of earthly and heavenly things, or to the policy of a deep and designing hypocrite? The remaining particulars of his life will best enable the reader to form his own judgment as to this, which is one of the most disputed points in our history.

The first step which Becket took after his promotion was to return the seals of his former office to Henry, on the ground of his incompetency to hold two such offices. This measure is said to have at first excited the indignation of the king, who had never before heard Becket object to the prelacy on that account. But it was not until 1163, when hostilities commenced between the church and the state, that Becket and the king came fairly into collision. Previously to the Norman conquest, ecclesiastical affairs had, like others, been decided before the hundred, with the addition of the metropolitan sitting as one of the judges. The Conqueror, however, had instituted a separate tribunal, where the clergy were judged by a court composed of themselves, and from that time they were independent of secular jurisdiction. Becket upheld this claim with firmness, as he ought to have done, until it was formally set aside by the king and his counsellors. This, however, did not justify the decisions which were pronounced, and which had now become notoriously partial. Crimes of the darkest description had frequently been perpetrated by ecclesiastics with the most scandalous impunity; for the judges could not inflict capital, nor indeed any adequate punishment. An abominable instance of seduction having attracted the notice of the king, he determined that those chargeable with such atrocities should be tried before the criminal tribunals of the state. For this purpose he summoned a great council at Westminster, where he demanded that ecclesiastics, whenever convicted of such offences, should be degraded, and handed over to a secular justiciary. His question was, Would they agree to observe the ancient customs of the realm? Becket answered yes, saving his order; an ambiguous reply, which was echoed by the conclave of bishops present, with only one exception. But, although not at this assembly, he was afterwards compelled to yield the point without any reservation respecting his order. This formal assent was obtained at the celebrated council of Clarendon, which took place on the 25th of January 1164. At this great or common council of the realm, for the word parliament had not yet been introduced, Becket was compelled to yield compliance to the demands of his sovereign. At first he peremptorily refused his acquiescence; but the king, incensed at his obstinacy, menaced him with exile or death, whilst several individuals of rank present entreated him with genuflections and tears to submit; by which means a compliance was at last reluctantly wrung from him. These customs and usages, the recognition of which was thus so vehemently urged, were contained in sixteen articles, which were afterwards well known under the name of the Institutions of Clarendon, by which it was enacted that clergymen accused of any crime should be tried in civil courts; that laymen should not be tried in spiritual courts, except by legal and reputable witnesses; that no ecclesiastical person should quit the realm without the king's license; that all causes not ecclesiastical should be finally determined in the king's court; that all ecclesiastical persons who were tenants *in capite* of the crown should follow the king's customs, sue and be sued respecting their fiefs before his justices, and attend, like other barons, at his courts; that vacant dignities in the church should be in the king's hands; and that he should also receive the profits of his seignorial dues. These, with some others, to the number of sixteen, were subscribed by all the ecclesiastics present, including Becket himself. He was now not only mortified in the highest degree, but, pretending extreme contrition for what he had done, did open penance for his supposed delinquency. He attempted to make his escape to France, but was arrested for an offence against the institutions which he had recently signed. Henry was now exasperated beyond all bounds at the archbishop, and assembled a parliament at Northampton, obviously for the purpose of crushing him. Becket was accordingly summoned to account for rents and profits connected with his primacy. He arrayed himself in his sacerdotal vestments, and, with the cross in his hand, proceeded to the place appointed. The king complained to the council of the insolent behaviour of Becket, and the whole assembly joined in condemning his inconsistency. The suit regarding rents, which was only intended as a menace, he attempted to free himself from, by pleading a release by Henry the king's son; but this was overruled. After being condemned as a perjured traitor, he left the palace, his eyes fixed upon the cross, which he held uplifted in his hands; and, travelling in disguise, he

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reached the port of Sandwich, whence he immediately embarked for the Continent.

Becket was received with marks of esteem by the king of France, and likewise by the pope, whose cause he had so strenuously defended in England. When Henry learned the flattering reception which the obnoxious exile had received, he dispatched an embassy to expostulate with Louis, and sent another to Rome, to justify his conduct to the pontiff. But the ambassadors were received with coolness, if not with something which bordered upon contempt. The judgment of the barons and bishops was annulled by the pope, and those who should invade the property of the church were declared to be cut off from the society of the faithful. Henry's irritation had now reached its climax, and he resolved upon taking a bold step, which, had the human mind been ripe for such a measure, might have ended in the separation of the English church from that of Rome; but this achievement was reserved for the Henry of a future day. He gave orders to his justiciaries, prohibiting, under severe penalties, all appeals to the pope or the archbishop, and forbidding any person to receive mandates from them, or to apply to their authority; and he declared it treasonable to bring over from either any interdict against the kingdom. On the other hand, the pope was not slow in issuing his fulminations. Becket was ordered to excommunicate Henry's chief ministers, and put the see of Canterbury, including about three fourths of the kingdom, under an interdict. But Henry stood firm, and looked with indifference upon the papal lightnings which played around him. At last, however, he began to dread the powers of his victim, chiefly on account of his continental dominions, and proposed a reconciliation. The treaty of accommodation, although more than once broken off, was finally concluded, and Becket returned to the see of Canterbury without having been compelled to make any express submission to the institutions of Clarendon.

But the wounds had been too deep to be thus suddenly healed, and, though closed at the surface, the venom still rankled underneath. The arrogance and presumption of the primate returned along with his dignity. He refused compliance with the terms of the general amnesty, and would not submit to take the oath of homage for his baronry; neither would he withdraw the whole of the ecclesiastical censure from the prelates who lay under it on account of their obedience to the king's commands. Several very imprudent excommunications soon followed, and so provoked Henry that he is said to have dropped certain passionate expressions, intimating something which was interpreted into a desire that Becket's life might be taken away. The supposed will of the king was instantly accomplished by four knights of distinguished rank, who repaired to the church of Canterbury, where the primate then officiated, and barbarously slew him at the foot of the altar. See BECKET.

Thus perished by foul murder, in the fifty-third year of his age, Thomas a Becket, who, every thing considered, was probably the most remarkable man of his time. That he believed he was all the while conscientiously performing his duty, in preserving the immunities of the church, there seems little reason to doubt; for he would not have met his fate with such heroic and martyr-like firmness unless this had been the case. His virtues were of an austere character, and wanted that amiable attractiveness which we usually associate with the character of one who is profoundly inspired by the morality of the gospel. His vices, on the other hand, were the reverse of mean and grovelling; for his spirit was lofty and aspiring, and his designs were invested with a dazzling grandeur, and pursued with a fearless firmness much more calculated to excite awe than detestation, far less contempt. That Henry did not intend the murder of Becket, appears certain from his subsequent conduct. He was thrown into the utmost consternation on hearing of it, knowing well that the primate's death would accomplish what his most violent opposition during his lifetime could never have effected. He abandoned himself to sorrow and mortification, and for some time refused to take any nourishment. The pope was with some difficulty made sensible of the king's innocence; but declined to grant him a pardon, except on condition that he should make every future submission, and perform every injunction which the holy see thought proper to prescribe or impose. He was likewise enjoined to perform a humiliating penance at the tomb of Becket, who was in due time canonized as a saint and venerated as a martyr. The assassins, despairing of pardon, sought refuge in a distant castle. By the pope they were enjoined to make a pilgrimage to the Holy Land, where they all died, and were buried before the gate of the temple at Jerusalem.

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We come now to a very important event in the reign of Henry II. that is, the annexation of Ireland to the English crown; but the details of his invasion it is unnecessary to relate here, as they will come in due order to be treated of under the head IRELAND.

The king was scarcely freed from the Irish war, and the dangerous controversy in which he had engaged with the church of Rome, when he found himself involved in the most unnatural contests with his own children, to whom he had always behaved in the most tender and affectionate manner. He had ordered Henry, his eldest son, to be anointed king; and he had destined that prince as his successor in the kingdom of England, the duchy of Normandy, and the counties of Anjou, Maine, and Touraine, territories which lay contiguous, and which might thus easily afford mutual assistance to each other when necessity required. Richard, his second son, was invested with the duchy of Guienne and the county of Poitou; Geoffrey, his third son, inherited, in right of his wife, the duchy of Brittany; and the new conquest of Ireland was destined for John, his fourth and youngest son. The last sixteen years of Henry's life were embittered by family hostilities. A mighty confederacy was secretly formed against him, in which his three eldest sons participated. Louis VII. king of France, fed the discord; for the power of the English monarch had now become so formidable as to excite alarm and kindle up jealousy in the breasts of the continental sovereigns. The young prince was persuaded to demand of his father some of the dominions which he had been promised, and of which he was nominal sovereign; but he was refused. Upon this the prince made his escape, and put himself under the protection of the king of France. The French monarch then invaded Normandy; and Richard and Geoffrey, the sons of King Henry, severally raised the standard of revolt in Guienne and Bretagne. William the Lion, king of Scotland, considering this as a favourable opportunity for invading England, advanced into the northern counties, destroying all he met with. A great force of foreign mercenaries, called Brabançons, landed in Sussex, under the command of the Earl of Leicester, whilst Prince Henry collected another army in France in order to co-operate with them. To meet this formidable coalition against his authority, King Henry made the best preparations which circumstances admitted of; and if we may judge of these by the results which followed, he must have taxed his constitutional activity to the utmost in collecting forces, and in opposing a barrier to the tide of war which thus rolled onward from every quarter, threatening to overwhelm his throne. Few of his own barons could be depended upon, and he had recourse to the foreign mercenaries so largely employed by his adversaries. Twenty thousand of these auxiliaries enlisted under his banners, and with them were united such of his own nobles and retainers as could be trusted.

The enmity of the young princes against their father had been in no inconsiderable degree excited and fostered by Eleanor their mother, whom the incontinent and licentious life of Henry had for ever estranged from her affections. She attempted to make her escape; but was taken prisoner, and consigned to close imprisonment, where, with the exception of a short interval, she remained till the death of her husband.

In the meanwhile, the plan devised by the allies began to be acted upon, as already indicated; but Henry of England proved himself superior to the emergency. His foreign enemies were on all sides discomfited, and William of Scotland having accidentally fallen into the hands of Henry, the Scottish army broke up and dispersed. Their sovereign afterwards obtained his freedom by the humiliating surrender of his authority as king of Scotland; for conceding to Henry the title of lord paramount of his kingdom was virtually casting his crown at the feet of his enemy. A pacification was brought about at Falaise, on the 28th of September 1174, by which the princes were pardoned and enriched with new liberalities.

King Henry, however, was permitted to enjoy but a few years of repose. The dissensions between him and his children again broke out. The latter also quarrelled amongst themselves, and a most unnatural war ensued, in which neither party gave quarter. But the death of Henry, the eldest son, for a time suspended these disputes. This unfortunate prince died in 1183, of a fever brought on by vexation and fatigue. Three years afterwards Geoffrey perished beneath the feet of a horse in a tournament at Paris, so that the subjects of discord were diminished. The widow of Geoffrey, soon after his decease, was delivered of a son, who was named Arthur, and invested with the duchy of Brittany, under the guardianship of his grandfather, who, as duke of Normandy, was also suzerain lord of that territory. Philip, as lord paramount, disputed the title of the English king to this wardship; but he was obliged to yield to the wishes of the Bretons, who preferred the government of Henry. Some other causes inflamed the dissension between these monarchs, and Philip once more seduced Richard from his duty. He insisted that the marriage of that prince with Adelais, his sister, should be immediately completed, and threatened to enforce his demands with a formidable army. This lady had been confined for a long time in a castle by Henry, who procrastinated the nuptials, until a suspicion arose that he intended to appropriate her to himself. At the conclusion of the truce which had followed the death of Geoffrey, Richard finally forsook his father, and did homage to the king of France for his continental dominions.

For some time the eyes of the monarchs of Christendom had been turned to Palestine, which the Sultan Saladin was overrunning with his mighty hosts. Henry of England was desirous of taking the cross and proceeding to Syria, but his perpetual contests with his family detained him until the holy city was taken by the infidels. The news of this event awakened feelings of regret and indignation throughout Christendom. The Emperor of Germany marched his bravest knights towards Asia. Philip of France and Henry agreed to follow, but the union of the former with Richard the son of the latter compelled the king of England, in the first place, to look to the defence of his own territories, which were once more invaded by the confederates. The war proved very unfortunate for Henry, who lost several towns, and very narrowly escaped falling into the hands of the enemy. A treaty was at length agreed to, but the terms of it were very humiliating to the English monarch. With a heart overwhelmed with grief, he returned to the castle of Chinon, where he soon afterwards expired, on the 6th of July 1189, in the thirty-fifth year of his reign and the fifty-seventh of his age. Upon his death-bed he was sedulously attended by one of his natural sons, the fruit of an amour with Rosamond, whom popular romance and tradition have surnamed the Fair, and invested with every virtue but one. Henry was interred with little pomp in the convent of Fontevraud, in the presence of his rebellious son Richard, and a few knights; but Eleanor, his queen, survived him many years, having been liberated by her son Richard. The character of Henry II. has been already detailed at sufficient length. During his reign important changes in ancient law and usage were matured, and became conspicuous, on which account they have been ascribed to the administration of this monarch; but it is more probable that they resulted from the slow growth of circumstances, with little aid from rulers, who were perhaps unconscious that any change had occurred.[1]

Richard I. succeeded to the throne without opposition, and was crowned on the 3d of September 1189. The reign of this monarch, the Achilles of modern Europe, is interwoven with events which are more akin to romance than to real history. His life is made up of the adventures of a knight-errant. His character was a singular compound of qualities noble and mean; of the grand and the grovelling, the sublime and the grotesque. It has been thus drawn by Mr Turner, in his *History of England:* "Haughty, irascible, and vindictive, a towering and barbaric grandeur, verging sometimes into barbarian cruelty, distinguished his actions. Valiant beyond the common measure of human daring, unparalleled in his feats of prowess; inferior to no man in hardihood, strength, and agility; stern and inflexible in his temper; rapacious and selfish, yet frequently liberal to profusion; gorgeous to ostentation, yet often gay, familiar, satirical, and jocular; unshaken by adversity; resolute to obstinacy, furious in warfare, fond of battle, and always irresistibly victorious; his life seems rather the fiction of a poet's imagination than the sober portrait of authentic history." But this character for martial prowess and heroism was softened by a love of literature, particularly Provençal poetry; and although the specimens of his compositions which have been transmitted to us scarcely deserve the name of poetry, still they evince the presence of the passion in his mind. It was the same sentiment which thus penetrated the tempestuous atmosphere so congenial to his soul that imbued his exploits with the spirit of genius and romance. An overweening love of praise added its inspiration to his feelings, and contributed to render his actions pre-eminently conspicuous even in the high and palmy age of chivalry. He had no sooner ascended the throne than he began to make arrangements for joining the new levies of crusaders preparing to embark for the Holy Land. In such a sphere nature had fitted the king of England to shine without a rival. His landing in Palestine was destined to mark an era, when the Moslemins were to encounter a warrior superior even to the most distinguished of their own in lofty daring and proud contempt of danger, and when the brows of their bravest chieftains were to darken at the name of Richard.

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[1] Mackintosh's *History of England*, vol. i. p. 172.

At his coronation an event occurred which it is painful to mention, and too shocking to give in detail. The Jews, eager to express their fealty to the new sovereign, approached him in numbers, bearing rich presents of gold and silver, commodities which they well knew would be peculiarly acceptable to the king. In their endeavours to press forward towards the hall door during the state dinner, a scuffle ensued. The Jews resisted the ill treatment they received, which so inflamed the passions of the English mob that they arose upon the defenceless strangers, and drove away or destroyed them. This example of violence spread not only over the city, but throughout the country; and the unfortunate Israelites were massacred and plundered without mercy. It was in vain that the king attempted to allay the tumult; the sanguinary rabble would not desist until its ferocity and rapacity were completely satiated.

Richard having equipped his armament, and acquired the necessary treasure by every means in his power (and from his natural impatience he was never scrupulous upon that point), joined Philip of France and marched with him to Lyons. As the principal events connected with this expedition are already embodied in the article CRUSADES, we shall not recapitulate here the whole details, but only notice such as have not been there introduced. On his way Richard relieved Portugal, by joining the sovereign of that country with five hundred knights, and bidding defiance to the Moors or Saracens. This was an evil omen for the followers of the Prophet. After landing at Messina, he remained there six months, which were chiefly occupied in warm disputes with Tancred, who had usurped the Sicilian crown. On the 10th of April 1191 Richard set sail from this place; but his fleet having been dispersed by a storm, and the ship in which were his sister Joan, and his betrothed wife Berengaria, being driven into Cyprus, he landed on that island for the purpose of chastising the governor, who had treated the royal ladies with some discourtesy. Richard reduced the whole island, and after marrying Berengaria, and causing her to be crowned queen of England, he set sail for St Jean d'Acre, which afterwards surrendered to him. (See ACRE.) The fall of this place opened the way to Jerusalem, towards which he now advanced, performing on his way those chivalrous deeds which taught the infidels to shudder at the apparition of his name. (See CRUSADES.) In October 1192 Richard set sail from the Holy Land for England, with a fleet, which contained his wife and sister, who appear to have reached their destination in safety. But a storm having dispersed the ships, Richard was driven near Marseilles. Having learned, however, that plans were in agitation to seize his person (for Philip of France and other continental sovereigns, together with his brother, were leagued against him), he formed the unfortunate resolution of passing through Germany in disguise.

He landed at Zara, and after a variety of adventures and hairbreadth escapes, he was at last arrested by Leopold, duke of Austria, who immediately ordered him to be loaded with fetters. This prince had served under Richard at the siege of Acre, where he received, or imagined he had received, some injury at his hands, and took this base method of revenging himself. Henry VI. emperor of Germany, was then equally an enemy to Richard, on account of his having married Berengaria, the daughter of Tancred king of Sicily. He therefore required the royal captive to be delivered into his hands, and stipulated to pay a large sum of money to the duke as a reward for his services.

The disaster which had befallen the English monarch could not be long concealed. The news of his captivity spread general indignation at home; a feeling which was responded to by the disinterested portion of Europe. Richard's mother, along with the clergy of Germany, appealed to the pope; and the emperor, finding that his conduct was condemned as disgraceful, made an attempt to justify it, by charging his prisoner with several weighty crimes. These were, his behaviour in Sicily, his conquest of Cyprus, and the alleged murder of Conrad, who was assassinated whilst contending for the Christian kingdom of Palestine. The latter charge being by far the most serious, every effort was made to vindicate Richard from the guilt of the alleged crime. At home the ministry exerted themselves to the utmost; and the most able prelates set out for the Continent to bargain for his ransom. He was removed from a dungeon in the Tyrol to the residence of the emperor at Haguenau, and was taken from thence to Worms, for a final adjustment of differences.

In the meanwhile, his brother John, with Philip of France, were busily prosecuting their plans for his destruction. Their design was to effect the utter ruin of Richard; and every method was tried to accomplish their purpose. John made his feudal submission to Philip for his brother's continental possessions; and having assembled an army, he returned to England with the intention of seizing the crown, whilst his colleague invaded Normandy. Both the confederates were completely unsuccessful. John, by circulating false reports of his brother's death, attempted to give a gloss of right to his projected usurpation; but his duplicity was too well known, and his armament of foreign mercenaries was repulsed from the coast.

The negociations for Richard's liberation ended at last in the agreement that a ransom of one hundred thousand marks of silver should be paid for it. It was in vain that his mortal enemies, Philip and John, protracted his imprisonment. By a general tax the sum was raised; and soon after his emancipation he set out for England, where he arrived on the 13th of March 1194. The remainder of his reign is very unimportant; it was chiefly occupied with a species of petty bickerings with Philip of France. The money required for the crusade, and the ransom of Richard, had so exhausted the finances of England, that the king found himself unable to undertake war upon a grand scale. If we contemplate the character of the individual who found himself thus fettered by pecuniary necessities, this was a fortunate circumstance. It would be difficult to estimate the amount of human misery which was thus saved. After various undecisive battles and equivocal victories, Richard was mortally wounded before Chaluze, an obscure castle in the province of Limousin, held by a rebellious vassal, and expired on the 6th of April 1199, in the forty-second year of his age and the tenth of his reign.

Thus perished, in the prime of life, one of the most romantic characters to be met with in real history.[1] His character we have already given; and with respect to his reign, we cannot discover any thing in which it added to the civilization or prosperity of the country. For the immense sums of money which he drew from it, the only return worthy of notice was an equalization of weights and measures throughout the realm.

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[1] The lines which Dr Johnson applies to Charles XII. of Sweden are literally true of Richard Cœur-de-Lion of England:

His fate was destined to a foreign strand,
A petty fortress, and a dubious hand;—
He left a name at which the world grows pale,
To point a moral or adorn a tale.

John, the brother of the late king, and the youngest legitimate son of Henry II., succeeded to the throne without opposition; for, although the hereditary right, according to the modern acceptation of the term, was vested in his nephew Arthur, son of John's elder brother Geoffrey, the uncle had likewise a hereditary claim, as being nearest of kin to the deceased monarch, and the nation declared in his favour. His coronation took place on the 27th of May 1199. The character of John is perhaps more strongly marked, and possesses more individuality, than that of any other monarch on the list of English kings. In cowardly villany, in perfidious malignity, in base ingratitude, in unprincipled cruelty, in grossness of appetite, in meanness, weakness, and every vicious infirmity, this prince figures in the page of history almost without a rival. Other kings there may have been whose vices are black enough to call forth the execrations of posterity; but the halo of talent which emblazons their names serves to mitigate the severity of censure. John, however, stands before us utterly divested of any such quality; his character is unredeemed by one solitary virtue; his reign is unillustrated by one solitary good action performed without compulsion. He is altogether alone, the lowest and most abject slave that ever wore a crown.

Richard had destined Arthur as his successor, and, on his death, Maine, Tours, and Anjou, appointed the youth, then Earl of Bretagne, their lord. On the assumption of the crown of England and the dukedom of Normandy by John, Constance, the mother of Arthur, gave her son over to the care of Philip, king of France, who claimed for him his continental possessions. A struggle ensued between the monarchs of France and England. Philip, who, it would appear, used Arthur entirely as a tool to suit his own purposes, sent him with a military retinue into the dominions to which he laid claim. He took the town of Mirabeau, saving a tower, which held out under Eleanor, the widow of Henry II.; but on the night between the 31st of July and 1st of August 1202, John arrived, and compelled the besiegers to surrender. The prisoners were treated with a cruelty truly demoniacal, and worthy of the man; but this was only the opening scene of the tragedy. Prince Arthur was brought to Falaise, where he was confined for some time. He then all of a sudden disappeared, and contemporary history has ascribed to John the guilt of his murder. That the hapless youth met with a violent death is evident, and that he fell either by his uncle's own hands, or by his orders, there seems no reason to doubt. Even in that semi-barbarous age, there was scarcely an individual capable of committing such an atrocity, excepting the wretch who, a few years afterwards, took a diabolical pleasure in starving to death the wife and children of a nobleman who had offended him, and hanging twenty-eight Welsh hostages, besides other atrocities too horrible to be named.

By this foul deed, a third part of John's dominions were wrenched from his grasp. Philip Augustus summoned John, as duke of Normandy and Aquitaine, to answer before a court of peers to the charge of having murdered Arthur duke of Brittany. But he dreaded the tribunal, and having refused to appear, he was branded as a murderer, condemned to death, and adjudged to lose all his French territories. The king of France moved onwards from conquest to conquest, and one by one the provinces of the English monarch were seized and annexed to the dominions of Philip; Touraine, Maine, and Anjou in 1203, the duchy of Normandy in 1205, and the county of Poitou in 1206.

Another important event in the reign of John was his contest with the pope, the only contest indeed in which he ever displayed any thing of that spirit which had fired the bosoms of his ancestors. The clergy had for some time acted as a community independent of the civil power, owning subjection to the pope alone, by whom their elections were usually confirmed. The election of the Archbishop of Canterbury had been a subject of contention between the suffragan bishops of the province, and the monks of St Augustin's Abbey in that city. Each party claimed the right of choosing; but under this question was concealed the more important one, whether the king or the pope had the power of nomination; for the bishops were accessible to the influence of the crown, and the monks, in consistency with the genius of their order, were biassed by Rome. In the mean time the archbishop died, and the monks privately elected Reginald their superior in his room. The bishops remonstrated against this as an innovation on their privileges; and the king took part in the contest, with the resolution of raising the Bishop of Norwich to the primacy. The cause was appealed to Rome; and Pope Innocent III., eager to extend his power in England, commanded the election of Stephen Langton, a most unexceptionable individual, and one who, in the sequel, proved himself eminently worthy of the highest station. John, however, incensed at this proceeding, violently expelled the monks from their convent, took possession of it himself, and seized upon the revenues. The tiara, however, was not to be thus contemptuously treated. An interdict was threatened, unless compliance with the wishes of the papal court was immediately yielded. In vain the prelates in the most suppliant manner entreated the king to give his consent to the measure. With that stupid recklessness of danger which he always uniformly evinced, he [illegible] that [illegible] and the nation should brave the vengeance of Rome. He swore that if it [illegible], he would expel the whole clergy, and confiscate their possessions. The pope, however, laughed his menaces to scorn, and published that terrible interdict, which in those ages was calculated to make the heart of a nation tremble. A stop was immediately put to divine service, and the administration of all the rites of religion, except baptism, and the confession, absolution, and extreme unction to the dying. The church-doors were shut, and the images of the saints deposed. The dead were refused Christian burial, and thrown promiscuously into ditches and on the highways, without any funeral solemnity. Other injunctions, equally severe, were included in this formidable sentence; and John, in revenge, persecuted the clergy with unsparing rigour. But his furious and imprudent efforts proved useless. Innocent remained firm, and, in two years thereafter, 1209, launched his last thunderbolt at the English monarch. He excommunicated John, absolved his subjects from their oath of allegiance, and soon afterwards deposed him. He also commissioned the king of France to take his crown; and published a crusade all over Christendom against King John, exhorting the chivalry of Europe to take up arms against him, and enlist under the French banner. Philip was not less active on his part. He summoned all the vassals of the crown to attend him at Rouen; and having collected a fleet of 1700 vessels, was ready in 1213 to invade England.

But the fulminations of the pope were alike disregarded by John and his subjects, who had now become familiar with them. His strength does not appear to have been lessened, for the only successful expeditions of his reign, those against Ireland and Wales, were undertaken during the period of his proscription by the see of Rome. In order to meet the king of France, he assembled a vast army; but it was not the interest of his holiness to allow matters

History.

At his coronation an event occurred which it is painful to mention, and too shocking to give in detail. The Jews, eager to express their fealty to the new sovereign, approached him in numbers, bearing rich presents of gold and silver commodities which they well knew would be peculiarly acceptable to the king. In their endeavours to press forward towards the hall door during the state dinner, a scuffle ensued. The Jews resented the ill-treatment they received, which so inflamed the passions of the English mob that they soon seized upon the defenceless strangers, and drove away or destroyed them. This example of violence spread not only over the city, but throughout the country; and the unfortunate Israelites were massacred and plundered without mercy. It was in vain that the king attempted to allay the tumult; the sanguinary rabble would not desist until its ferocity and rapacity were completely satisfied.

Richard having equipped his armament, and raised all the money he could, by every means in his power (and from the means to which he resorted he was never scrupulous upon that point), joined Philip of France and marched with him to Vezelay. As the principal events connected with this expedition are already recorded in the article CRUSADES, we shall not recapitulate here the whole details, but only notice such as have not been there introduced. On his way Richard relieved Portugal, by joining the sovereign of that country with five hundred knights, and bidding defiance to the Moors or Saracens. This was an evil omen for the followers of the Prophet. After landing at Messina, he remained there six months, which were chiefly occupied in warm disputes with Tancred, who had usurped the Sicilian crown. On the 10th of April 1191 Richard set sail from this place; but his fleet having been dispersed by a storm, and the ship in which were his sister Joan, and his betrothed wife Berengaria, being driven into Cyprus, he landed on that island for the purpose of chastising the governor, who had treated the royal ladies with some discourtesy. Richard reduced the whole island, and after marrying Berengaria, and causing her to be crowned queen of England, he set sail for St Jean d'Acre, which afterwards surrendered to him. (See ACRE.) The fall of this place opened the way to Jerusalem, towards which he now advanced, performing on his way those chivalrous deeds which taught the infidels to shudder at the apparition of his name. (See CRUSADES.) In October 1192 Richard set sail from the Holy Land for England, with a fleet, which contained his wife and sister, who appear to have reached their destination in safety. But a storm having dispersed the ships, Richard was driven near Marseilles. Having learned, however, that plans were in agitation to seize his person (for Philip of France and other continental sovereigns, together with his brother, were leagued against him), he formed the unfortunate resolution of passing through Germany in disguise.

He landed at Zara, and after a variety of adventures and hairbreadth escapes, he was at last arrested by Leopold, duke of Austria, who immediately ordered him to be loaded with fetters. That prince had served under Richard at the siege of Acre, where he received, or imagined he had received, some injury at his hands, and took this base method of revenging himself. Henry VI. emperor of Germany, was then equally an enemy to Richard, on account of his having married Berengaria, the daughter of Tancred king of Sicily. He therefore required the royal captive to be delivered into his hands, and stipulated to pay a large sum of money to the duke as a reward for his services.

The disaster which had befallen the English monarch could not be long concealed. The news of his captivity spread general indignation at home; a feeling which was responded to by the disinterested portion of Europe. Richard's mother, along with the clergy of Germany, appealed to the pope, and the emperor, finding that his conduct was condemned as disgraceful, made an attempt to justify it, by charging his prisoner with several weighty crimes. These were, his behaviour in Sicily, his conquest of Cyprus, and the alleged murder of Conrad, who was assassinated whilst contending for the Christian kingdom of Palestine. The latter charge being by far the most serious, every effort was made to vindicate Richard from the guilt of the alleged crime. At home the ministry exerted themselves to the utmost; and the most able prelates set out for the Continent to bargain for his ransom. He was removed from a dungeon in the Tyrol to the residence of the emperor at Haguenau, and was taken from thence to Worms, for a final adjustment of differences.

In the meanwhile, his brother John, with Philip of France, were busily prosecuting their plans for his destruction. Their design was to effect the utter ruin of Richard; and every method was tried to accomplish their purpose. John made his feudal submission to Philip for his brother's continental possessions; and having assembled an army, he returned to England with the intention of seizing the crown, whilst his colleague invaded Normandy. Both the confederates were completely unsuccessful. John, by circulating false reports of his brother's death, attempted to give a gloss of right to his projected usurpation; but his duplicity was too well known, and his armament of foreign mercenaries was repulsed from the coast.

The negociations for Richard's liberation ended at last in the agreement that a ransom of one hundred thousand marks of silver should be paid for it. It was in vain that his mortal enemies, Philip and John, protracted his imprisonment. By a general tax the sum was raised; and soon after his emancipation he set out for England, where he arrived on the 13th of March 1194. The remainder of his reign is very unimportant; it was chiefly occupied with a species of petty bickerings with Philip of France. The money required for the crusade, and the ransom of Richard, had so exhausted the finances of England, that the king found himself unable to undertake war upon a grand scale. If we contemplate the character of the individual who found himself thus fettered by pecuniary necessities, this was a fortunate circumstance. It would be difficult to estimate the amount of human misery which was thus saved. After various undecisive battles and equivocal victories, Richard was mortally wounded before Chaluze, an obscure castle in the province of Limousin, held by a rebellious vassal, and expired on the 6th of April 1199, in the forty-second year of his age and the tenth of his reign.

Thus perished, in the prime of life, one of the most romantic characters to be met with in real history.[1] His character we have already given; and with respect to his reign, we cannot discover any thing in which it added to the civilization or prosperity of the country. For the immense sums of money which he drew from it, the only return worthy of notice was an equalization of weights and measures throughout the realm.

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[1] The lines which Dr Johnson applies to Charles XII. of Sweden are literally true of Richard Cœur-de-Lion of England:

His fate was destined to a foreign strand,
A petty fortress, and a dubious hand;
He left a name at which the world grew pale,
To point a moral or adorn a tale.

John, the brother of the late king, and the youngest legitimate son of Henry II., succeeded to the throne without opposition; for, although the hereditary right, according to the modern acceptation of the term, was vested in his nephew Arthur, son of John's elder brother Geoffrey, the uncle had likewise a hereditary claim, as being nearest of kin to the deceased monarch, and the nation declared in his favour. His coronation took place on the 27th of May 1199. The character of John is perhaps more strongly marked, and possesses more individuality, than that of any other monarch on the list of English kings. In cowardly villany, in perfidious malignity, in base ingratitude, in unprincipled cruelty, in grossness of appetite, in meanness, weakness, and every vicious infirmity, this prince figures in the page of history almost without a rival. Other kings there may have been whose vices are black enough to call forth the execrations of posterity; but the halo of talent which emblazons their names serves to mitigate the severity of censure. John, however, stands before us utterly divested of any such quality; his character is unredeemed by one solitary virtue; his reign is unillustrated by one solitary good action performed without compulsion. He is altogether alone, the lowest and most abject slave that ever wore a crown.

Richard had destined Arthur as his successor, and, on his death, Mons, Tours, and Anjou, appointed the youth, then Earl of Bretagne, their lord. On the assumption of the crown of England and the dukedom of Normandy by John, Constance, the mother of Arthur, gave her son over to the care of Philip, king of France, who claimed for him his continental possessions. A struggle ensued between the monarchs of France and England. Philip, who, it would appear, used Arthur entirely as a tool to suit his own purposes, sent him with a military retinue into the dominions to which he laid claim. He took the town of Mirabeau, saving a tower, which held out under Eleanor, the widow of Henry II.; but on the night between the 31st of July and 1st of August 1202, John arrived, and compelled the besiegers to surrender. The prisoners were treated with a cruelty truly demoniacal, and worthy of the man; but this was only the opening scene of the tragedy. Prince Arthur was brought to Falaise, where he was confined for some time. He then all of a sudden disappeared, and contemporary history has ascribed to John the guilt of his murder. That the hapless youth met with a violent death is evident, and that he fell either by his uncle's own hands, or by his orders, there seems no reason to doubt. Even in that semi-barbarous age, there was scarcely an individual capable of committing such an atrocity, excepting the wretch who, a few years afterwards, took a diabolical pleasure in starving to death the wife and children of a nobleman who had offended him, and hanging twenty-eight Welsh hostages, besides other atrocities too horrible to be named.

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But the fulminations of the pope were alike disregarded by John and his subjects, who had now become familiar with them. His strength does not appear to have been lessened, for the only successful expeditions of his reign, those against Ireland and Wales, were undertaken during the period of his proscription by the see of Rome. In order to meet the king of France, he assembled a vast army; but it was not the interest of his holiness to allow matters to be carried to extremities. He accordingly sent over two legates, Pandulf and Durand, who, in a meeting of parliament holden at Northampton, ventured to declare to John that he was bound to obey the holy see as much in temporal as in spiritual affairs. After shuffling, according to custom, John, at the head of an army capable of bidding defiance to any invader, surrendered himself to the will of the pope, and acceded to all the terms which Pandulf had exacted. With a meanness of spirit almost exceeding belief, he laid his crown at the feet of the haughty legate, resigned England and Ireland into the hands of the pope, swore homage to him as his liege lord, and took an oath of fealty to his successors. The terms of this remarkable oath deserve a place in every history.

" I John, by the grace of God king of England and lord of Ireland, in order to expiate my sins, from my own free will and the advice of my barons, *give* to the church of Rome, to Pope Innocent and his successors, the kingdom of England, and all other prerogatives of my crown. I will hereafter hold them as the pope's vassal. I will be faithful to God, to the church of Rome, to the pope *my master*, and to his successors legitimately elected. I promise to pay him a tribute of 1000 merks ; to wit, 700 for the kingdom of England, and 300 for the kingdom of Ireland." This memorable submission took place on the 15th of May 1213.

This oath was taken by the king before all the people, kneeling, and with his hands held up between those of the legate. Having then agreed to install Langton in the primacy, he received the crown which he had been supposed to have forfeited; whilst the legate, to add to his former insolence, trampled under his feet the tribute which John had consented to pay, but afterwards stooped to gather it up. The king of France was enraged at this behaviour of the pope, and resolved to execute his project of conquering England in spite of him and his censures. His fleet, however, was attacked in their harbours by the English, who took three hundred vessels, and destroyed about a hundred more; whilst Philip, finding it impossible to prevent the rest from falling into the hands of the enemy, set fire to them himself, and thus abandoned the enterprise. This naval action is memorable as being the first which took place between the fleets of France and England, and was a good omen for the latter.

John being thus delivered from all danger, continued to follow the same cruel and tyrannical measures which had hitherto rendered him odious to his subjects. His scandalous subjection to the clergy now gave the barons an opportunity of exerting themselves, in order to reduce the enormous prerogatives of the crown. Their designs were greatly facilitated by the concurrence of Langton the primate, who on all occasions showed a sincere regard for the interests of the kingdom. At a synod of his prelates and clergy, convened in St Paul's on pretence of examining into the losses of some bishops who had been exiled by John, he privately conferred with a number of barons, to whom he expatiated upon the vices and injustice of their sovereign. He showed them a copy of Henry I.'s charter, the only one in the kingdom, having been found amidst the rubbish of an obscure monastery. Langton exhorted the barons to insist on a renewal thereof; and this they solemnly swore to perform. The same agreement was afterwards renewed at a more numerous meeting of barons summoned by Langton at St Edmondsbury. Here it was resolved that at Christmas they should prefer their common petition in a body, and in the mean time they separated, intending to put themselves in a posture of defence, to enlist men, and to make other warlike preparations. In the beginning of January 1215 they repaired to London, accoutred in the military garb and with their equipage, and presented their petition to the king, alleging that he had promised to grant a confirmation of the laws of Edward the Confessor, at the time when he was absolved from his excommunication. John resented their presumption ; and required a promise under their hands and seals that they would never demand or attempt to extort such privileges in future. But this they refused with such unanimity and resolution, that the king desired time to consider of their petition ; at the same time promising that, at the festival of Easter, he would give a positive answer. He also offered securities, which the barons accepted, and thereafter withdrew.

John, however, had no intention of complying with their demands, for it is evident that his promise was extorted from him by fear. He had recourse to the clergy, whose favour he propitiated by promising many things which he had not the slightest intention of ever performing. The pope was likewise appealed to, who threw the weight of his authority into the scale of his vassal, and exhorted the barons to abandon their treasonable enterprise. At the same time his holiness also agreed to consider their petition, and to endeavour to obtain for them the concession of those demands which appeared to be just. But, happily for English liberty, the confederates disregarded the injunctions of Innocent III., who by his decision had now more embroiled the fray. Both parties gave up all hopes of a peaceful negociation at the ensuing festival, and made the best preparations they could for war, in which the barons had an unequivocal superiority.

After waiting until Easter, when the king promised to return them an answer, they met by agreement at Stamford. There they assembled a force of above two thousand knights, with a prodigious number of foot, and thence marched to Brackley, about fifteen miles from Oxford, then the court residence. John, hearing of their approach, sent the Archbishop of Canterbury, the Earl of Pembroke, and others of his council, to know the particulars of their request, and what those liberties were which they so much importuned him to grant. The barons delivered a schedule containing the chief articles of their demands, founded on the charters of Henry and Edward, but which were in the highest degree displeasing to the king. He burst into a furious passion, and, asking the barons why they did not also demand his kingdom, swore that he would never comply with such exorbitant requests. The confederates then as their general chose Robert Fitzwalter, whom they dignified with the title of Mareschal of the army of God and of the holy church. They laid siege to Northampton, but were repulsed ; they, however, took Bedford, and were joyfully received into London.

The concurrence of the metropolis proved decisive of the contest. It was in vain that the pope fulminated a bull in favour of his vassal John ; the many were unanimous, and the few were compelled to yield the point. The king, with a court now reduced to seven attendants, retired to Odiham, where, seeing the necessity of submitting, he agreed to a friendly conference. The barons named, as a proper place for meeting, Runnymede. It was a meadow situated between Staines and Windsor, and, like the holy ground of the Hebrews, it is still held in veneration as the spot where the standard of English freedom was first unfurled. On the 15th of June 1215, both parties met there ; and having taken up separate stations, a long discussion ensued, which terminated in the king signing the charter, called, by way of pre-eminence, Magna Charta. For a particular account of the great charter, which for centuries afterwards was looked upon as the palladium of our national freedom, the reader is referred to the article MAGNA CHARTA.

This charter, however, at the time when it was granted, secured liberty to the clergy, the barons, and the gentlemen, much more than to the bulk of the people, who did not for a long time obtain any privileges of importance. Freedom of elections was secured to the clergy; and it was determined that fines imposed on them for any offence should be laid on in proportion to their estates, and not the value of their benefices. The privileges secured to the barons were, either abatements in the rigour of the feudal laws, or relief from arbitrary and ambiguous decisions before the courts. It was also decreed that barons should recover the lands of their vassals, even though forfeited by felony, after having been in the possession of the crown for a year and a day; and no tax was to be imposed without consent of the great council of the nation, excepting in case of the captivity of the king, the knighting of his eldest son, or the marriage of his eldest daughter. No land belonging to any baron was to be seized for a crown debt, except when the possessor had not personal property enough to pay it; neither was any vassal to be allowed to sell so much of his land as to incapacitate him from performing the necessary service to his lord. It was also determined, that when the great council of the nation was called, the prelates, earls, and barons should be summoned by a particular writ, and that the lesser barons should receive a summons from the sheriff. In favour of the people it was stipulated, that they should receive from the barons all the immunities and privileges granted by the king to the former. Merchants were to be allowed to carry on their business without any arbitrary tolls or impositions, and to go out of the kingdom and return at pleasure. The goods of every freeman were to be disposed of according to his will; or if he died intestate, the nearest heir was in that case to succeed him. No carts, horses, or wood were to be taken by the crown officers without the consent of the owner. The king's courts were to be stationary; no delay was to take place in doing justice to every one; and no freeman was to be taken or imprisoned, dispossessed of his free tenement, outlawed, or banished, unless by the legal judgment of his peers. It was likewise stipulated that London should remain in the hands of the barons, and that the Tower should be consigned to the primate, till the 15th of August following, or till the articles contained in the charter were fulfilled. In order to secure the accomplishment of this, the king allowed them to choose twenty-five of their own number, to whose authority no limits were assigned. If any complaint were made of a violation of the charter, either by the king or his officers, any four of the barons might admonish the king to redress the grievance; and if satisfaction were not obtained, they might assemble the whole council of twenty-five and, in conjunction with the great council, compel him to fulfil the charter. In case of his resistance, they had liberty to levy war against him, attack his castles, and use every kind of violence, except against his person, or those of his queen or children. All men throughout the kingdom were bound, under the penalty of confiscation, to swear obedience to the twenty-five barons; and the freeholders of each county were to choose twelve knights, whose business it was to report such obnoxious customs as ought to be redressed in terms of Magna Charta.

But although John had thus been obliged to recognise the liberty of his subjects, he had no mind that they should in reality enjoy it. The sense of his subjection to his own vassals sunk deep into his soul, and he became sullen, silent, and reserved. He shunned the society of his former friends, and retired into the Isle of Wight, as if to hide his disgrace in solitude, but, in reality, to meditate plans of revenge. He sent to the Continent in order to enlist a large body of mercenary troops, and made heavy complaints to the pope on account of the insurrections of the barons against him. The pontiff, as might be expected, warmly espoused his cause; a bull was sent over annulling the whole charter; the principal barons were excommunicated by name, and declared to be worse than Saracens; and at the same time the foreign troops arriving, the king once more found himself in a condition to demand his own terms from his untractable subjects.

The barons had made no preparations for war, not suspecting the introduction of a foreign army. The king, therefore, was for some time undisputed master of the field, and the most horrid cruelties were committed by his army. The nobility who had been most active in procuring the great charter accordingly fled with their families to Scotland, where they obtained the protection of King Alexander by doing homage to him. The barons, finding themselves totally unable to raise an army capable of contending with that of John, resorted to the equivocal and perilous expedient of calling in foreign aid. They applied to their old enemy Philip of France, offering the crown to his eldest son Louis, upon the condition of their being protected from the fury of John, and the unprincipled mercenaries whom he commanded. The French king eagerly accepted their proposals, and dispatched his son with a powerful army to England. He was received by the barons with great acclamations, and having united their forces, they secured all the southern counties. Essex and Sussex were soon after added; and they advanced successfully into Norfolk, spreading around them all the devastations of civil war. The forces of John occupied the northern districts, where the king of Scotland harassed him by an invasion of Northumberland. But these hostilities, which might ultimately have ruined the independence of the country, by sinking it to the level of a French province, were happily terminated by the death of John, in the forty-ninth year of his age, and seventeenth of his reign. His demise took place at Newark, on the 19th of October 1216. The death of this monarch was as much a public blessing as his reign had been a national misfortune. The signing of Magna Charta is the only event of his life which is worthy of being recorded in history. He, however, deserves no credit for that act, which was the result of compulsion. As well might we consider honesty the actuating principle or motive of the malefactor who consents to deliver up the treasure of which he had possessed himself, when he comes in sight of the wheel upon which, in case of refusal, he is to be broken alive.

John left six legitimate children, namely, three sons and three daughters. The eldest of the former, Henry of Winchester, was only ten years of age when he found himself in possession of the title, although not entirely of the power, of king. He was crowned as Henry III. upon the 28th of October 1216, nine days after he succeeded to the inchoate right to the throne. The care of his person was entrusted to the Earl of Pembroke, earl-marshal, with the style and title of guardian of the kingdom. Through the instrumentality of this nobleman the great charter of liberties was revived, and the claims of the crown were reconciled with those of the subject, to the satisfaction of the adverse barons. Besides the eldest son of John, there was another competitor for the crown, namely, Louis of France, who had been called over by the barons of Runnymede, in order to take possession of the English throne. For some time Louis kept the field, and not without success; but he was defeated at Lincoln; and a fleet which his father had sent to him with succours having been totally destroyed by the English, he was compelled to abandon the enterprise, and to make an honourable retreat.

A peaceful king is looked upon either as imbecile or as pusillanimous by an age which feels the intoxication of military glory, and considers the principal duties of a monarch to be "to go out and in before his people, and fight their battles." The reign of Henry III. is but little adorned with the triumphs of war; and, if we are not mistaken, it has been too much depreciated on this account. But this fact, as well as his monarchical character, we will be enabled to ascertain with more certainty after we have passed in review the principal events of his reign. Its early history exhibits only some of those evils incident to an injudicious, but not, strictly speaking, wicked administration. In 1225 the great charter was a third time confirmed, upon the occasion of Henry assembling a great council, and urgently demanding aid against a pretended invasion of the French. In consequence of this, it has ever since retained its place at the head of English statutes. The wardship of the young king had now solely devolved upon Hubert de Burgh, the grand justiciary, and a man of ability and spirit, but nurtured under Richard and John. For several years he ruled as the favourite without control, repressing the disorders of the times with a vigorous, but, in the eye of an enlightened age, cruel policy. In 1227, Henry was declared in parliament to have attained to the years of discretion; and two years afterwards he resumed the project of conquering France, and landed there with a considerable army. The expedition proved most disgraceful to the English arms; and in a year after he returned to his country not a little humbled in its estimation, as well as his own. The next event of importance which we meet with is the disgrace of De Burgh, who was accused of negligence and treachery in the discharge of his duties; with what degree of truth it is difficult now to determine. He was imprisoned for some time, but afterwards restored to liberty, honours, and emoluments.

In 1236, Henry espoused Eleanor of Provence. This event gave rise to a new immigration of foreigners of higher rank and more specious pretensions than those who usually flocked to the soil of England. One of the queen's uncles became prime minister, a second was made primate, and a third Earl of Richmond. This favouritism excited much discontent both amongst the native barons and the people. The other events of this long reign consist of petty wars and bickerings with France, Scotland, and Wales. The prodigality of the king was extreme, and he was repeatedly compelled to lay his necessities before parliament and solicit supplies. These were as often afforded; but notwithstanding these grants, he had frequent recourse, under specious pretexts, to the most unjust exactions. Meanwhile England rapidly increased in wealth, and widely extended her commercial relations with other countries.

In the year 1254, at the instance of the pope, Henry accepted of the crown of Sicily for his son Edmund. It had been formerly offered to his brother Richard, who was wise enough not to accept of it, probably because he felt himself unable to compete with the other powerful princes who aspired to it. In order to raise the money necessary to carry his foolish project into execution, Henry had recourse to every expedient which the regal or papal ministers could devise. The principal burden fell upon the clergy, who, by the menace of excommunication on the one side, and of forfeiture on the other, were compelled to submit. This oppression widened more and more the breach between the king and his people; and he found it necessary at last to look to the security of his own crown, instead of fighting for a foreign diadem to grace the brow of his son.

Amongst the foreigners of distinction who established themselves in England during the reign of Henry III. was Simon de Montfort, earl of Leicester. He was the younger son of the Count de Montfort, celebrated in the annals of religious warfare for his cruel crusade against those dissenters from the Roman faith called Albigois or Albigenses. Simon the younger received the hand of King Henry's sister in marriage, and very early began to act a conspicuous part in the civil commotions which agitated the country. He was a bold and ambitious man; and placing himself at the head of the disaffected barons, he formed a powerful confederacy against the king. In the year 1258, a famous parliament was summoned at Oxford, in order to digest the new plan of government, and to elect to the chief authority such individuals as were deemed worthy of trust. This assembly, afterwards celebrated in our annals by the derisive name of the *mad parliament*, went very expeditiously to work in the business of reformation. Twenty-four barons were appointed, with supreme authority, in order to reform the abuses of the state; and Leicester was placed at their head. Twelve of these barons were chosen by the king's council, and twelve by the parliament. Their first step was to order four knights to be chosen out of each county, who should examine into the state of their respective constituents, and attend at the ensuing parliament to give information of their complaints. They ordained that three sessions of parliament should be regularly held every year; that a new high sheriff should be elected annually; that no wards nor castles should be entrusted to foreigners, no new forests made, nor the revenues of any counties farmed out. Thus far these provisions were good, and an approximation to popular representation, although some modern writers have designated the whole transaction as a revolution.

The twenty-four barons continued to conduct the affairs of government for several years; but they at last began to quarrel amongst themselves. The Earls of Gloucester and Leicester pursued opposite interests, and formed opposite parties, who eyed each other with mutual jealousy. Leicester, perceiving that his rival was likely to gain the ascendency, retired to France; but the balance was again restored in his favour by the union of Prince Edward with his friends. A short time after this event, the rival parties seem to have assumed, if not the reality, at least the appearance of unanimity. In 1262, Henry made a fruitless attempt to escape from the authority of the barons; but his son Edward remained firm to their cause, on account of his having sworn to observe the provisions of Oxford. After other ineffectual attempts upon the part of the king, he agreed that the twenty-four noblemen should continue to govern, not only during his own reign, but also during that of his successor. By this stipulation, Edward joined his father, which restored vigour to the royalists, and more equally balanced the power of the parties. It was proposed that the differences between them should be submitted for arbitration to Louis IX., and both swore to abide by his decision. That excellent monarch enjoined the restoration of all castles, possessions, and royal rights enjoyed by the crown before the parliament of Oxford, upon condition of universal amnesty, and of the full enjoyment of all the privileges and liberties granted by the charter. The award was confirmed by the pope, who empowered the Archbishop of Canterbury to excommunicate all who refused to submit to it.

The moment the decision was made known to the barons, they declared it to be contrary to truth and justice, and immediately took the field. The contest was at first favourable to the royal prerogative; but in 1264 Prince Edward lost a great battle by his impetuosity in pursuing too far one of the wings of the enemy's army, which he had defeated. His father and uncle were taken prisoners, and placed in the castle of Lewis, where he contrived to join them. They acceded to the propositions submitted to them, and the administration of the kingdom fell into the hands of the Earls of Gloucester and Leicester, and the Bishop of Chichester.

The situation to which the kingdom was now reduced proved at last the means of settling the government upon a more proper foundation. Leicester, in order to secure himself, was obliged to have recourse to an aid, till now entirely unknown in England, namely, that of the body of the people. He called a parliament, where, besides the barons of his own party, and several ecclesiastics who were not properly tenants of the crown, he ordered returns to be made of two knights from every shire; and also deputies from the boroughs, which had been hitherto considered as too inconsiderable to be allowed any share in the legislation. This parliament was called on the 22d of January 1265; and here we find the first outline of an English House of Commons; an institution which has ever since been considered, and justly, as the bulwark of British liberty.

The new parliament was far from being so compliant to Leicester as he had desired or expected. Many of the barons who had hitherto stedfastly adhered to his party were disgusted with his boundless ambition; and the people, who found that a change of masters was not a change of circumstances, began to wish for the re-establishment of royal authority. Leicester at last, making a virtue of necessity, released Prince Edward from his confinement, and had him introduced at Westminster-hall, where his freedom was confirmed by the unanimous voice of the barons. But though Leicester had all the popularity of restoring the prince, he was yet politic enough to keep a strict watch over him. Edward was nominally free, but in reality a prisoner. At last, however, he found means to effect his escape. The Duke of Gloucester, being disgusted with Leicester, left the court, and retired to his estates upon the borders of Wales. His antagonist pursued him thither, and, in order to give the greater authority to his arms, carried the king and Prince Edward along with him. This afforded young Edward an opportunity which he had long desired of making his escape. Being furnished by the Earl of Gloucester with a horse of extraordinary speed, he took leave of his attendants, or rather his guards, under pretence of trying the mettle of his steed. He was hotly followed; but an end was put to the pursuit by the appearance of some of Gloucester's troops.

No sooner was the prince at liberty than the royalists joined him from all quarters, and an army was soon assembled which proved more than sufficient to meet the forces of Leicester. The latter now found himself in a remote quarter of the kingdom, surrounded by his enemies, and shut out from all communication with his friends by the river Severn, the bridges on which Edward had broken down. In this extremity he wrote to his son to hasten to his assistance from London, with a considerable body of troops which the latter had under his command. With this view his son advanced to Kenilworth; but here he was surprised by Prince Edward, and the greater portion of his followers were made prisoners. The young prince immediately advanced upon Leicester himself, whose last anchor had given way with the defeat of his son. He was by no means able to cope with the royalists; his men were inferior both in numbers and resolution to their antagonists. In the battle which ensued, the royalists gained a signal victory over their opponents, defeating them with great slaughter. Leicester himself was slain, together with his eldest son Henry, and about a hundred and sixty knights and other gentlemen. The body of the fallen earl was mutilated in a frightful manner, and portions of it sent to various places. His memory was long revered by the people, who looked upon him as a martyr to the liberties of the realm. But a vigorous reign ensued, and the national feeling was suppressed, or directed to other objects. He left, however, an imperishable name, as the first who had called together a parliament of which the lower house composed part.

The victory of Evesham restored the fortunes of the royalists. The followers of Leicester were proscribed, and their lands distributed amongst the victors. With the death of Montfort the spirit departed from the baronial party, whose members hastened to give in their submission, and to open the gates of their castles to the king. Several places, however, still held out; but by the activity and valour of Prince Edward they were all finally reduced. The country submitted, and the royal authority was completely re-established throughout the realm. The good sense of Edward, however, infused a wiser and more popular spirit into the conduct of government. So judicious appears to have been his administration, indeed, that, in a few years after the battle of Evesham, he felt himself in a capacity to take the cross, and enlist under the banners of the crusaders. This step of the heir apparent to the crown of England may appear somewhat extraordinary, when we consider the advanced period of life to which his father had now attained, and the civil commotions from which he had so recently emerged. But in an age when it was common to ascribe any sudden transition of fortune from one extreme to another, to the immediate interposition of providence, it is less to be wondered at. The recent deliverance of himself and his father from their enemies had incurred a debt of gratitude to heaven which it was now his desire to pay off. His expedition to the Holy Land was of little importance, and was moreover in no way connected with the history of his country, although it was distinguished by those romantic adventures and chivalrous feats of arms peculiar to the age, and more especially to the wars in Palestine.

The remaining events of Henry III.'s reign afford no materials for history. He died on the 16th of November 1272, in the fifty-seventh year of his reign. The character of Henry is not strongly marked either by good or by evil. During its long continuance we see no premeditated crime, no deep laid plot involving the liberties of his subjects, with which to impeach his memory. The evils which grew and prospered whilst he held the sceptre did not arise from vices in the sovereign, but from the unsettled state of society and the turbulent spirit of the times. His virtues, however, were not very conspicuous; they were rather of a passive than of an active kind; rather the negative of vice than positive moral greatness. With regard to intellect, he appears to have been below mediocrity; and it is usual with historians to describe him as deficient in capacity to govern. This was probably the case, but it was productive of inconvenience to himself rather than misery to his subjects. Under his pacific rule, as we have already observed, the nation grew more rapidly in wealth and prosperity than it did under the more dazzling sway of his military progenitors.

Edward, upon hearing the news of his father's death, and feeling himself secure of the throne, returned slowly from the Holy Land. He arrived in England in August 1274, and was crowned at Westminster on the 19th of the same month. Two years afterwards he undertook an expedition against Lewellyn, prince of Wales, who had refused to do homage for his crown. The conquest of that country cost him some trouble, and was not completed until the year 1283. After this period the principality of Wales was annexed to the crown of England, and thenceforth conferred a title upon the king's eldest son. In 1286, Wales had been so entirely broken into subjection, that Edward undertook a journey to the Continent for the purpose of mediating a peace between Alonzo of Aragon and Philip the Fair of France. These two monarchs had differed about the kingdom of Sicily; but a negociation was effected, and the king of England returned to his country after an absence of three years, during which period much disorder had been introduced into his dominions. Robbery and violence had become frightfully prevalent, and the corruption of the judges had poisoned the fountains of justice. In order to remedy these evils, Edward summoned a parliament, and cited the delinquents to appear and take their trial. All of them, except two clergymen, having been convicted of flagrant acts of corruption and bribery, were accordingly fined, and deposed from their office.

The next great event of Edward's reign was an attempt to subjugate Scotland. This he never altogether effected, although he succeeded in reducing the country to great distress, and in even nominally attaching it to the English crown as a conquered province. For an account of these transactions, see the article SCOTLAND. Edward was at the same time engaged in expensive contests with France; and these multiplied wars, by obliging him to have frequent recourse to parliamentary supplies, became the remote causes of great and important changes in the government. The parliament was modelled into the form which it has ever since retained. As a great part of the property of the kingdom, by the introduction of commerce and by improvements in agriculture, was transferred from the barons to the lower classes of the people, so their consent was thought necessary in order to raise the supplies. For this reason the king issued writs to the sheriffs, enjoining them to send to parliament, along with two knights of the shire, two deputies from each borough within their county; and these, too, provided with sufficient powers from their constituents to grant such demands as they should think reasonable for the safety of the state. The charges of these deputies were to be borne by the boroughs which sent them; and so far were they from considering this deputation as an honour, that nothing could be more displeasing to any borough than to be thus obliged to send a deputy, or to any individual than to be thus chosen. The authority of these commoners, however, increased in course of time. Their union gave them weight; and it became customary among them, in return for the supplies which they granted, to prefer petitions to the crown for the redress of grievances. The more the king's necessities increased, the more he found it necessary to give them an early hearing, until, from requesting, the commons proceeded to demanding; and having all the property of the nation, they by degrees began also to be possessed of a considerable share of the power.

Edward I. died of a dysentery, near Carlisle, on the 7th of July 1307, as he was leading a great army into Scotland, against the inhabitants of which he had vowed the most dreadful vengeance. Edward ranks amongst the greatest monarchs of England. In military talents, in sound judgment, in vigour, decision, irascibility, and vindictiveness, he bore some resemblance to the Conqueror. Like him too he possessed an unsatiable ambition, and his unholy crusade against the independence of Scotland must be regarded as an indelible blot upon his memory. He was succeeded by the eldest of his surviving sons, who bore his father's name, but inherited nothing of his capacity, and who was crowned on the 8th of July 1307, with great magnificence. His father had charged him upon his death-bed to prosecute the war against Scotland until he had finally subdued the kingdom; but war had few attractions for Edward II., and he withdrew his army ingloriously from the country which his father went to subjugate. The first years of Edward's reign are distinguished for nothing but bickerings with his barons, who finally extorted from him a reformation of abuses in full parliament. The Scots in the mean time gradually recovered their power; and Edward having invaded their country with a prodigious force, was met by Robert Bruce at Bannockburn, near Stirling, who totally defeated the puissant army of the English on the 24th of June 1314. See SCOTLAND.

The reign of Edward II. was one continued series of quarrels with his turbulent subjects. His favourites were the most general causes of discontent. The first of these was one Pierce Gaveston, the son of a Gascon knight of some distinction. The latter had honourably served the late king, and, in reward for his services, had obtained an establishment for his son in the family of the Prince of Wales. To be the favourite of any king whatsoever is no doubt in itself a sufficient offence to the rest of the courtiers. Numberless faults were therefore found with Gaveston by the English barons. When the king went over to France to espouse the Princess Isabella, to whom he had been long contracted, Gaveston was left guardian of the realm, with more ample powers than had usually been conferred in such cases. But upon the arrival of the queen, who was of an imperious and intriguing spirit, Gaveston had the misfortune to fall under her displeasure, on account of the ascendency he had acquired over the king. A conspiracy was soon formed against the favourite, at the head of which was the queen and the Earl of Lancaster, a relation of the king's, and the most powerful nobleman in England. Edward found himself unable to protect his favourite against such a formidable combination, and was compelled to banish him. His recall some time afterwards again spread alarm over the country, and kindled a civil war. The nobility were successful in obtaining possession of the obnoxious Gaveston; and, in order to free themselves for ever from uneasiness on his account, they put him to death.

After the defeat of Bannockburn, King Edward chose a new favourite named Hugh le Despencer. He was a young man of a noble English family, and possessed some merit, and engaging accomplishments. His father was a person of apparently unimpeachable character, but he also enjoyed the king's favour, and that was a sufficient crime. The king imprudently dispossessed some lords of their estates, in order to bestow them upon young Despencer. This afforded a sufficient pretext to the barons for openly attacking both the father and son. The Earls of Lancaster and Mortimer, chief of the Welsh marshes, flew to arms; and sentence of perpetual exile against the two Spencers, with a forfeiture of all their estates, was procured from parliament. At last the king took the field, and obtained a signal victory over the other party at Boroughbridge. The Earl of Lancaster was made prisoner, and beheaded a few days afterwards at his own castle of Pomfret. This individual was canonized in 1389. Many other noblemen suffered the same punishment without having the same respect paid to their memory, whilst Mortimer was condemned to perpetual imprisonment.

The triumph of the Spencers was now complete; but the partiality with which the king regarded his two favourites had the effect of alienating not only the affections of his subjects, but also those of his queen. Other charges are brought against Edward as having contributed to effect this estrangement, and Isabella sought an opportunity of escaping from her husband. The palace of her brother at Paris was her natural place of refuge. A rupture having commenced between England and France, the queen proceeded to the court of the latter as negociator, and concluded a peace humiliating to her husband. But she had another object in view in visiting her native country. Her residence became a sanctuary for the English malcontents, who flocked to her in great numbers; and amongst these came Mortimer, who had contrived to effect his escape, and for whom she has been charged with entertaining a stronger passion than that of friendship. The cause of quarrel between the two powers was the county of Guienne, for which the monarch of France required Edward to do homage and fealty. The disputed territory was resigned to the young Prince of Wales, who joined his mother, and made the necessary submissions. When Isabella considered that matters were sufficiently matured for executing her purpose, she landed in England on the 22d of September 1326, where she was universally welcomed, and immediately joined by the most potent barons. The unfortunate king found that the spirit of disloyalty had spread over the whole kingdom. Some dependence was placed upon the garrison of Bristol, which was commanded by the elder Spencer; but the soldiers rebelled against their governor, and delivered him into the hands of the barons, by whom he was cruelly put to death. Young Spencer did not long survive his father. Along with some others who had followed the fortunes of the wretched king, he was made prisoner in an obscure convent in Wales; and the queen having no patience to wait the formality of a trial, gave orders for his immediate execution.

In the mean time the king was discovered and delivered up to his adversaries, who loaded him with insults. He was conducted to the capital, and consigned to the Tower. The charge against him exhibited no other crimes than his incapacity to govern, his indolence, his love of pleasure, and his accessibility to evil counsel. His deposition was quickly voted by parliament; he was assigned a pension for his support; his son Edward, a youth of fourteen, was appointed to succeed him, and the queen was nominated regent during the minority. But the deposed monarch did not long survive his disgrace. He was at first put into the custody of the Earl of Lancaster; but this nobleman having shown some marks of respect and pity for the misfortunes of his sovereign, the latter was taken out of his hands and delivered over to the Lords Berkeley, Maltravers, and Gournay, who were entrusted alternately, each for a month, with the charge of guarding him. Whilst he was in Berkeley's custody, he was still treated with some degree of humanity; but when the turn of Maltravers and Gournay came, every species of indignity was practised upon him, as if they had designed to accelerate his death by accumulating his mental sufferings. As his persecutors, however, saw that his death might not speedily arrive, even under every cruelty which ingenuity could devise, and as they were daily afraid of a revolution in his favour, they determined to put their fears to rest by destroying him at once. Mortimer, therefore, secretly gave orders to the two keepers to dispatch the king; and these ruffians contrived to render the manner of his death as barbarous as possible. Taking advantage of Berkeley's sickness, in whose custody he then was, and who was thereby incapacitated from attending to his charge, they came to Berkeley Castle, and obtained possession of the king's person. They threw him on a bed, and held him down with a table which they had placed over him. They then ran a horn pipe into his bowels, through which they conveyed a red-hot iron; and thus deprived him of life without disfiguring his body. The murderers fled on the perpetration of this horrible enormity; for the dying agonies of the king created suspicions which ended in the discovery of the crime. One of the fugitives was taken at Marseilles, and beheaded on his way to England. The other concealed himself for some years in Germany; but having found means of rendering some services to Edward III. he ventured to approach the person of that monarch, and by his humiliating submission received a pardon.

By the death of Edward II. the government fell entirely into the hands of the queen and Mortimer, who had now the disgraceful pre-eminence of royal paramour. The parliament, which had raised young Edward to the throne, had indeed appointed twelve persons as his privy council, to direct the operations of government. Mortimer excluded himself, under a show of moderation; but at the same time secretly influenced all the measures which came under their deliberation. As this influence began very soon to be perceived, and the queen's criminal attachment to Mortimer was universally known, the administration soon became obnoxious to the people. It had continued four years, when a circumstance occurred which added greatly to its unpopularity. The Scots having made an irruption into England, were met by an overwhelming force under young Edward, or rather Mortimer. The results of this mighty expedition were most ludicrous. By their superior skill and activity, the Scots foiled the English commanders, and made their escape into their own country. Soon after this inglorious campaign, a solemn treaty of peace was concluded, in which Edward, for a sum of money, renounced every claim of superiority over Scotland. This, although a commendable act of moderation, was not calculated to propitiate the favour of the English people. It was not long before another stroke of Mortimer's power and policy startled the nation from its propriety, and paved the way for his own destruction. Amongst those who began to betray indignation against the encroaching spirit of Mortimer, was Edmund earl of Kent, who, deceived into a belief that his brother Edward II. was still alive, wrote a letter to that prince, which was betrayed into the hands of Mortimer, now Earl of March, by the individual who had undertaken to deliver it. The writer of the epistle was immediately tried for high treason, condemned, and executed. There is little doubt that the whole affair of the letter was a plot laid for the destruction of Kent, not only to get him out of the way, but to show that there was no one too high not to be struck down by the vengeance of Mortimer.

Edward finding the restraint under which he was retained becoming irksome, resolved to shake it off, and to rid himself and the nation at once of an authority which had now become alike odious to both. The queen and her paramour had repaired to Nottingham, where a parliament was then held. They had chosen the castle as a place of residence, and taken every precaution to ensure their safety; for fear follows guilt like its shadow. The enemies of Mortimer, however, found means to obtain admission at dead of night; and having seized him as he lay in an apartment adjoining to that of the queen, he was taken prisoner to London, tried before his peers for various crimes, convicted, and executed.

The queen, who was perhaps the most culpable of the two, was screened from capital punishment by the dignity of her station, but stripped of all power, and confined for life to the castle of Risings. From this imprisonment she was never liberated, but during her life the king paid her an annual visit of ceremony.

Edward III. proved one of the greatest warriors who had ever sat on the English throne. His first attempts were to raise Edward Baliol to the throne of Scotland: this however he failed in effecting. But his mind now began to be diverted to loftier and more ambitious speculations. The crown of France became the object of contest between Edward, the son of Philip the Fair's daughter Isabella, and Philip of Valois, the son of the brother of Philip. The question was, whether the crown was descendible only through males, or whether it might be claimed by the nearest male although his descent was by females. Charles the Fair died in 1328, and left the crown of France without direct male descendants to inherit it. The three last kings were the sons of Philip the Fair, and they all reigned successively, but died without issue. According to the English law, the son of the daughter precedes the nephew in inheritance; but the French Salic law excluded females. Edward contended that the feudal laws of France forbade females to inherit who could not perform the feudal duties, yet that their male heirs were not debarred by the spirit of this law, because they were competent to discharge all the military services required. On the other hand, it was insisted by the French advocates for Philip de Valois, that the exclusion of the female in the first instance was an exclusion of all the descendants of either sex. If it had been a question of succession to the English crown, it would have been rightfully determined by the parliament and law of England; but as it concerned the crown and law of France, it was clearly a matter for the French state and lawyers to decide. They decided in favour of Philip de Valois, and he was accordingly crowned king of France. In this decision they displayed the soundest principles of national policy, and Edward ought undoubtedly to have acquiesced.[1] The king of England, however, thought otherwise, and accordingly began to make preparations for an invasion of France.

By doing homage to Philip for the duchy of Guienne, Edward gained time to collect such an army and treasure as were necessary for the enterprise. Two powerful continental allies appeared in his favour; namely, Robert of Artois, who had been excluded from the county to make way for his aunt Matilda, a nearer relative by blood to the preceding count; and James von Artaveldt, a famous brewer of Ghent, and leader of the democratical party among the Flemings. It was at the suggestion of the latter that Edward assumed the title of king of the French, as a pledge that he would pursue his undertaking with inflexibility of purpose. The king of England landed at Antwerp in July 1338; but it was not until more than a year thereafter that he reached the confines of France. His first campaign was unimportant, but in the second he achieved a considerable naval victory on the 22d of June 1340. Flushed with this success, he marched to the siege of Tournay at the head of 100,000 men. Near this town the king of France had encamped himself in a situation so strong as to bid defiance to attack. Edward challenged him to single combat, but this was refused; and the English were at last compelled to raise the siege, and to retire sullen and discontented from the place.

The efforts of Edward began now to be much crippled for want of money. The exchequer of England was unable to satisfy his demands, and his allies had become clamourous for their arrears. Some of his courtiers having instilled into his mind suspicions of the fidelity of his ministers, he suddenly returned to London, where he landed about midnight at the Tower. Next morning he displaced the chancellor, treasurer, and master of the rolls, confined three of the judges, and ordered the arrest of most of the officers employed in the collection of the revenue. Archbishop Stratford, however, boldly opposed his career of resentment and cruelty, and vindicated the cause of the ministers. The king was compelled at last to abandon his process against the primate, for the urgency of his wants admitted of no delay.

The failure of his first two campaigns did not wean Edward from his attachment to foreign alliances. By a disputed succession to the duchy of Brittany, in which he took the part of the individual who opposed Philip of France, a new road was opened up to him into that country. He collected a vast army, with which he landed near Cape la Hogue about the end of July 1346. His career in France was a series of triumphs most glorious to the English arms. On the 26th of August 1346 was fought the decisive battle of Cressy, which is still memorable after the lapse of many centuries. In this celebrated conflict, Edward the Black Prince, a youth only sixteen years of age, gained unfading laurels. The siege of Calais followed, and the place was reduced after an obstinate defence. The first fruit of the reduction of this place was a truce, which lasted till 1355, when Edward the Black Prince, who governed his father's dominions in France, undertook an expedition into the neighbouring provinces, and in the following year carried his arms into the heart of France. The victory of Poitiers was another mortifying humiliation to the French. John their king was taken prisoner, and treated with noble hospitality and respect by his renowned conqueror. He was conveyed to England, where his reception resembled rather the return of a victorious prince than the humiliation of a captive monarch. For a particular account of these and other transactions of the English in France, the reader is referred to the article FRANCE.

During the absence of the king of England on the Continent, his country was harassed by the Scots, who invaded it, but experienced a defeat at Nevelles Cross. In 1355, Edward himself invaded Scotland; and the havoc caused by this expedition was long remembered by the natives. The death of Edward Baliol in 1364 left David Bruce without a rival to the Scottish throne; and the pretensions of the Plantagenets to Scotland were terminated by Edward III.'s recognition of his brother-in-law. See SCOTLAND.

In the mean time Edward the Black Prince, after a Spanish campaign, in which he gained the celebrated battle of Navarete, returned to England in pursuit of health and quiet. But thirty years of toil and war had exhausted his robust frame, and he expired at Canterbury on the 8th of June 1376, in the forty-sixth year of his age. He left behind him a lofty reputation for bravery and skill as a commander, generosity as a knight, and wisdom and vigour as a statesman. His father Edward III. did not long survive his loss. He died on the 21st of June the year following. The reign of this monarch is generally considered by Englishmen as the most illustrious period of their ancient annals. "The victories of Cressy and Poitiers," says Mr Turner, "may have produced the popular sentiment; but the reflective mind will adopt the opinion as steadily, when it observes, during this reign, that our navy established its preponderance over the most celebrated fleets that were then accustomed to navigate the British channel; that our parliament enjoyed, in full and upright exercise, those constitutional powers which the nation has long learnt to venerate as its best inheritance, but which weaker sovereigns have too eagerly contested; that our manufactures and commerce began to exhibit an affluence and an expanding growth, and to be conducted on the true principles of public improvement; that our clergy evinced a disposition to emancipate themselves from the papal despotism, and some to exercise a just freedom of thought on the most important of all human concerns; that the lineaments of our prose literature became distinctly discernible; that the pursuit of the mathematical and natural sciences, and of the art of reasoning, at one or both of our venerable universities, was ardent and successful; that our poetry assumed the attractive form with which its life, sympathy, utility, and immortality are most surely connected; and that our manners displayed a moral sentiment, which, though somewhat fantastic, and always pure, yet contributed to soften the horrors of war, and has led to that more cultivated feeling which, continually increasing and refining, has made Englishmen distinguished for their generosity, magnanimity, and honour." It may be added, on the authority of Sir Mathew Hale, that during this reign the law was greatly improved, and nearly attained its meridian. The monarch himself kept pace with the progress of the time, and his reign was sufficiently protracted to afford opportunities for the development and consolidation of all improvements. He left his country ennobled in the eyes of Europe, and possessed of gigantic energies capable of realising the glorious destinies which awaited her.

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[1] Turner's *History of England*, vol. ii. p. 144.

Edward III. was succeeded by Richard II. son of the beloved Black Prince. He commenced his reign, being only eleven years of age, on the 22d of June 1377, with many expressions of congratulation from his subjects. His coronation took place on the following year, and parliament was opened with a speech from the Archbishop of Canterbury, which, being "soothing and gracious," was meant to propitiate the favour of the representatives of the nation in behalf of the young sovereign. The Dukes of Lancaster, York, and Gloucester, uncles to the king, with some other noblemen, were appointed regents during Richard's minority. The war, which was still prosecuted in France on a small scale, and the expenses necessary for retaining the towns already taken, required supplies of money, which could not be raised without additional taxation; and this gave rise to much discontent amongst the people. An imposition of three groats upon each person of both sexes and every condition who had passed the age of sixteen, particularly excited the minds of the common people against the government. The manner, too, of collecting this tax, soon furnished an occasion of revolt. The insurrection began in Essex, where a report was industriously spread that the peasants were to be destroyed, their houses burned, and their farms plundered. At Dartford, an individual, well known by the name of *Wat Tyler*, was the first who excited the malcontents to arms. The tax-gatherers proceeded to this man's house whilst he was at work, and demanded payment for his daughter. He refused to comply, on the ground that she was under the age stipulated in the act; upon which one of these fellows offered to prove the contrary in a very indecent manner, and for this purpose laid hold of the maiden. Such insolence, however, roused the spirit of the father, and with one blow he laid the ruffian dead at his feet. A shout of applause burst from the bystanders, who declared themselves prepared to protect Wat from the vengeance of his enemies. The cry of the men of Kent was responded to by those of the neighbouring counties, and Wat soon found himself at the head of an enormous body of insurgents. They advanced to Blackheath in the month of May 1381, and proceeded to enforce their counsels by an attack upon London, in which they succeeded. The king, finding that resistance was vain, agreed to listen to their demands. On this they made a very humble remonstrance; requiring a general pardon, the abolition of slavery, freedom of commerce in the market-towns, and a fixed rent instead of those services required by the tenure of villenage. The king granted all these requests; and charters were made out by which the grant was ratified. In the mean time, another body of these insurgents had broken into the Tower, and murdered the chancellor, the primate, and the treasurer, with some other officers of distinction. They then divided themselves into parties, and took up their quarters in different parts of the city. At the head of one of these was Wat Tyler, who led his men into Smithfield, where he was met by the king, who invited him to a conference, under pretence of hearing and redressing his grievances. Tyler ordered his companions to retire till he should give them a signal, and boldly ventured to begin a conference with the king in the midst of his retinue. His demands were, that all slaves should be set free, that all commonages should be open to the poor as well as to the rich, and that a general pardon should be granted for the late outrages. During the interview, the rebel kept playing with his dagger, and at last he is said to have laid his hand on the bridle of his sovereign's horse; upon which Walworth, lord mayor of London, alarmed for the king, plunged a basillard in the throat of Tyler, and at the same moment another esquire dispatched him with his sword. This is the tale told by the writers of the victorious party, for the partizans of Wat Tyler had no historian to give their version of the story. The insurgents who witnessed the fall of their leader bent their bows with the design of revenging his death. But Richard, though only sixteen years of age, with admirable presence of mind galloped up to them, exclaiming, "What are you doing, my lieges? Tyler was a traitor. Follow me, and I will be your leader." With sullen and wavering discontent they followed him into the fields at Islington, where a body of troops had been collected for the protection of the young king. The insurgents were ordered to return to their homes instantly, and under the penalty of death they were forbidden to skulk about the city during night. But the whole of the rebels did not thus escape, and the revolt was not finally extinguished without much bloodshed and cruelty.

The courage, address, and presence of mind which the king had discovered in quelling such a dangerous tumult, gave great hopes to the nation: but, in proportion as Richard advanced in years, these hopes began to wither; and his want of capacity, or at least of solid judgment, appeared in every enterprise which he attempted. The king had unluckily lost the favour of the common people after the insurrection just mentioned. He allowed the parliament to revoke the charters of enfranchisement and pardon which had been granted; some of the ringleaders in the late disorders had been severely punished, and others were put to death without any form or process of trial. Thus the popular leaders were greatly exasperated by this cruelty, though probably the king did not in this follow the dictates of his own mind so much as the advice of his counsellors. But having thus lost the favour of one party, he quickly afterwards fell under the displeasure of the other also. Conceiving himself to be in too great subjection to his uncles, particularly the Duke of Gloucester, he attempted to shake off the yoke, by raising others to an equal share of rank and favour. Accordingly one of his favourites, Michael de la Pole, was created Earl of Suffolk, and raised to the chancellorship; whilst another, Robert de Vere, earl of Oxford, a young man of an agreeable person, but dissolute in his behaviour, soon acquired an absolute ascendency over him. This nobleman was first created Marquis of Dublin, and afterwards Duke of Ireland, both preposterous and invidious titles. The duke having soon become the dispenser of all the king's favours, a conspiracy was formed against him by some of the most powerful nobility in the kingdom. The Earl of Suffolk was impeached in parliament, and, being convicted of certain charges brought against him, was condemned to pay a suitable fine. Soon afterwards the king was prevailed upon to vest the government in the hands of eleven commissioners along with the three great officers of state. This measure was carried into effect by the Duke of Gloucester, who stood at the head of the committee; and the king could not without regret perceive himself thus totally deprived of authority. He first endeavoured to gain over the parliament to his interests, by influencing the sheriffs of each county, who were then the only returning officers; and this measure failing, he next applied to the judges, who declared that the commission which had deprived the king of his authority was unlawful, and that those who procured or advised it deserved condign punishment; but their sentence was quickly opposed by declarations from the lords. The Duke of Gloucester armed his partizans, and appeared at the head of a body of men sufficient to intimidate both the king and his adherents. These insurgents, sensible of their own power, began by demanding of the king the names of those who had advised the adoption of the late rash measures. A few days afterwards they appeared armed in his presence, and accused by name the Archbishop of York, the Duke of Ireland, the Earl of Suffolk, and Sir Robert Tresillian, one of the judges who had declared in his favour, together with Sir Nicholas Brembre, as public and dangerous enemies to the state. The parliament which met on the 3d of February 1388 condemned the five accused persons to suffer the death of traitors. The Duke of Ireland escaped to Flanders, where he expired four years afterwards; De la Pole died at Paris in the same year; Tresillian and Brembre were put to death, and the Archbishop of York became a Flemish curate, and died in that humble capacity. The other individuals who had subscribed the bold opinion were condemned to perpetual imprisonment; with the exception of Black, who had drawn up the questions, and Usk, appointed under-sheriff to arrest the Duke of Gloucester, who were both executed.

But the king became restive in the traces with which his uncle restrained him. In a meeting of parliament he declared himself competent to manage his own affairs, as he had by this time attained his twenty-second year. This bold announcement was followed by his ordering Thomas Arundel, whom the commissioners had recently appointed chancellor, to give up the seals, which, on the following day, he delivered into the hands of William Wickham, bishop of Winchester. The council was next cleared of the Duke of Gloucester, the Earl of Warwick, and other opposition lords; and the great officers of the household, as well as the judges, were changed for more pliable instruments.

Being now his own master, Richard notified by proclamation that he had taken the reins of government into his own hands; and, whether it was owing to the king or his ministers, it must be owned that for some years his administration was tranquil and happy. During this halcyon period he made a journey into Ireland, in order to divert the melancholy with which he was afflicted on account of the loss of his wife Anne. Soon afterwards he espoused Isabella, a princess of France, then in her eighth year, which contributed to an armistice with that kingdom for twenty-five years.

This alliance with the royal family of France encouraged Richard to execute a scheme of vengeance which he had long nourished in his bosom against Gloucester and others who had been instrumental in the punishment of his favourites. The duke, with the Earls of Warwick and Arundel, were appealed for treason; in consequence of which the former was sent prisoner to Calais, and the two latter committed to the Tower. Here the head of Arundel was shortly after struck off, and Warwick was banished; but the fate of the Duke of Gloucester is involved in some obscurity. On the 21st of September 1397 a writ was issued to Thomas Mowbray, earl marshal, governor of Calais, commanding him to bring the body of his prisoner, the Duke of Gloucester, to answer before the king in parliament to the appeal of treason against him. The reply of the governor of Calais was, that the prisoner had died in his custody. At a subsequent period circumstances transpired which indicate that the duke perished by the foulest murder, doubtless at the instigation of his own nephew. It remains to be mentioned, that at the meeting of parliament, in which these noblemen were impeached, all the acts in which Gloucester had taken a share were annulled, the commission of government was cancelled, the opinions of the judges were declared to be legal, and the judgment against Michael de la Pole was reversed.

After the destruction of Gloucester and the heads of his party, a misunderstanding arose amongst the noblemen who had joined in the prosecution. The Duke of Hereford, son to John of Gaunt, appeared in parliament, and accused the Duke of Norfolk of having uttered treason in a private conversation. Norfolk denied the charge, and offered to establish his innocence by single combat. The challenge was accepted; but the king interrupted the duel, and commanded both the parties to leave the kingdom. The Duke of Norfolk was banished for life, but the Duke of Hereford only for ten years. The former retired to Venice, where he died shortly afterwards. Hereford displayed so much resignation to the will of his sovereign, that the latter commuted the period of his exile to four years. The king had obtained the object of his wishes, namely, the civil destruction of those whose power he dreaded. Even his uncles, either through affection or fear, seconded all his measures, which were now deeply tainted with despotism. On the death of John of Gaunt, "time-honoured Lancaster," the crown claimed his immense estates, to the exclusion of the banished Earl of Hereford, who was pronounced incapable of inheriting them after the judgment which had been pronounced against him in parliament.

By these and other impolitic acts, the king overstrained the bow, and excited a spirit of discontent, which finally hurled him from the throne. The resentment of Hereford had been inflamed by the injury which he had received, and he only waited for a favourable opportunity of retaliation, which soon afterwards occurred.

The Earl of March, presumptive heir to the crown, having been appointed the king's lieutenant in Ireland, was slain in a skirmish with the natives of that country; and Richard, regardless of his precarious situation at home, went over to Ireland with a considerable army, in order to revenge the death of his relative. Hereford, now duke of Lancaster, took advantage of the king's absence. Solicited by the discontented lords, and aware of the alienation of the people from Richard, he embarked at Nantes, and, with a retinue of only sixty persons in three small vessels, landed at Ravenspur in Yorkshire. The Earl of Northumberland, who had long been a malcontent, together with Henry Percy, his son, surnamed *Hotspur* on account of his impetuous valour, immediately joined him with their forces; and the people flocked to him in such numbers that in a few days he found himself at the head of sixty thousand men.

Richard in the mean time continued in fancied security in Ireland. Adverse winds for three perilous weeks together prevented his receiving any news of the rebellion which had broken out in his native dominions; but when the intelligence arrived he was overwhelmed with dismay. Some advised him to sail immediately and face the danger; others recommended that he should first send over the Earl of Salisbury, for the purpose of collecting all who were disposed to support his interests, which plan was adopted. A numerous army joined the earl, but the king protracted his stay in Ireland so long, that on his arrival the whole of this force had melted down to less than an hundred men. To take the field against Henry of Lancaster was consequently out of the question. He therefore proceeded in disguise to the fortress of Conway, where

Salisbury had taken up his quarters. It was the policy of Henry to show symptoms of negotiation, in order to allure the king into his own hands. This he effected in a very deceitful manner. The Earl of Northumberland was dispatched to Richard with a thousand men, who concealed themselves at some distance, whilst the earl proceeded to the fortress where the king was lodged, and by fair promises induced him to quit his stronghold and go along with him to Henry for the purpose of effecting a reconciliation. But during the journey Richard was made prisoner, and finally committed to the Tower to await the judgment of parliament. On Monday the 29th of September 1399, a deputation of lords and commons waited upon the king, and having reminded him of a declaration which he had formerly made at Conway Castle, of his unfitness to govern, and readiness to resign the crown, required his resignation of the regal power. To this he consented, according to the ancient chroniclers, "with a cheerful countenance." During his whole reign, Richard held the sceptre with a wavering grasp, and in the paralysis with which he was now stricken, he as it were unconsciously relinquished it. He likewise recommended Henry his nephew as a fitting successor to the throne.

Before proceeding with the reign of Henry IV. we shall follow the deposed monarch through the few sad weeks of his unhappy life. By parliament he was adjudged "to a perpetual prison, to remain there *secretly* in safe custody." Richard was accordingly consigned to close confinement, and shortly afterwards came to his end, there can be little doubt in an unnatural manner. His fate seems to have been accelerated by a conspiracy amongst his friends to restore him to the throne. The Earls of Kent, Huntingdon, and Salisbury, laid a plot for the destruction of King Henry; but the secret was betrayed, and the confederated noblemen were executed. The death of Richard seems to have immediately followed this unsuccessful enterprise, but the manner of it is involved in impenetrable mystery. According to some chroniclers, several ruffians were sent to the castle of Pomfret, where he had been removed, for the purpose of dispatching him. They rushed unexpectedly into his apartment; but he succeeded in wresting a pole-axe from one of the murderers, with which he killed several of them, but was at length overpowered and slain. Others relate that he was starved in prison, and that he lingered fifteen days before he expired.[1] According to some accounts, he was condemned to suffer this miserable and protracted death; whilst others state that it was a voluntary abstinence, to which he was impelled by despair. He died in the thirty-fourth year of his age, and twenty-third of his reign. It was during the life of Richard II. that Wickliff, the celebrated reformer, promulgated his doctrines in England. See WICKLIFF.

After the throne had been vacated by its legitimate occupant, Henry duke of Lancaster stepped forward and claimed it in right of his being a descendant of Henry III. He was descended from this monarch both by father and mother, but he could not claim by the father's side, because the young Earl of March was sprung from the Duke of Clarence, the elder brother of John of Gaunt, nor by the mother's side, because she was sprung from Edmund of Lancaster, a younger brother of Edward I. It was pretended that Edmund was the elder brother, but it was never proved. By the law of succession it belonged to the descendants of Lionel, the third son of Edward III. That prince died without issue male, and his possessions and pretensions descended to his daughter Philippa, wife of Roger Mortimer, the male representative of the powerful baron who was attainted and executed for the murder of Edward II. the grandfather of the Duke of Clarence. The son of that powerful delinquent had been restored to his honours and estates at a late period of the reign of Edward III. The fourth in descent from the regicide was Roger Mortimer, lord-lieutenant of Ireland, who was looked upon as heir to the crown during the early part of Richard's reign; but his son Edmund Mortimer was only ten years of age when Richard was deposed, so that his claim was easily set aside. Mortimer died in 1425 without male issue, and the pretensions which he inherited through the Duke of Clarence fell to his sister Anne Mortimer, who espoused Richard of York, earl of Cambridge, the grandson of Edward III. by his fourth son Edmund of Langley, duke of York. But from the foregoing pedigree it is clear that during the life of the Earl of March no right to the crown had descended to any branch of the house of York. Henry, however, notwithstanding the inferiority of his title, was unanimously acknowledged by both houses, and was crowned within a fortnight after the deposition of his predecessor. He was the idol of the populace, the master of parliament, and the heir of the fame and possessions of John of Gaunt.

The reign of Henry IV. was little else than a continued series of insurrections. In the very first parliament which he assembled, a great number of challenges were given and accepted by different barons; and though Henry had ability and address enough to prevent these duels, it was not in his power to avoid continual combinations and revolts against himself.

The most formidable of these disorders was that under the Earl of Northumberland. Various causes are assigned for this insurrection. One is, that the resentment of the Percies had been excited by the king denying them the privilege to liberate or ransom their prisoners; for at the battle of Homildon, where the Scotch suffered a defeat, a number of noblemen had fallen into the hands of Hotspur, who commanded the English. The insurgents themselves assigned another cause for the quarrel, and this was probably the real one. In the course of a war with the Welsh, the Lord Grey of Ruthyn and Sir Edmund Mortimer had both fallen into the enemy's hands. The former being a friend to the king, was allowed to be ransomed by his relations; but the latter, who was uncle to the young Earl of March, the lawful heir to the throne, and of course an object of jealousy to Henry, was denied the privilege of being liberated. This fired with resentment the inflammable spirit of Hotspur, who had married the sister of Sir Edmund; his father the Earl of Northumberland, and his uncle the Earl of Worcester, shared his discontent; and amongst them they projected nothing less than the dethronement of the king.

With this view they formed an alliance with the Scots and Welsh, who were to make an irruption into England, at the same time that the Percies were to raise what forces they could in order to join them. The Earl of Northumberland, by a sudden fit of illness, having been incapacitated for active warfare, young Percy took the command, and marched to Shrewsbury for the purpose of joining the Welsh. But the king had assembled a small army, with which it was his intention to act against the Scots; and, knowing the importance of celerity in civil wars, instantly hurried to meet the rebels. He approached Shrewsbury before a junction could be effected with the Welsh; and by his headstrong impatience Percy was impelled to risk an engagement, which at that time he ought to have declined. The evening before the battle he sent a manifesto to Henry, in which he renounced his allegiance, set the king at defiance, and enumerated all the grievances of which he imagined the nation might justly complain. Amongst the charges with which he reproached the king, were those of perjury, murder, and usurpation of rightful property. All this vituperation was productive of no other effect than that of exasperating to the utmost both the king and his adherents.

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[1] It was at first believed that Richard had effected his escape into Scotland, and that he lived there twenty years. This ancient tradition has been revived by Mr Tytler, in his *History of Scotland*, and he supports his views with considerable ingenuity. The chief evidence upon which he relies consists in charges made by the regent of Scotland for the expenses of the king of England. But Sir James Mackintosh, in a note at the end of the first volume of his *History of England*, gives several cogent, and we think unanswerable reasons for differing from Mr Tytler upon this point, and adhering to the common narrative. Those who feel an interest in this subject are referred to the work above mentioned, and to the appendix to the third volume of Mr Tytler's *History of Scotland*.

The armies were fairly matched, consisting of about fourteen thousand men each, and both leaders were men of approved valour. The action, which took place on the 21st of July 1403, was obstinate and bloody. After a chivalrous display of his characteristic valour, Percy was slain by a random arrow, and with his fall the courage and the confidence of his followers evaporated. They were completely routed, and driven from the field with great loss. Lord Worcester and two other conspicuous individuals were beheaded on the field. The Earl of Northumberand, however, notwithstanding his connection with the rebels, was mercifully treated by Henry. But this lenity does not appear to have quieted the country; for various insurrections, particularly amongst the Welsh under the celebrated Owen Glendower, disturbed the remaining years of Henry's reign. Owen, under the title of Prince of Wales, gained so many remarkable successes over the royal troops, that the king himself publicly attributed them to necromancy. The unconquerable spirit of the Welsh leader actuated all classes of his countrymen, who flocked to his standard from every part in England where they had taken up their abode. Owen remained free and unsubmissive to the English yoke till the close of his career, and the last glimpse which history affords of his patriotic course is as bright as the first.

The reign of Henry was much disturbed, and the language which our great dramatist makes him employ, "uneasy lies the head that wears a crown," is remarkably appropriate from the lips of such a monarch. The swell with which the nation heaved when he ascended the throne never subsided during his lifetime. The position in which he stood with regard to the succession seems to have caused him much concern; for the case was a difficult one. In his first parliament his eldest son Henry was created Prince of Wales; and in 1404 the right of that prince's brothers to reign, in the event of his dying without issue, was recognised by parliament. The most disgraceful feature of Henry's reign was his deadly persecution of those who entertained the new religious doctrines. In his second year was passed that sanguinary act, the first that stains the English statute-book on the subject, which orders heretics to be burned; and many an unfortunate Lollard suffered for his faith during the sway of the Bolingbrokes. A remarkable circumstance occurred in 1405, namely, the capital punishment of a clergyman of the highest rank. Scroop, archbishop of York, was an enthusiastic defender of the claims of the Earl of March, and, being taken in arms against his sovereign, was beheaded without trial, conviction, or defence.

Notwithstanding the act against the Lollards, the doctrines of Wickliff gained ground; and the support which Henry gave the hierarchy did not preclude his parliament from attempting its reformation, and even from despoiling it of part of its possessions.

In 1405 the Commons, who had been required to grant supplies, proposed to the king to seize all the temporalities of the church, and employ them as a perpetual fund to meet the exigencies of the state. When this address was presented, the Archbishop of Canterbury, who then attended the king, objected that the clergy, though they went not in person to the wars, sent their vassals and tenants in all cases of necessity; whilst at the same time they themselves who staid at home were employed night and day in offering up their supplications for the success of the enterprise and the prosperity of the state. The speaker answered with a sarcastic smile, that he thought the prayers of the church but a very slender supply. The archbishop, however, prevailed in the dispute; the king discouraged the application of the Commons, and the Lords rejected the bill which the lower house had framed. The Commons were not discouraged by this repulse; in 1410 they returned to the charge with renewed zeal and determination.

A Lollard had been burnt, and the lower house of parliament, as if in retaliation of this atrocity, presented a schedule to the king, showing that he might have from the temporal possessions of the bishops, abbots, and priors, that were then uselessly wasted, 15 earls, 1500 knights, and 6200 esquires. But the reply of the king was severe, and he forbade them to discuss such topics for the future. They then petitioned that the clergy should be subjected to the civil tribunals, but this was also refused; and a request that the statute against the Lollards might be mitigated shared the same fate.

The reign of Henry was now drawing towards a termination. The last years of his life were darkened by disease, and undistinguished by vigour. He had been subject to eruptions in his face and to attacks of epilepsy. By one of these he was carried off, at Westminster, on the 20th of March 1413, in the forty-seventh year of his age and fourteenth of his reign. Henry owed the English sceptre, not, in the first instance, to his own plotting or ambition, but to a popular revolution against the authority of his predecessor. He landed in England for the avowed purpose of only seizing his own possessions, of which he had been most unwarrantably deprived; but finding Richard a most unpopular sovereign, and his own reputation very high, whilst his affinity to the blood royal was, though not so near as that of the Earl of March, sufficiently so to give him a plausible pretext for standing forward as a candidate for the crown, he accordingly did so, and proved successful. He united in a high degree watchfulness and circumspection, with a bold and decisive policy. For his arbitrary measures he brought forward the plea of necessity, "which," says Sir James Mackintosh, "prevented them from growing into precedents subversive of the constitution." As he owed his throne to popular revolt, so he was in some measure compelled to adopt popular principles. Under his reign the House of Commons advanced with a steady pace towards importance and authority. It assumed a higher and more decisive tone than had hitherto characterized its proceedings, and pushed its inquiries into all the affairs and departments of government.

Henry of Monmouth, eldest son of the preceding monarch, ascended the throne immediately after the death of his father. With the early life of Henry V. we usually associate acts of frivolity, insubordination, and even low vice. But to the creative genius of a powerful poet must in a great measure be attributed this almost universal impression. That he was guilty of delinquencies beneath the dignity of the heir apparent to the English throne, may be true; but there is no satisfactory evidence either to confirm or refute the traditionary stories which are told of him. At an early age he discovered talents of no common order. He was only sixteen years of age when the battle of Shrewsbury was fought, and on that occasion he displayed equal firmness and ability. Afterwards, when intrusted with the guardianship of the Welsh marches, he conducted himself in a manner so highly creditable, that he more than once received the thanks of the House of Commons for his conduct. On his accession to the throne, he made himself popular by several wise and generous measures. He liberated his cousin the Earl of March from the constraint under which that prince, undoubtedly the heir of Edward III., had been held by the jealousy of Henry IV. The Percies, who were exiles in Scotland, he restored to their possessions, and even to a command over their martial vassals. Those ministers of his father who had recommended themselves by their uprightness and decision, were retained in the offices which they held. The chief justice, in particular, who had formerly imprisoned the king, whilst Prince of Wales, for his misconduct, was not only pardoned, but received into high favour. He expressed deep regret for the fate of Richard II., and performed his funeral obsequies with becoming pomp and solemnity. That Henry had a mind which towered above the level of his contemporaries, his remarkable triumphs in France are evidence; but that in some respects he was not in advance of his age, the severities which he practised against the Lollards afford ample proof. The head of that party was Sir John Oldcastle, an individual alike distinguished for his valour and military talents, and who had acquired the esteem both of the late and present king. His high character pointed him out as a proper object of ecclesiastical fury, and he was accordingly denounced to Henry, who, at a private interview, attempted to make him recant his faith; but in vain. Oldcastle was therefore condemned to suffer the death of a heretic; but having effected his escape, he raised an insurrection, which was soon crushed. He succeeded however in eluding pursuit for four years, but he was at last taken and executed as a traitor. After the suppression of the revolt, the most severe laws were passed against the unfortunate Lollards. It was enacted, that whoever should be convicted of Lollardy, besides suffering capital punishment according to the laws formerly established, would also forfeit his lands and goods to the king; and the officers of government were likewise bound by oath to use their utmost endeavours to extirpate the heresy.

The restoration of tranquillity afforded Henry an opportunity of turning his attention to France, the miserable condition of which offered a fair prospect of success to his arms. The claim of his family to the crown of that country was revived; and on the 15th of April 1415 he assembled a great council at Westminster, to whom he announced his determination of making a "voyage in his own proper person, by the grace of God, to recover his inheritance." He appointed his brother, the Duke of Bedford, lord lieutenant of the kingdom during his absence. When about to set sail for Normandy, a rash conspiracy broke out, which detained him for a little time; but it was soon suppressed, and Henry embarked at Southampton with an army of about thirty thousand men, the greater proportion of whom were archers. He entered the Seine, and having reduced Harfleur, he challenged the dauphin to meet him in single combat, and decide the contest for the crown of the country which he had invaded. But this was destined to be competed for on a far wider arena than that which two combatants could occupy. Henry crossed the Somme, and was proceeding on his road towards Calais, when he came up with the enemy at a small village, called by the French Azincourt, and by the English Agincourt. Here was fought a great and decisive battle, which ended in the total defeat of the French army, estimated at not less than four times the strength of that of the English. (See AGINCOURT.) Henry did not immediately pursue his victory, and returned to England, where he was received with the utmost enthusiasm; but he soon afterwards rejoined his troops in France. The claimants for the crown of that kingdom were so numerous, that had he boldly prosecuted his own schemes, the opposing factions might have leagued together against him as a common enemy. It was therefore his policy to remain inactive, and, by tampering with them separately, to foment the discord which prevailed amongst the French leaders. On the 21st of May 1420, a treaty was at length concluded at Troyes, which promised to crown the hopes of the Plantagenets with success, and establish them on the throne of France. The principal articles stipulated the marriage of Henry with Catherine, daughter of the French king; that Henry should be regent of France whilst Charles remained alive; and that he should succeed that monarch after his decease. Henry accordingly espoused the French princess; but he was not long permitted to enjoy his connubial happiness or his good fortune. A fatal malady seized him at Paris; and having been conducted by his own orders to Vincennes, he expired there on the 31st of August 1422, in the thirty-fourth year of his age, and the tenth of his reign.

The name of Henry V. is adorned with all the splendour of brilliant conquest and successful ambition. By a single victory he brought the crown of France within his reach, if not within his grasp. But he had other qualities besides those of a warrior; he was a statesman of consummate skill, as his conduct after the victory of Agincourt sufficiently testifies. His mind was altogether of a superior order, and there seems nothing to prevent his being ranked with the greatest of English monarchs, except the countenance which he gave to ecclesiastical persecutions.

By Catherine of France Henry had a son who succeeded him when not yet a year old. The whole of his long reign is occupied with a war for the French crown, and a disastrous civil war in England between the houses of York and Lancaster. At the accession of Henry VI. parliament ordered a new royal title, in which he was recognized as king of France and England, and lord of Ireland; appointed his father's eldest brother, the Duke of Bedford, protector, defender, and chief counsellor of the kingdom and of the English church; and in his absence invested the Duke of Gloucester, his younger brother, with these honours. A council was named, and certain articles enacted, for the purpose of limiting the power of the protector. The kingdom of France was now in the most deplorable situation. By the solemn investiture of the infant king of England with the royal prerogative in that country, Charles VII. succeeded only to a nominal kingdom; for the greater portion of it adhered to the interests of Henry. But notwithstanding all these advantages, the English daily lost ground, and in the year 1450 they were finally expelled from the country. See the article FRANCE.

It may be easily conceived that such a train of bad success was likely to be productive of discontent at home. Continual animosities were kept up amongst the king's counsellors during the first thirty years of his nominal rule. This tended to plunge the nation in convulsions, and prepare it for becoming the theatre of a sanguinary civil war. Humphrey duke of Gloucester was envied by many on account of his high station. Amongst these was Thomas Beaufort, bishop of Winchester, afterwards cardinal, the legitimate son of John of Gaunt, brother to

Richard II. This prelate, to whom the care of the king's education had been committed, was a man of some capacity and experience, but of an intriguing and restless disposition. He had frequent disputes with the Duke of Gloucester, over whom he gained several advantages. The Duke of Bedford employed both his own authority and that of parliament to reconcile them, but in vain; their mutual animosities served for several years to embarrass government, and to lay it open to its enemies. The sentiments of the two leaders were particularly divided with regard to France. The bishop laid hold of every prospect of accommodation with that country; and the Duke of Gloucester was for maintaining the honour of the English arms, and regaining whatever had been lost by defeat or delay. Both parties, therefore, called in all the auxiliaries they could command. The bishop resolved to strengthen himself by procuring a proper match for Henry, at that time twenty-three years of age, and then by bringing over the queen to his interests. Accordingly, the Earl of Suffolk, a nobleman whom he knew to be stedfast in attachment to him, was sent over to France, apparently to settle the terms of a truce which had then been contemplated, but in reality to procure a suitable consort for the young king.

The bishop and his friends had turned their attention to Margaret of Anjou, daughter of Regnier, titular king of Sicily, Naples, and Jerusalem, but who was destitute of either real power or possessions. She was looked upon as the most accomplished princess of the age, both in mind and person; and it was thought the abilities which she possessed would supply the want of them in her husband, to whom maturity of years had brought no maturity of understanding. He was a child from the cradle to the grave. The treaty was therefore hastened on by Suffolk, and soon afterwards ratified in England. Previously to the king's marriage, however, a conspicuous blow was struck at the protector's greatness. In that age a charge of sorcery was capable of blasting any character, however spotless or pure; and even of throwing odium upon all who were related to the individual accused. It was an irresistible weapon made use of by churchmen for the destruction of their enemies, and it was wielded by the prelate against his political opponent with tremendous force. He brought forward an accusation of sorcery and treason against Elinor Cobham, wife or concubine of the Duke of Gloucester. She was charged with having made an image of the king in wax, which being placed before a gentle fire, gradually dissolved; and it was expected that as the wax wasted away, the strength of the king would also disappear, and that his death would take place when the whole of the image had melted. Three other individuals were implicated in this accusation, which was readily believed. The prisoners were pronounced guilty; the duchess was condemned to do penance and suffer perpetual imprisonment; one priest was hanged, and another died in prison; whilst, to consummate the affair, Margaret Jourdemayn, a reputed witch, was burnt at Smithfield.

The Bishop of Winchester was resolved to carry his resentment against Gloucester to the utmost. He procured a parliament to be summoned, not at London, which was too well affected towards the duke, but at St Edmundsbury, where the prelate's adherents greatly preponderated. As soon as Gloucester appeared, he was accused of treason, and thrown into prison. On the day appointed for him to make his defence, he was found dead in his bed, though without any signs of violence upon his body. This, however, is no proof that he came not by a violent end.

The death of the Duke of Gloucester was universally ascribed to the cardinal of Winchester, who himself died six weeks thereafter, without leaving behind him so good a name as his political adversary. The Lancasterian party was thus deprived of its chiefs: no male Plantagenet of that lineage remained except the king, who was at best but an apology for one.

After the demise of the cardinal of Winchester, Suffolk governed with uncontrolled sway. But his conduct was obnoxious to the rest of the nobility, who now concerted measures for his destruction. In the year 1447 he was impeached of high treason on various charges. He was accused of exciting the French to invade England, in order to depose Henry and place on the throne De la Pole's son, who was to marry Somerset's daughter, considered by the Lancasterian party as the next in succession to the crown. He was also charged with the loss of France by his negotiations in that country, and with revealing state secrets to the French ministers. Other illegal acts were ascribed to him in the bill of impeachment; and so strong did the current of opinion run against him, that, whether guilty or not, the king was compelled to banish him from the kingdom. But this did not satisfy his enemies, who looked upon expatriation as a sheltering from justice rather than as a punishment. The captain of a ship was therefore employed to intercept him in his passage to France; and, having been seized near Dover, his head was struck off in a small boat, and his body consigned to the waves.

The complaints against Henry's government were heightened by an insurrection, headed by an individual of equivocal descent, but who has been transmitted to posterity by the name or nickname of Jack Cade. He assumed the honourable name of John Mortimer; and having assembled a great body of the peasantry of Kent, he marched to Blackheath. A message was sent to him by the king, demanding the cause of the insurrection. The audacious Cade answered in the name of the community, that their purpose was to punish evil counsellors, and to obtain a redress of grievances. Henry assembled a force; but part of it having been defeated, the remainder refused to fight, and the king retired from the field. Lord Say, the treasurer, was committed to the Tower, in order to satisfy the revolters. In the mean time, the citizens of London opened their gates to the victorious rebel, who made a triumphant entry into the city arrayed in the shining armour and gilt spurs of a knight. For some time he maintained great order and regularity amongst his troops. He always led them out into the fields in the night-time, and published several edicts against every kind of plunder and violence. His followers, however, were not to be thus restrained. Lord Say, without any trial, was beheaded; and soon afterwards, the insurgents, having committed some irregularities, were shut out of the city by the inhabitants. Cade endeavoured to force his way back to his quarters, when a bloody scuffle ensued, which was only terminated by the approach of night. The Archbishop of Canterbury, and the chancellor, who had taken refuge in the Tower, hearing how matters stood, drew up an act of amnesty, which was privately circulated amongst the rebels. This had an electrical effect upon them, and in the morning Cade found himself totally abandoned by his followers. He effected his escape, but was afterwards captured and slain. A number of circumstances now contributed to revive the long dormant pretensions of the house of York to the throne. France had been lost; the arms of England had been disgraced; Margaret the queen, by violence and arrogance, was most unpopular; the king himself was a perfect cipher; whilst, in strong contrast to him, appeared the Duke of York, a man of popular virtues, and the legitimate heir to regal power, according to the English laws of real inheritance. All the males of the house of Mortimer were now extinct; but Anne, the sister of the last Earl of March, having espoused the Earl of Cambridge, who had been beheaded for treason in the reign of Henry V. had transmitted her latent but unforgotten claim to her son Richard. This prince, descended by his mother from Philippa, only daughter of the Duke of Clarence, third son of Edward III. stood plainly in order of succession before the king, who derived his descent from the Duke of Lancaster, fourth son of that monarch. The duke was a man of valour and abilities, as well as of some ambition; and he thought that the weakness and unpopularity of the present reign afforded a favourable opportunity for asserting his title. The ensign of Richard was a white rose, and that of Henry a red one; circumstances which gave names to the two factions who were now about to deluge the kingdom in blood.

The Duke of York was in Ireland during the proceedings against Suffolk and the sedition of Cade. In September 1450 he returned to England, a circumstance which excited considerable alarm at court. He advanced upon London; and, proceeding to the palace at Westminster, knelt before the king, and, deploring the state of the kingdom, entreated him to summon a parliament. The queen appears to have evinced her usual arrogance upon this occasion; but York succeeded in extorting a promise from the king that he would comply with his request, upon which he retired to his castle at Fotheringay. He was scarcely gone, however, when the Duke of Somerset returned from France, and was chosen favourite adviser of the king. The session of parliament proved unquiet and stormy. York presented a complaint against the administration of Somerset, and in the year following exhibited several articles of impeachment against him. But the power and influence of the queen rendered his efforts fruitless. Legal prosecutions became thus inadequate to suit the feelings of the enraged York, and he accordingly assembled an army. The king, doubting his ability to triumph by opposing force to force, affected to acquiesce in the demands of the duke, and put Somerset under restraint. Upon this York disbanded his troops, and retired unattended to the royal pavilion, where he was immediately made prisoner, and compelled to take an oath of allegiance to the king. Somerset rose higher in favour than ever, and completed his ascendency in the government by obtaining the entire confidence of the king and his consort.

On the 13th of October 1453 Queen Margaret presented her husband with a son and heir, the ill-fated Edward prince of Wales. Not long afterwards the king sunk into a state of mental as well as bodily incapacity, and the star of York again appeared above the horizon. The total imbecility of the king having been ascertained, the Duke of York was chosen protector and defender of the kingdom. Previously to this event Somerset had been removed from the palace of the queen to the Tower. The king's malady was not permanent, and on his recovery he put an end to the protectorate, released Somerset from his confinement, and reinstated him in his honours. This was a mortal blow to the peace of York; and having conferred with the powerful Earls of Warwick and Salisbury, who united themselves to his interests, he took the field with the declared intention of only expelling Somerset from the government. But this nobleman's fate involved that of the house of Lancaster. It was in vain that the king attempted a reconciliation of interests; he was compelled to have recourse to arms, and meet the Yorkists in open warfare. A battle took place at St Albans, in which the royalists were totally defeated; Somerset, the immediate cause of the conflict, having fallen in the action.

The king relapsed into his former state, and the Duke of York was a second time chosen protector; but the queen, who could not brook the idea of his continuing at the head of government, procured his dismissal. She is even charged with having conspired his destruction, and that of his most conspicuous adherents. A temporary reconciliation was effected, but discord was again introduced; and the parties having irrecoverably lost confidence in each other, prepared for the deadly struggle of arms.

The forces of the Duke of York under the Earl of Salisbury gained an advantage over the royalists at Bloreheath; but a fatal desertion on the part of York's troops at Ludlow turned the balance in favour of the king; and York fled to Ireland, where he was joyfully received.

But this disaster, though in appearance it suppressed the party of York, was far from being fatal to its power. The snake was scotched, not killed, and it only waited a favourable opportunity for darting on its victim. This soon presented itself. Warwick, who had retained the government of Calais, landed in Kent, and, being joined by a number of barons, advanced upon the capital, which he entered amidst the acclamations of the people. The number of his troops had now so much increased that he found himself in a condition to encounter the royal army. Early in July 1460 he came up with them at Southampton, and a bloody battle ensued, in which the king was taken prisoner, and his army utterly dispersed. Meanwhile the Duke of York having returned from Ireland, openly laid claim to the crown. In the House of Lords the cause of Henry and the Duke of York was solemnly debated; and the latter, though a conqueror, did not absolutely gain his cause. It was determined that Henry should possess the throne during his life, and that the Duke of York should be appointed his successor, to the utter exclusion of Henry's offspring.

Though the royal party now seemed destitute of every resource, the queen still retained her intrepidity, disdaining every arrangement which implied the dethronement of her child. Wales seemed the natural place of refuge for the mother of him who was called its prince, and thither accordingly she fled. This warlike dame assembled a considerable army to rescue her pusillanimous husband, and marched to the northern provinces, where Northumberland and Clifford joined her with their borderers. This union having alarmed the victorious party, York and Somerset hastened to anticipate their designs, and, having assembled a sufficient force, succeeded in reaching the strong castle of Sandal before Christmas. Actuated by the pride of prowess and the impatience of inaction, York engaged the queen's army with one of inferior force. The conflict took place at Wakefield on the 30th of December 1460, and terminated in the total defeat of the Yorkists. The duke himself was either slain in the action, or put to death after it; whilst the Earl of Salisbury was taken during the night, and decapitated next day. But no one was so much lamented as the young Earl of Rutland, the son of York, a boy in the twelfth year of his age. He was made prisoner, and coolly stabbed to the heart by Clifford, in revenge for the death of his father, who had perished at the battle of St Albans.

After this victory Margaret marched towards London, in order to set the king at liberty; but the Earl of Warwick, who had now put himself at the head of the Yorkists, led about the captive king in order to give a sanction to his proceedings. Except by the countenance which his presence seemed to give to the transactions of the Yorkists, he was as inert an instrument in their hands as the royal standard which waved above their lines. Warwick engaged the queen's forces at St Albans; but, through the treachery of Lord Lovelace, who deserted with a considerable force during the heat of the action, Warwick was defeated, and the pageant king fell once more into the hands of his own party.

The submission of the city of London seemed now to be all that was wanting to complete the queen's success; but Warwick had secured it in his interests, and the citizens refused to open their gates to the royal victor. In the mean time, young Edward, eldest son of the late Duke of York, put himself at the head of his father's party. He was now in the bloom of youth, remarkable for the beauty of his person and for bravery; and he was, moreover, a very great favourite with the people. He defeated Jasper Tudor, earl of Pembroke, at Mortimer's Cross in Herefordshire; the earl himself being taken prisoner, and immediately beheaded by Edward's orders.

Meanwhile he was joined by the remainder of Warwick's army, and the united forces entered the metropolis amidst the applause of the people of the city and of the surrounding provinces. Edward laid his claim before a council of lords, and on the 4th of March 1461 he was proclaimed king by the style and title of Edward IV.

But notwithstanding all her disasters, the queen remained inflexibly devoted to her purpose. She retired to the northern counties, where such numbers flocked to her standard that her army very soon amounted to sixty thousand men. Edward IV. was a voluptuary, but he never allowed his activity and vigilance to slacken. With Warwick and an army of forty thousand men he commenced his march to the north. The hostile forces met at Towton, in the county of York, on the 29th of March 1461, and an obstinate engagement ensued, which continued during the night, and was renewed with the utmost fierceness on the following morning. The queen's army was totally defeated, and, as quarter was given on neither side, the slaughter was dreadful. Between thirty and forty thousand persons perished in these two bloody days. After this disaster the queen with her husband took refuge in Scotland, whilst Edward returned to the metropolis, where he was crowned on the 29th of June 1461. For three years Edward IV. possessed the throne without any serious insurrection having taken place on the part of the Lancasterians. But during this period Queen Margaret was making strenuous exertions both in France and Scotland to raise a force capable of taking the field against Edward. Having collected a small army, she made an inroad into England, but after several indecisive skirmishes she was totally defeated at Hexham, in Northumberland, on the 17th of May 1464. The Duke of Somerset, who commanded for her, was beheaded; and a number of gentlemen were also executed at York, with little form of law or justice.

By these repeated misfortunes the house of Lancaster became so effectually reduced that Margaret was obliged to separate from her husband, and both were compelled to seek their safety in individual flight. The king was still protected by some of his friends, who conveyed him to Lancashire, where he was at last discovered, and consigned to the Tower as a prisoner. The queen made her escape through Scotland into France, along with her son, and his famous preceptor Sir John Fortescue.

In the mean time King Edward vigorously applied himself to the affairs of government. Feeling secure on the throne, he now also began to give way to the gratification of his amatory passions, to which he was exceedingly prone. In order to divert his mind from such debasing indulgences, the Earl of Warwick, hitherto his steady friend, advised him to marry. Edward consented, and the earl was appointed to negotiate a match with the Princess Bonne of Savoy. He was successful in his mission, but before the conclusion of the marriage treaty the king privately espoused a lady of whom he had become enamoured, and who resisted all his efforts to form an illicit connexion. This lady was Elizabeth, daughter of Sir Philip Woodville, and relict of Sir John Grey, a Lancasterian, who had fallen at the second battle of St Albans. The parties were solemnly united in marriage on the 1st of May 1464, and the bride was acknowledged and in due time crowned. This transaction highly displeased Warwick, who afterwards became still more disgusted at the favour shown to the queen's party, his own and his sovereign's natural enemies. A plan of revenge was therefore set on foot, and a most powerful conspiracy was also formed against Edward. To accomplish his aim, Warwick not only employed his own influence, which was very extensive, but likewise that of the Duke of Clarence, Edward's brother, on whom the earl had conferred the hand of his daughter without the king's permission. The effects of Warwick's secret combination with Clarence, his own brother Montague, and the discontented nobility and gentry, soon began to appear. Sedition was fomented throughout the country, and a popular insurrection at last broke out in Yorkshire, where Robin of Redesdale, a hero amongst the moss troopers of the border, appeared at the head of sixty thousand men. The articles of their manifesto were principally directed against the king's counsellors and the church.

Henry earl of Pembroke was sent against them with a body of seven or eight thousand men. He was joined by Lord Stafford with five thousand more troops, and the two commanders prepared to meet the insurgents. They at first received a repulse, but it was of no material importance. An unfortunate dispute, however, between Pembroke and Stafford, caused the latter to march off the field with his troops; and in a battle which immediately afterwards ensued, the royalists were cut to pieces, and their commander taken prisoner and beheaded.

The king, enraged at this, caused Stafford to be executed in a like summary manner. This event completed the disaffection of the king's followers, who now deserted him in thousands; and he himself was at last taken prisoner by Warwick and his friends; but this conquest embarrassed the confederated nobles. The detention of the king was not popular; and the military refused to act until he was released, which took place accordingly, and a reconciliation was effected. The truce was, however, of short duration. A new insurrection broke out in Lincolnshire, in which Warwick and Clarence were deeply involved. The rebels were commanded by Sir Robert Welles, son to a nobleman of the same name. Under an alleged charge of treason, the latter was beheaded by the king, who marched against the insurgents with his usual celerity, and gave them a total overthrow at Erpingham, in Rutlandshire, on the 12th of March 1469. Warwick and Clarence again attempted to entrap Edward, but having failed of success, they escaped to France.

Louis XI. openly espoused the cause of the malcontent barons, and effected a reconciliation between them and the fugitive Queen Margaret. Their mortal enmities were reconciled in common hatred of the king of England. A treaty was concluded, which stipulated that Edward should espouse Anne Neville, Warwick's daughter, and that they should combine their efforts to restore Henry to the throne of which he had been deprived. It was likewise agreed upon, that in case of failure of issue by the prince, the crown should descend to Clarence. After these preliminary arrangements, Warwick assembled a small force, and set sail for England, where he landed whilst Edward was in the north suppressing an insurrection which had there broken out. This seems to have been an artifice practised by a brother-in-law of Warwick's, who thus drew the incautious monarch to a distant part of the kingdom, and left the southern counties open to the invader. Warwick was a great favourite with the people, the subject of popular ballads, which resounded his praise throughout every town in the kingdom. Thousands having flocked to his standard, he advanced upon London, and there proclaimed Henry VI. The usual activity of Edward seems to have forsaken him, or else his pernicious frivolities had alienated the affections of his troops, whose fidelity towards him likewise decreased as Warwick drew near to them. Edward was compelled to fly to Holland, Clarence and Warwick made their triumphal entry into the capital, and Henry was formally restored to regal authority. But those who had reinstated him had placed only a barren sceptre in his grasp, for the real power resided with them. Edward was pronounced an usurper, and all acts passed under his sanction were repealed. The crown was settled on the male issue of Henry VI., and in default of such issue, on the Duke of Clarence and the heirs of his body. But Edward's party was not yet destroyed. After an absence of nine months, he, seconded by a small body of troops granted him by the Duke of Burgundy, made a descent at Ravenspur in Yorkshire. At first he met with little success; but his army increasing on his march, he was soon in a condition to appear before the capital, which instantly opened its gates to receive him.

The unfortunate Henry was thus again plucked from the throne; and the hopes of Warwick were almost totally blasted by the defection of Clarence, Edward's brother. He however advanced to within about ten miles of London, resolving to wait the approach of Edward, and took a position at Barnet, where, on the 14th of April 1471, a battle was fought, more remarkable for its consequences than for the number of the slain or the obstinacy of the combatants. Considering the animosity existing between the parties, the general slaughter was unusually small; but amongst the fallen were Warwick and his brother Montague; and the death of the first of these individuals was of far more importance to Edward than the victory which he had gained. It broke the charm which associated with his name the certainty of victory and success to the caûse which he espoused. On account of the remarkable transactions in which he had been engaged, he received the appellation of "the king-maker." His death also destroyed the greatness of the house of Neville.

At this time the queen had just returned with her son from France, where she had been soliciting supplies. She had scarcely time to refresh herself from the fatigues of the voyage, when she received the fatal news of the death of Warwick, and the total destruction of his forces. All her resolution was unable to support her under this calamity, and she sunk to the ground in despair. Upon recovering herself, she took sanctuary in the Abbey of Beaulieu in Hampshire, where she still found friends ready to assist her. Tudor earl of Pembroke, Courtenay earl of Devonshire, the Lords Wenlock and St John, with some other men of rank, encouraged her yet to hope for success, and promised to stand by her to the last. On this assurance she resumed the undaunted bearing which was natural to her, and, advancing through the counties of Devon, Somerset, and Gloucester, collected a considerable army. The hostile forces came in sight of each other at Tewkesbury on the 14th of May 1471, where a battle was fought, which decided this sanguinary war. The queen's army was totally defeated; the Earl of Devonshire and Lord Wenlock were slain in the conflict; the Duke of Somerset, and about twenty other persons of distinction, who had taken shelter in a church, were surrounded, dragged forth, and immediately beheaded; about three thousand of their soldiers fell in battle, and the rest were entirely dispersed. Queen Margaret and her son were taken prisoners, and brought to the king, who asked the prince how he dared to invade his dominions. The youth replied that he came hither to claim his just inheritance; upon which Edward struck him on the face with his gauntlet. The Dukes of Clarence and Gloucester, Lord Hastings, and Sir Thomas Gray, taking this blow as a signal for further violence, hurried the prince into the next apartment, and there, it is said, dispatched him.[1] Margaret was thrown into the Tower along with her husband Henry, who there closed his unhappy career a few days afterwards. The Duke of Gloucester has been charged with his murder, but there is no proof of the fact.[2] Margaret was ransomed by the king of France in 1475, for fifty thousand crowns. She survived her deliverance about seven years, during which time she lived in France, withdrawn from the tumults of state.

Edward being now freed from all his enemies, began to inflict punishment on those who had formerly appeared against him. Amongst the cruelties which he committed, that on his brother the Duke of Clarence was the most remarkable. They had been formally reconciled to each other; but this hollow truce to fraternal animosity was broken by a singular incident. Whilst the king was one day hunting in the park of one Burdett, a servant of the duke, he killed a white buck which was a great favourite of the owner. Burdett, concerned at the loss, broke into a transport of rage, and declared that he wished the horns of the deer were in the belly of the person who advised the king to that insult. For this exclamation Burdett was tried for his life, and executed at Tyburn. Clarence exclaimed against this sentence as iniquitous, for which he was attainted of treason, and charged with sorcery, in order to give to Burdett's expressions the dignity of necromantic imprecation. Sentence of death was pronounced against him; but the king having some repugnance to order the public execution of a brother, he was dispatched in private. There was a rumour prevalent at the time that he was drowned in a butt of malmsey wine, to which he is said to have been very partial; but there is no proof that his murder was effected in this manner.

The remainder of Edward IV.'s reign is unimportant. A war with France, which followed the civil wars in England, terminated in 1475 without being characterized by any memorable events. But the foolish idea of aggrandisement in France was still popular with the people, and Edward employed a considerable portion of the latter years of his reign in making apparent preparations for reviving the pretensions of his predecessors to the crown of that country. It does not appear, however, that he ever had any intention of carrying his threats into execution. Edward died on the 9th of April 1483, in the forty-second year of his age and twenty-first of his reign, calculating from the period of his first assuming the crown. In the character of Edward IV. we see a combination by no means singular of great and vicious qualities. As a commander he possessed decision, promptitude, daring, and valour, in a remarkable degree; in these respects indeed he surpassed all his competitors. But the laurels which he won in the field were stained by many cool-blooded atrocities, which altogether deprive the individual who perpetrated them of any claim to real greatness. He was cruel and faithless, and no barrier was capable of restraining him from indulging in sensual gratifications. Besides five daughters, he left two sons; Edward prince of Wales, his successor, then in his twelfth year; and Richard duke of York, then in his eleventh year.

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[1] Such is the account commonly given of the death of this scion of the house of Lancaster. It is worthy of remark, however, that the Harleian manuscript not only gives no sanction to this popular tale, but expressly declares that the prince was slain in the field.

[2] A reader of the present day who can calmly dispossess his mind of the poetical associations with which the subject is invested, will probably agree with a historian who has minutely investigated the subject, that Gloucester is to be exculpated from the charge of murder in this case. (See Turner's *History of England*, vol. ii. p. 375.)

On the death of Edward IV. the kingdom was divided into new factions; and those of the queen's family, who, during the last reign, had come into power, were obnoxious to the old nobility, who looked upon them as upstarts and inferiors. The king had endeavoured to prevent these animosities proceeding to any extent, by desiring on his death-bed that his brother Richard duke of Gloucester should be entrusted with the regency; and he recommended peace and unanimity during the minority of his son. But the monarch was no sooner dead than the former resentment between the two parties burst forth with violence; and the Duke of Gloucester, to whom it is customary to attribute every bad quality, resolved to profit by their contentions. As soon as he learned the tidings of his brother's death, he proceeded to Ludlow Castle, where Prince Edward then was under the charge of Lord Rivers, his uncle by the mother's side. This nobleman was charged by Gloucester with having instilled into the mind of his young ward unfavourable opinions of the protector, and under this groundless accusation he was put into confinement, along with others of the Woodville family. Gloucester, with Buckingham, his noted accomplice, marched to London with Prince Edward, and the other young prince's person having also been secured, both of them were consigned to the Tower, under the specious pretext that they would there be safe from the machinations of their enemies. The coronation was postponed from the 4th of May till the 22d of June, so that the secret purposes of the protector began to be unveiled; and it would seem probable that Hastings and Stanley, the friends of the late king, began to show some misgivings as to the designs of Richard. At a council held in the Tower on the 13th of June 1483, Hastings was seized, and soon afterwards executed upon a log of timber, without any form of trial. Stanley and other obnoxious lords were thrown into various dungeons; and on the same day Earl Rivers and some others were executed at Pomfret Castle, on the most unjust pretences of treason.

The protector now considered himself as in a situation to lay claim to the throne. He used his utmost endeavours to inspire the people with a notion of the illegitimate birth of the late king, and that his children were not only illegitimate on this account, but also because their father had been secretly wedded to Elinor Butler previously to the solemnization of marriage between him and Elizabeth Woodville. Shaw, a popular preacher, was hired to harangue the people to this effect from St Paul's cross. The number of Edward's amours gave some plausibility to these rumours, and prepared the minds of the people for the usurpation of the crown by Richard. Two days afterwards Buckingham harangued the populace in much the same manner as Shaw; and on the 25th of June 1483, that nobleman presented Richard with a parchment purporting to be a declaration of the estates of parliament in favour of the protector, as the only legitimate prince of the house of York. Richard, with his usual dissimulation, evinced some hesitation upon the point; but on the following day he took possession of the crown, and from the 26th of June 1483 is accordingly dated the commencement of his reign.

The only obstacles which now interposed between Richard and the peaceful possession of the crown were his two nephews, whom he still kept in the Tower, for the sake of safety, as he miscalled their imprisonment. During a progress through the kingdom a confederacy was formed against him, and meetings were held, which had for their object the liberation of the princes. But this was unnecessary, as they had been privately dispatched by the king's orders. The manner of their death was kept a profound secret, and it is very doubtful if even yet we are acquainted with the real facts. The most probable account, however, is, that Richard having tampered in vain with Brackenbury, the governor of the Tower, to put them to death, found a ready instrument for the execution of his diabolical purpose in Sir James Tyrrel, his master of the horse. This individual, with two other ruffianly associates, having obtained access during the night to the apartment of the princes, smothered them as they lay asleep, and buried their bodies at the foot of the staircase.

Richard having thus secured himself on the throne, attempted to strengthen his interest by means of foreign alliances, and also by procuring the favour of the clergy at home; but he found his power threatened from a quarter where he least expected an attack. The Duke of Buckingham, who had been so instrumental in raising him to the throne, either thinking his services inadequately rewarded, or for some other causes which cannot now be ascertained, instigated a revolt against Richard. The horror with which the intelligence of the midnight murder in the Tower was received prepared the public mind for seconding the designs of Buckingham, who, with several other leading individuals in the kingdom, now declared for Henry, the young Earl of Richmond, in opposition to Richard. The earl, at this period an exile in Brittany, was considered as the chief of the Lancasterian party. His right to the crown by succession was, however, very equivocal; but the cruel behaviour of Richard inclined the people generally to favour his pretensions; and, in order to give an additional strength to his title, a match was projected between him and the Princess Elizabeth, the eldest daughter of Edward IV., which, by uniting the two rival families, would put an end to those dissensions which had so long distracted the kingdom and deluged it with kindred blood. Messengers were accordingly dispatched to give him information of the conspiracy, which fortunately escaped the usual vigilance of Richard; and, in about a fortnight afterwards, Richmond returned an answer, which was no sooner communicated to his friends than it reached the ears of the king. The latter immediately summoned his adherents to join him with their retainers at Leicester; and after proclaiming Buckingham a traitor, he marched against him at the head of his army. In the mean time storms interrupted the voyage of Henry; and the army of Buckingham, dispirited by broken bridges and impassable currents, broke up and dispersed. A price was set upon the head of Buckingham, who fled, but was betrayed into the hands of Richard, and immediately put to death.

Richard, now emboldened by his success, employed every means of confirming his title to the throne, and destroying the plans of the exiles and malcontents. He summoned a parliament, the first which he had ventured to call together; and an act was passed declaring him undoubted king of the realm, and settling it upon his son Edward, prince of Wales. The marriage of Edward IV. with Elizabeth Woodville was declared null, and his son pronounced a bastard: then followed a severe bill of attainder, in which several noblemen, bishops, knights, and gentlemen, were deprived of their estates, honours, and rights.

But notwithstanding all the measures of severity adopted by Richard, he was seriously alarmed at the projected marriage between Henry of Richmond and the eldest daughter of the late king. To defeat this project, therefore, now became the chief policy of the king. The princess was induced to quit her sanctuary and come under the protection of Richard, who probably had destined her for his son; but the death of that prince forced him to alter his plans, and secure her for himself. Lady Anne Neville, Richard's queen, was in infirm health, and this induced him secretly to make an offer of his hand to the young princess, which she agreed to accept. During the illness of Anne, Elizabeth discovered, it is said, an unnatural degree of impatience, and hinted her surprise at its duration; a most suspicious circumstance. Her apprehensions, however, were soon allayed. In less than a month the queen died; but her hopes of sharing the throne with Richard were not realized. The match was so very unpopular that the royal wooer was dissuaded from his purpose, and his attention was soon directed to another quarter.

The crimes of Richard had alienated the greater portion of the York party from his interests; and a union between Elizabeth and Henry, for the purpose of reconciling conflicting factions, became a topic of serious consideration. The latter prince again conceived the hopes of seizing the crown by another invasion of England; and having collected an army of three thousand men, he set sail from Harfleur early in August 1485, and landed at Milford Haven on the 6th of that month. Richard affected to hear the intelligence with joy; and displaying the vigilance and activity of his brother Edward, he marched from London on the 16th. His competitor had directed his march through the northern districts of Wales, a tract of country in the interest of the Stanleys. Both armies met at Bosworth in Leicestershire, on the 22d of August 1485, where a battle was fought, memorable for having restored tranquillity to the kingdom, which had so long been the theatre of sanguinary civil wars.

The army of Richmond amounted to about six thousand men, that of the king to nearly twice the number; and both prepared for the contest, equally confident of victory. For, notwithstanding the inferiority of Richmond's troops, he was secretly encouraged by the promises of Lord Stanley, who was hastening, with seven thousand men under his command, apparently to join the royalists, but really with the intention of siding with Henry. Stanley continued his march slowly; and on the morning of the battle he took up a neutral station on the wing of either host. The king entrusted his vanguard to the Duke of Norfolk, whilst that of Henry was assigned to the Earl of Oxford; and the two competitors for the crown placed themselves at the head of the main bodies of their respective armies. Richard, taking advantage of a marsh which covered his right flank, ordered a shower of arrows to be discharged into the adverse ranks, which for a moment threw them into confusion. He sent orders to Stanley to join him immediately; but the refusal of that nobleman to comply with his request shook his confidence and also that of his army, which now began to waver. To complete his dismay, he saw Stanley join the ranks of Henry, a circumstance which determined the fortune of the day. But, in order to retrieve it, Richard made a vigorous effort worthy of a better cause. Chancing to observe Henry in the midst of the conflict, he made a dash at him, determined to cut him down or perish in the attempt. He slew with his own hand Sir William Brandon, the bearer of the hostile standard, unhorsed Sir John Cheney, and was within a blow of his rival, when he was overpowered by numbers, struck to the ground, and immediately slain. After his fall resistance was hopeless, and his army broke up and dispersed. The crown which he wore on that day was taken up by Lord Stanley and placed on Henry's head, who was instantly greeted with shouts of "Long live King Henry." Of Richard's army a considerable number were killed in the battle and pursuit, and amongst these were the Duke of Norfolk, and Lords Ferrers, Radcliff, and Brackenbury. The victors lost but few, and none of any note except their standard-bearer. To enhance their triumph, Lord Strange, the son of Stanley, whom Richard had ordered for execution before or during the conflict, escaped in the confusion and rejoined his father. The body of the tyrant was thrown carelessly across a horse and conducted to Leicester, where it was interred with small ceremony.

Of Richard's character little remains to be said. The crimes of which he was undoubtedly guilty almost remove him from the ranks of mankind, and class him with the most ferocious animals. The arguments which have been brought forward in modern times to prove his innocence are inconclusive, and scarcely to be named, when confronted with the mass of evidence which may be arrayed against him. His fall excited no regret, except amongst a few of his partizans, the slaves of his despotic will. How could it? The death of his unoffending nephews must have still been fresh in the memory of his subjects.

The quarrel between the houses of York and Lancaster was now brought to a conclusion. In order to secure the blessings of peace and an undisputed succession, it was necessary for Henry at once to espouse Elizabeth, and, by so doing, to blend the white and the red roses together. There is no concealing the fact that his title to the crown was of a very ambiguous description. It rested on three grounds, first, his marriage with Elizabeth; secondly, his descent from the house of Lancaster; and thirdly, the right of conquest. According to the sagacious Bacon, "he rested on the title of Lancaster in the main, using the marriage and the victory as supporters." But this main support was not a valid one; for even allowing his descent from John of Gaunt to have been legitimate, he was not the nearest descendant of that prince's children. There were several who had claims superior to his; but the individual whom Henry looked upon with peculiar jealousy was Edward Plantagenet, son of the late Duke of Clarence. After the death of this prince's father, Richard sent for him to court, and created him Earl of Warwick, the title borne by his grandfather; but fearing that he might afterwards become a dangerous competitor, Richard had him conveyed to a distant fortress; and one of the first acts of Henry was to change his place of confinement, and put him in the Tower, as a prison of greater security. Elizabeth, who had been his fellow-captive, was ordered to be conducted to the house of her mother in London, whilst Henry himself leisurely followed her to the capital. He was received there with every demonstration of joy, and greeted by the inhabitants as the deliverer of his country. His coronation was delayed for a time, by the breaking out of a dreadful disease, called from its predominant symptom the sweating sickness. But at the end of a month its virulence began to abate, and Henry was crowned on the 30th of October 1485. To heighten the splendour of the ceremony, he bestowed the rank of knights-banneret on twelve persons, and conferred peerages on three. Jasper earl of Pembroke, his uncle, he created Duke of Bedford; Thomas, Lord Stanley, his father-in-law, Earl of Derby; and Edward Courtenay, Earl of Devonshire. At the coronation likewise appeared a new institution, which the king had established for personal security as well as pomp; a band of fifty archers, who were denominated yeomen of the guard. But lest the people should take umbrage at this step, as if it implied a diffidence in their loyalty, he declared the institution to be perpetual. The ceremony of the coronation was performed by Cardinal Bourchier, archbishop of Canterbury. On the 18th of January 1486, Henry was united to the Princess Elizabeth; and his marriage was celebrated at London with even a greater appearance of joy than either his first entry or his coronation.

The reign of Henry VII. was for several years disturbed by plots and insurrections. The people, by a long course of civil war, had become so turbulent and factious, that no governor could rule, nor was any king likely to please them. The violent animosity expressed by this monarch, however, against the house of York, may justly be considered as one of the causes of the extreme proneness to rebellion which was manifested amongst his subjects. Instead of endeavouring to conciliate the affection of the opposite party, he invariably strove to quell them by force and violence. For this purpose, soon after his accession he took a journey to the north of England, where the Yorkists were very numerous, trusting that his presence might overawe them. On his way thither he received intelligence of an insurrection against him, headed by Viscount Lovel, with Sir Henry Stafford and his brother Thomas. The two latter had raised an army, and were marching to besiege the city of Worcester; whilst Lovel was hastening to their assistance with a body of several thousand men. But they were induced to disperse by the offer of a general pardon. Lovel withdrew from his troops, who immediately gave in their submission to the king. The Staffords took refuge in the church of Colnham, near Abingdon; but they were dragged from this sanctuary, as it was found not to possess the privilege of sheltering rebels. The elder brother was executed at Tyburn, but the younger one received a pardon.

Henry returned from his northern tour, and soon afterwards his queen presented him with a son, whom he named Arthur, in honour of the supposed progenitor of the house of Tudor, the renowned King Arthur; but Henry was not permitted to enjoy undisturbed security. He never was at any time popular except amongst his own party; and in the northern counties, particularly, the late King Richard was remembered and spoken of with regret. Henry was hated for his success, and even charged with having put to death the young Earl of Warwick, whom he had imprisoned, as has already been mentioned. It was necessary for the king to exercise extreme caution, on account of the dangers which surrounded him; and hence he is described as having been mysterious and impenetrable. Sir Thomas More remarks that one thing was frequently pretended whilst another was meant; and Bacon says that the king had a fashion rather to create doubts than assurance. The birth of his son seems to have roused his enemies to make some exertions against him; and being destitute of any chief of sufficient ability round whom insurgents might rally with any hope of success, they were urged to make one of the most extraordinary attempts recorded in history. One Richard Simons, a subtle priest of Oxford, took under his charge Lambert Symnel, the son of a tradesman belonging to the same town. The boy was about eleven years of age, comely, and not without dignity and grace in his person. With this individual, who was well tutored to perform the extraordinary part which was to be assigned him, the churchman landed in Ireland, and presented him to the lord-deputy of the county as Edward Plantagenet, earl of Warwick, who had made his escape from the Tower. It seems to have been at first the design of the fabricators of this singular deception to have presented him to the public as the younger of the princes who had been put to death by Richard in the Tower. In order to further this scheme, a report was circulated that one of these princes had made his escape from his assassins. Why this plan should have been changed, and the youthful impostor seduced to personate an individual still living, it is difficult to conjecture; but such is the fact. The Earl of Kildare, to whom he was presented in Ireland, swallowed the bait, and allowed the claims of Symnel without discussion. This nobleman was a zealous adherent of the house of York; and the little colony called the English Pale, long ruled by that party, retained all its ancient attachments. A belief in the identity of Symnel with the Earl of Warwick became universal, both amongst the nobility and the people. He was lodged in the castle of Dublin; the inhabitants universally took an oath of allegiance to him, as the true descendant of the Plantagenets; he was crowned with a diadem taken from the statue of the blessed virgin, and proclaimed king by the title of Edward VI.

Such an unexpected event so alarmed Henry that he would have gone over to Ireland in person to quell the rebellion, had he not dreaded the machinations of the queen dowager in his absence. To prevent any thing of this kind from occurring, it was resolved to confine her for life in a monastery, under pretence, however, that it was done on account of her having formerly delivered up the princess her daughter to King Richard. The royal dame murmured at the severity of her sentence; but the king persisted in his resolution, and she remained in confinement till her death, which did not take place till some years afterwards.

The next measure was to exhibit the person of Warwick to the people. That prince was accordingly taken from the Tower, and conducted through the principal streets of London; after which the procession moved to St Paul's, where great numbers were assembled to see him. Still, however, the fictitious Warwick prospered in Ireland, and being furnished by the Duchess of Burgundy with a body of two thousand veteran Germans, under the command of Martin Swart, a brave and experienced officer, the invasion of England was determined upon. He landed in Lancashire, whence he marched towards York, expecting that the country people would rally round his standard during his march. But in this he was disappointed; the people were unwilling to join a body of foreigners, and were besides kept in awe by the reputation of Henry. Lord Lincoln, therefore, who commanded the rebel army, determined to bring the matter to a speedy issue. Accordingly he met the royalists at Stoke, in the county of Nottingham, and an obstinate engagement took place, which terminated in Henry obtaining a complete victory. Lord Lincoln, with four thousand soldiers, perished in the action; and Symnel with his tutor Simons were taken prisoners. Simons being a priest, could not be tried by the civil power, and was only committed to close confinement. Symnel was pardoned, and made a scullion in the king's kitchen, whence he was afterwards advanced to the rank of falconer, in which capacity he died. Thus ended this most absurdly planned and injudiciously executed revolt; but it was not destitute of good results. It taught the king that the house of York was not to be trampled upon with impunity; for to such an extent had his antipathy to the branches of that family and its adherents been carried, that it was said his own queen was not exempt from the common odium which was thrown upon them. It was asked by the people, why was she, the rightful heir to the throne, not crowned, and invested with the usual insignia of royalty? Henry silenced these rumours by ordering her coronation; and from that period she shared with him the usual honours of royalty.

Having thus to a great extent established his authority at home, he thought of diverting the minds of his subjects from domestic insurrection to foreign enterprise. He does not appear, however, to have had any intention of prosecuting a serious war in a distant country, but he used the pretext as a means of aggrandising himself. A parliament was summoned, which granted the king a considerable sum for prosecuting the war in Bretagne, the only great fief of the French crown which still retained its own prince and its ancient constitution; by force, by policy, or by good fortune, the French monarchs had obtained possession of all the others. But of the supply granted by parliament, only a small part could be raised. The northern counties not only refused payment of their proportion, but rose in revolt, and murdered the Earl of Northumberland, the king's lieutenant. The insurrection, however, was quickly suppressed by the Earl of Surrey. John a Chambre, one of the ringleaders, suffered at York; and Sir John Egremont, the other, escaped to the Duchess of Burgundy, where he had leisure to hatch new schemes of rebellion. The money which Henry by this means obtained, and also in consequence of another grant from parliament, was quietly deposited in his coffers. For although he collected a considerable army, with which he proceeded to Calais, the king had other objects than victory and conquest in view. Some months previously to his landing on the Continent, he had commissioned the governor of Calais to negotiate a peace and alliance with Charles of France, which was formally concluded. To the French monarch the possession of Bretagne was an important object; and Henry, naturally avaricious, agreed to accept about L.200,000 as a reimbursement for the expenses of the expedition. It was also stipulated that the king of France should pay to him and his heirs an annual pension of 25,000 crowns.

But Henry's hopes of a tranquil possession of the crown of England were doomed to perpetual disappointment. His reign was now to be disturbed by one of the most mysterious personages to be met with in English history. About the time when war was declared against France, a pretender to the regal dignity appeared in Ireland, which seems to have been the natural soil for these spurious shoots of royalty. This impostor passed under the name of Perkin Warbeck, but asserted himself to be Richard duke of York, the second son of Edward IV. who, it was alleged, had escaped from the Tower when his brother was murdered. Previously to his appearance in Ireland, he had been heard of at the court of Margaret, his supposed aunt, who interested herself to the utmost in his favour, and fondly styled him the White Rose of England. But he was compelled to quit Burgundy; for Henry had dispatched some ambassadors to the sovereign of that country, with secret instructions to demand either the person of the impostor, or his expulsion from the territories of the duke. Warbeck was received with open arms in Ireland, for the Irish were fanatically attached to the house of York. Several noblemen who had credulously believed in the fraud of Symnel, from which they had just escaped, gave countenance to his pretensions. A deputation was sent to Flanders to ascertain his history; but they had been corrupted by Henry before their landing in Burgundy, and they returned fraught with charges of treason against the disaffected nobility. Some of the most eminent malcontent Yorkists were put to death, and amongst the rest Sir William Stanley, lord-chamberlain, to whom the king had owed his life on Bosworth field. His fate was most mysterious, and the conduct of Henry upon this occasion is open to the most odious suspicions. Sir Robert Clifford, the individual whose information led to these executions, was a confidential Yorkist; and his behaviour towards his own party, so different from what might have been expected, tended to dissolve the ties which subsisted between it and the malcontent exiles.

Three years had now elapsed since the pretender had set forth his claim, and during that period he had never attempted to establish it by legal proof. He began to feel that he stood upon delicate ground, and resolved at once to enforce his pretended right by an appeal to the sword. With a small force collected in Flanders (for he had been for some time absent from Ireland) he made a descent in the neighbourhood of Deal; but the adventurers were attacked by the inhabitants, and all of them driven back to their vessels, or taken prisoners. Warbeck himself made his escape, and returned in despair to Flanders. From this country he was ejected at the instigation of Henry; and after vainly attempting to gain a footing in Ireland, he set sail for Scotland, where he was well received by the young king, who professed a conviction in the justice of his title. King James conferred upon him the hand of Lady Catherine Gordon, a near kinswoman of his own. The adventurer's fortunes being thus suddenly elevated, he, along with the king of Scotland, advanced into England; but not a native sword was unsheathed in favour of the White Rose. The enthusiasm which had been excited amongst the Scots by his first appearance in their country had begun to decline, and during a long truce, which served all the purposes of a treaty of peace between James and Henry, it was agreed to by the former that he should induce Warbeck to quit Scotland. The adventurer, with a few adherents, accordingly departed, and, after touching once more at Cork, and in vain soliciting the aid of Earl Desmond, steered for Cornwall, where he landed on the 7th of September 1497.

His arrival in this part of the country was a politic step, for an attempt to raise a tax there some time before gave rise to an insurrection, which, although quelled, left behind heartburnings and discontent. A considerable body of Cornish men joined his standard, and before he reached Exeter his army amounted to six thousand men. But the king arrived, and preparations were made for a battle; the heart of the pretender, however, failed him at the sight of the royal standard, and instead of risking an engagement for the crown, he withdrew during the night, and entered his name in the sanctuary of Beaulieu in Hampshire. His followers laid down their arms to the king, and his wife also submitted to his authority, and was placed near the person of the queen. From his sanctuary the fugitive was removed by the king to London, where he was ordered to keep within the precincts of the palace. He contrived, however, to make his escape, but, despairing of getting out of the country, surrendered himself to the prior of the monastery of Shene. The monk contrived to prevail with the king to spare his life; but he was condemned to stand in the stocks and make a public confession of his imposture, after which he was committed to the Tower. In this fortress he met with a singular companion, the real Earl of Warwick, who had now been a prisoner for the period of fourteen years. His life had thus been passed in cheerless captivity, for no other offence than that of being the sole survivor of the male descendants of Edward III. The two contrived a means of escape, but they were discovered. Warbeck was executed at Tyburn; and the son of Clarence having been arraigned for high treason, was condemned to death and beheaded on the 28th of November 1499. This deed was worthy of Richard III. It was a cool-blooded murder, aggravated by circumstances; for the harmless and joyless victim was, from his long confinement, reduced to a state of idiocy. The human soul shudders to think of such atrocities, perpetrated in defiance alike of justice and humanity. From the guilt of shedding innocent blood it is impossible to purify the name of Henry VII.

In 1501, the king's eldest son Arthur was married to the Infanta Catherine of Spain; but he survived the marriage only a few months, having died on the 2d of April following. It was agreed upon a short while afterwards, by the parents of the parties, that the widow of the late prince should be espoused by Henry's next son, now Prince of Wales, and afterwards Henry VIII. The union was sanctioned by the pope, who granted a bull, dispensing with any impediment which their affinity might otherwise cause. The eldest daughter of King Henry was conferred upon James IV. of Scotland; an important union, as from this stock sprung all the sovereigns who have since reigned in Great Britain. King Henry, in his own time, was called the Solomon of England; and, without allowing him to possess undisputed claims to so high-sounding a title, the saying recorded of him regarding the Scottish marriage displays no common foresight and sagacity. When some of his counsellors objected to it, on the ground that the kingdom might thereby fall to the king of Scotland, he answered, "Scotland would then become an accession to England, not England to Scotland; the greater would draw the less; it is a safer union for England than one with France."[1]

In the latter part of this king's reign, his economy, which had always been very exact, degenerated into avarice, and his oppressions at last became severe. In Empson and Dudley he possessed two ministers, who did all that inventive minds could suggest, and hearts of stone perform, to gratify a rapacity, which fed with equal appetite on friend and foe. We are informed by one of the wisest of historians and of men, that these individuals had no reputation, otherwise than by servilely following his bent, and that they "shaped his way to those extremities for which himself was touched with remorse at his death."[2] The hoard which the king had amassed by their unjust extortions, and which was mostly kept in "secret places at Richmond," is said to have amounted to nearly L.16,000,000 of our present money. This amount of specie is so enormous as to warrant a conviction that it has been greatly exaggerated. It may be doubted whether the whole circulating medium of the country at that period amounted to the sum which the avaricious monarch is said to have accumulated.

Henry, who had enjoyed an uncommon share of health during his life, was at fifty-two years of age attacked by severe indisposition. He died on the 21st of April 1509, in the twenty-fourth year of his reign, which, although perpetually disturbed by domestic insurrections, was upon the whole prosperous. He was interred in the chapel at Westminster, which still bears his name; one of the noblest trophies of architectural genius produced in any age, and which confers peculiar distinction upon that in which it was erected. There are many acts of Henry's administration, and some of these have already been particularised, which cannot be related but to his discredit. He was mean, sordid, and unamiable in his nature. No tenderness softened his rigid nature, if we except that which he evinced towards his mother; a virtue, however, too common to be praised even in a king. We see no qualities about the man which inspires us with regard for him; but there are many virtues to admire in the ruler. He favoured every national improvement; and, though penurious to excess in ordinary or essentially private matters, he was munificent in public works. He greatly improved the laws of the realm. With respect to these, Lord Bacon remarks, with his usual clearness and sagacity, "his laws are deep, not vulgar; not made upon the spur of a particular occasion, for the present, but acts of prudence for the future, to make the estate of his people still more happy, after the manner of the legislators in ancient and heroical times." He manifested great regard for trade, as is evinced by his excellent laws for promoting it, and by the extended commercial intercourse of the country. He accepted the offer of Columbus to make that most memorable of voyages, in which he lifted the veil that covered a grand division of the globe, and would have patronized it if he had not been forestalled by Isabella. He gave his sanction to Cabot's celebrated voyage (see CABOT), and fitted out a ship to join the expedition. In fine, the country improved under his government, and became steadily attached to his family.

Henry VIII. son of the preceding monarch, ascended the throne on the 22d of April 1509, being then in the eighteenth year of his age. He assumed the reins of government under most auspicious circumstances. His title was undisputed; his treasury was well stocked; commerce was in a flourishing condition; and the kingdom, which now may be supposed to have looked to the youthful monarch with hope and indulgence, was at peace with every foreign power, and quiet in itself. He was prepossessing in person, accomplished in mind, and adroit in every martial and fashionable exercise. But these advantages belonged to an individual whose heart was usurped by debasing passions, and whose mind was cast in the true mould of despotism.

On the 6th of June 1509, Henry and Catherine were finally united in wedlock, and on the 24th of the same month they were crowned with great splendour. One of Henry's first acts was to bring Empson and Dudley, the obnoxious ministers of his father, to trial. As a capital accusation could not be brought against them for merely executing the will of the late king, it was found necessary to indite them for a conspiracy to seize upon London with an armed force during the last illness of Henry. Of this charge, absurd and incredible as it appears to be, these individuals were convicted; and though it seems probable that the king would have been satisfied with imprisonment for life, yet so clamorous were the people for the blood of the culprits, that he was compelled to sign a warrant for their execution, which took place on Tower Hill.

In 1511, Henry entered into a league with Pope Julius II., Ferdinand king of Spain, and other continental powers, against Louis XII. of France. In this alliance the king of England was not a deeply interested individual; but his vanity was flattered with the idea of receiving the title of Most Christian Majesty, which was promised to him by the pope. The object which the confederates had in view was to wrest from Louis some valuable provinces which he had obtained in Italy; and although Henry had no hope of sharing the spoil with them in this quarter, yet the occupation of the French monarch in schemes of aggrandisement beyond the Alps afforded an opportunity to the English of invading France, and reviving the old chimera of conquering that country. The point, whether England should aim at continental dominions, was debated in parliament; and the arguments against it greatly preponderated. But the vanity of Henry was too much flattered to relinquish the scheme. He sent an ambassador to demand of Louis the ancient patrimony of the English crown in France, and this being refused, war was denounced. Parliament granted a supply, and an army was equipped and sent into Spain. But this expedition was attended with no success, and the troops, dispirited and mutinous, returned to England towards the close of 1512. On the north-western frontier of France, however, the arms of Henry were triumphant, and also in Scotland, which had been tempted by French councils to invade England. James IV. with a considerable army under his command, was met by the Earl of Surrey at Flodden, where a bloody battle was fought, in which the Scots were totally routed, and their king, with the greater portion of his nobility, perished. (See SCOTLAND.) Henry received the news of this victory at Tournay, which he had invested, after having demolished Terouanne. The latter city opened its gates to him in eight days; but all parties being now disposed for peace, a general treaty was concluded in August 1514.

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[1] Bacon, iii. 409.

[2] Ibid. iii. 379.

With regard to the administration of government in England, when Henry mounted the throne, the leading ministers in the cabinet were, Howard, earl of Surrey, lord treasurer; and Fox, bishop of Winchester, lord privy seal. Amongst the inferior dependents of the court there now appeared an individual, whose ambition and talent enabled him speedily to supplant every competitor. This was Thomas, afterwards Cardinal Wolsey, who, although only the son of a burgess of Ipswich, gradually raised himself to the first offices of state. (See WOLSEY.) His preferment had been rapid beyond all precedent, and this was not likely to be forgiven by an envious world. From the year 1513 to 1515, he had passed through the various gradations, from being bishop of Tournay, to the honours of the cardinalate, and he succeeded Archbishop Worham in the office of chancellor. With respect to the manner in which he executed his duty as a high public functionary, Sir James Mackintosh remarks, that "his administration of justice as chancellor has been celebrated by those who forget how simple the functions of that office then were; and his rigid enforcement of criminal justice appears only to have been a part of that harsh but perhaps needful process by which the Tudor princes rather extirpated than punished criminals, in order to reclaim the people from the long license of civil wars. As he was chiefly occupied in enriching and aggrandizing himself, or in displaying his power and wealth, objects which are to be promoted either by foreign connections, or by favour at court, it is impossible to determine what share of the merit or demerit of internal legislation ought to be allotted to him. His part in the death of the Duke of Buckingham was his most conspicuous crime; yet, after all, it is probable that he was no worse than his contemporary statesmen. The circumstance most favourable to him is the attachment of dependents."[1]

On the death of Maximilian, which happened towards the end of the year 1519, Henry, along with the kings of France and Spain, became a candidate for the imperial throne. The Spanish monarch was the successful competitor, and, to soothe the wounded pride of Henry, he paid him a visit of ceremony at Dover. His principal design in this was to persuade Henry to abandon a projected meeting which was to take place between him and the king of France, the wily emperor dreading that such an interview might be fraught with danger to himself. He was unsuccessful, however, and the two monarchs met between Ardres and Guines in 1520. The place where this meeting was held has been long celebrated under the name of the Field of the Cloth of Gold. The pomp and parade, the tournaments and other sports of the age, exhibited upon the occasion, were on the grandest scale, and peculiarly calculated to delight the young king of England, a creature of impulse, and one who sacrificed policy to temper, and interest to passion. It was thus that the continental monarchs flattered his foibles, and ingratiated themselves into his favour.

About the same time a crime was perpetrated, in the guilt of which both Henry and his minister Wolsey have been implicated; we mean the execution of Edward Stafford, duke of Buckingham. This nobleman was descended from the youngest son of Edward III.; and the principal accusation brought against him was, that he had tampered with a priest who laid claim to the gift of prophecy, and who had foretold that he would yet ascend the throne in virtue of his descent. Several other charges equally absurd, and not amounting to an overt act of high treason, were brought against him; he was tried by a jury of peers, condemned to death, and beheaded on the 17th of May 1521. Upon this occasion the populace vented their indignation against Wolsey, whose subtle policy had brought the sufferer to the scaffold, by loud cries of "the butcher's son."

Wolsey, however, continued to rule with unabated sway from 1521 till 1527. This period is not distinguished by any events of importance, if we except the opposition which the House of Commons offered to the minister in his attempts to raise supplies. That body obstinately disputed these grants, and attempts were made to raise money by the expedients of forced loans and pretended benevolences, which the legislature had already condemned. But these attempts produced a small supply and a great deal of discontent. Wolsey, notwithstanding his unwearied exertions in behalf of his master, never felt himself perfectly secure in his elevated situation. The capricious and tyrannical temper of Henry forbade his ministers to be at ease in any place of trust near his person. The fall of Wolsey seems always to have appeared to himself as an event of very likely occurrence, and these gloomy forebodings were at last realized. The cause of the rupture between the king and him was the divorce of Queen Catherine, which the former had begun to project. But the fall of Wolsey was not the only event connected with Henry's divorce; it ultimately led to one of the most memorable transactions in the history of England, namely, the separation of that country from the communion of the church of Rome.

The doctrines of the reformation, propagated by Luther in 1517, had gained considerable ground in England, and many professed a belief in them, notwithstanding the severe persecution which had been carried on against heretics during some of the preceding reigns. The papal authority, though still very great, had in the space of ten years declined considerably; but a detail of the circumstances connected with this subject is not required in this place. It may be noticed in general, that the reformation in England was facilitated by the undeniable corruption of the clergy, and the experience which many individuals had of, and the partiality which they entertained for, the doctrines of Wickliff. The seed sown by that divine had never been destroyed; and if it did not show itself above ground, it was extending itself underneath, perpetuating a sort of dormant existence, and ready to spring up on the first propitious occasion. Besides, the marriage of King Henry was looked upon by many as in itself illegal, and only sanctified by a dispensation from the pope.

Whether Henry himself, during the early years of his reign, felt any scruples about the validity of his marriage, may reasonably be doubted; for no trace of any thing of the kind can be discovered in his public conduct till the year 1527. The queen was some years older than himself, and was now past the meridian of life. Her personal charms had decayed, and the heart of the royal sensualist could not be attracted by beauty that belonged purely to the mind. She had born him several children, all of whom died in infancy except the Princess Mary, who survived both her parents, and afterwards ascended the throne. It is reported of the inconstant monarch, that he attributed the mortality in his family to the curse of heaven, which blighted his unnatural alliance with Catherine, his brother's widow. But there was another and more powerful circumstance which led him to contemplate a divorce from his queen; this was the love which he had contracted for Anne Boleyn. The charms of this lady had touched his fiery but not unsusceptible heart; and as his passion could not be gratified except by means of an alliance sanctioned by law, he set seriously to work for the purpose of removing the amiable partner of his throne and bed, and placing the youthful beauty in her stead. The secret intentions of the king having become to some extent public, he ventured to ask the opinions of the most eminent ecclesiastics upon the point. The dangers of a disputed succession, if the king should die without male issue, were brought forward as an urgent plea for taking the step which he had in view. He had also recourse to his theological lore, and certain religious scruples connected with his first marriage helped to give a colour of principle to his real desires, and at the same time to impart to them life and warmth. Some of the divines whose counsel was asked declared that no dispensation could authorize a marriage with the widow of a brother; which they proved from a passage in the Pentateuch. Others, who also founded their arguments upon a portion of Scripture, contended that the prohibition referred to by the opposite party was not universal, and might be dispensed with in the king's case, where the first marriage had been unproductive of issue. Cardinal Wolsey, who had a hazardous game to play, coincided with the former, and gave Henry hopes that his petition to the court of Rome would be successful. But Anne was not the individual whom the prelate had in his eye as a wife for the king. He was desirous of wedding his master to a French princess, and, we are informed, threw himself on his knees before Henry, and entreated him to desist from a project so unworthy of his birth as an alliance with the Boleyn family. But the pliant mind of the cardinal yielded to the impetuosity of his master and to the force of circumstances; and he found it necessary to atone for his indiscreet zeal by displaying redoubled activity to promote the marriage with the lady upon whom the king had fixed his affections. The illustrious Sir Thomas More declined to support the divorce, and Fisher bishop of Rochester acted with the same integrity.

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[1] *History of England*, vol. ii. p. 121.

A deputation was sent to Rome by Henry for the purpose of sounding Pope Clement upon the subject of the divorce. The pontiff was in a situation unfavourable to the success of the application; and although he was bound to the English monarch by the ties of gratitude, he declined giving an immediate assent to the proposition, but appointed two legates to hear and determine the validity of the first marriage of Henry. He also gave a solemn promise not to recall the commission, nor to do any act which should annul the judgment or prevent the progress of the trial. The pontiff was at this period engaged in a contest with the imperialists; but he at last concluded a treaty of alliance with the emperor, who appeared the only potentate capable of shielding him from his other enemies. The forensic disputes respecting the divorce still remained unsettled, and, from the date above mentioned, Clement took his final part against the degradation of the queen of England, who was an Austrian princess. But still, by ingenious delays and plausible formalities, he contrived to amuse Henry, whose power it was not his interest to treat with direct contempt. The patience of the English monarch, however, was now completely worn out by these fruitless attempts at negotiation, and he redoubled his entreaties to the pope to comply with his demands. Clement, in order to show a willingness to acquiesce in the wishes of Henry, sent over Cardinal Campeggio, who, either separately or in conjunction with Wolsey, was empowered to hear and determine the matrimonial suit. The legate at first attempted to dissuade Henry from pursuing the divorce; but being unsuccessful with the monarch, he next tried to persuade Catherine to embrace a religious life, in which he also failed. The popular feeling was against Henry, and he felt himself compelled to remove Anne Boleyn from court, where she had for some time resided. At a great council which he convoked, he declared that in prosecuting this matter he was solely actuated by a desire to know whether or not his only remaining child Mary was the rightful heir of the crown. On this occasion he made an appeal to the feelings and consciences of his hearers which affected them much; and the perplexities consequent upon the late proceedings afforded Campeggio an opportunity for putting off the decision of the question until he had obtained further instructions from Rome. Meanwhile Clement was seized with a dangerous illness, which retarded his answer, and is said to have revived in the ambitious mind of Wolsey a hope which he had before indulged in, of obtaining possession of the tiara. This occurred in the spring of 1529; and although the pope recovered from his sickness, his legate contrived from time to time to postpone the trial. On the 31st of May, however, the court of parliament met, and summoned the king and queen to meet on the 18th of June. The latter obeyed, but protested against the judges, and appealed to the pope. At the next session, on the refusal of the cardinals to admit the appeal, she rose, and in a calm and dignified manner threw herself at Henry's feet, imploring him in a truly eloquent address to desist from his intended purpose of repudiating her. It made a profound impression upon the audience, and even touched the cold heart of her husband. The legates carefully prolonged the trial until July, when a vacation from July to October took place, during which time all courts were bound to suspend their sittings; and, notwithstanding the importunities of the king, Campeggio contrived to get the suit removed to Rome. Agreeably to the instructions of Clement, Campeggio quitted England, and the pope summoned Henry to appear before him in forty days.

In these transactions Wolsey took no inconsiderable share, and the compliant manner in which he gave his consent to the suggestions of Campeggio excited the suspicions of the king, that his minister was playing a double game with him. The symptoms of approaching disgrace now became too palpable to escape the notice of the cardinal; for all parties joined either openly or privately to destroy him who had so long enjoyed the favour of the king. It was a singular coincidence that the friends both of Queen Catherine and Anne Boleyn were employed as instruments of his overthrow. On the 9th of October 1529 a prosecution was commenced against him for procuring bulls from Rome without the king's license. On the 17th of the same month the great seal was taken from him and given to Sir Thomas More. On the 1st of December the lords presented an address to the king, in which were embodied various articles of accusation against the cardinal; and notwithstanding that the more serious parts of the charge were refuted by his servant Thomas Cromwell, the court at last pronounced him to be beyond the protection of the law, and "that his lands, goods, and chattels were forfeited, and that his person was at the mercy of the king." Wolsey had confessed his offence against the statute of *præmunire*, of which he was technically guilty, inasmuch as he had received the bulls without a formal license. It is scarcely necessary to observe that the sentence pronounced was most unjust; for the bulls had been obtained with the consent and for the service of his ungrateful master, under whose eye they had been executed for years without a word being uttered as to the manner in which they had been obtained. But nothing could now save the cardinal. He was at once hurled from his place of pride and power, and fell, with his vast possessions, a helpless victim, into the hands of the king. But it would appear that, from habit perhaps, Henry still cherished a feeling of partiality for his old favourite, and sent him from time to time tokens of his esteem and regard. In February 1530 Wolsey was actually pardoned, and restored to his see of Winchester, and to some other emoluments. Even the great diocese of York was shortly afterwards restored; but at the moment when he was making magnificent preparations for his installation on the archiepiscopal throne, he was arrested at Cawood on a charge of high treason. His health was infirm, and during his journey from York he was seized with a dysentery, which confined him for some time at the seat of Lord Shrewsbury. As soon as he was able he mounted his mule and resumed the journey. But his strength rapidly declined, and he was compelled to take refuge in the abbey of Leicester, where he expired on the 30th of November 1530, in the sixtieth year of his age.

After the death of Wolsey, the king, by the advice of his ministers, had the legality of his marriage debated in all the universities of Europe. (See the article CRANMER.) By dint of money he succeeded in obtaining their votes in his favour, but not without a stubborn opposition. Backed by these judgments, Henry appealed to the pope; but Clement remained inflexible, and the king prepared to resist the papacy, though not yet to separate himself entirely from the church of Rome. In 1532 Cranmer was elevated to the archbishopric of Canterbury; and early in the following year Henry privately married Anne, and thus himself determined the long debated topic. A few months afterwards he openly solemnized his marriage with Anne, who went in state with him as queen. On the 23d of May Cranmer pronounced, not a divorce, but a sentence that the king's marriage with Catherine had been and was a nullity, because it had been contracted and consummated against the divine law; and not long afterwards he confirmed the marriage of the king with the Lady Anne, whose coronation was performed in the most gorgeous manner on the first of June 1533. (See BOLEYN.) The unfortunate Catherine, perceiving all further opposition to be vain, retired to Ampthill, near Dunstable, where she remained for the rest of her days in privacy and peace.

The pope was no sooner informed of these proceedings, than he passed a sentence declaring Catherine to be the king's only lawful wife; requiring him to take her again, and denouncing censures against him in the event of refusal. Henry, on the other hand, knowing that his subjects were entirely at his command, resolved to separate altogether from the church of Rome. In the year 1534 he was declared head of the church by parliament; the authority of the pope was completely abolished in England; all tributes formerly payable to the holy see were declared illegal; and the king was intrusted with the collation to all ecclesiastical benefices. The nation readily entered into the king's measures, and took an oath called the *oath of supremacy;* all the authority which the popes had maintained over England for ages was overthrown at a blow; and none seemed to repine at the change except those who, from their dependence upon Rome, were immediately interested.

But though the king thus separated from the church of Rome, he by no means adhered to the doctrines of Luther which had been lately promulgated. He had himself written a book against this celebrated reformer, which the pope pretended greatly to admire, and honoured King Henry, on this account, with the title of Defender of the Faith. This character he seemed to be determined to maintain, and therefore persecuted the reformers most violently. Many were burnt for denying the Catholic doctrines, and some also were executed for maintaining the supremacy of the pope. The courtiers knew not which side to take, both the new and old religions being equally persecuted; and as both parties equally courted the favour of the king, he was by that means enabled to assume an absolute authority over the nation.

The established clergy co-operated actively in the revolution which was in progress. Six bishops sanctioned by their vote every blow which was struck at the power of Rome; and fourteen abbots were usually present when the number of temporal peers who attended were somewhat more than forty. "They did not shrink," says Sir James Mackintosh, "from the deposition of Catherine, by reducing her title to that of Princess Dowager of Wales. By ratifying the marriage of Anne Boleyn they adopted those parts of the king's conduct which most disgusted the people. The bill for subjecting the clergy to the king, as their sole head, was so favourably treated as in one day to be read three times and passed: no division appears to have taken place on these measures."[1]

The attention of the king was now turned to Elizabeth Boston, a nun in the priory of St Sepulchre at Canterbury, who believed herself endowed with the power of working miracles, and foretelling future events. Several clergymen and other gentlemen of Kent believed in her mission; and some individuals of the highest order, both of intellect and piety, gave credit to her pretensions. She was subject to convulsions; and in the trances into which she frequently fell, visions of a marvellous nature were vouchsafed to her, which turned of course upon the extraordinary events taking place around her. She was tried and executed for high treason, and her abettors were arraigned on the same charge. Fisher, bishop of Rochester, was attainted by the act against this modern Pythia; but by a separate statute he was afterwards attainted of misprision of treason, for not having taken the oath to the succession. He was eminent for his learning and virtue, and probably his life would have been saved had not the pope sent him a cardinal's hat while in prison, which roused the jealousy of Henry. The remorseless tyrant ordered him to be executed, at the same time remarking, with his usual heartlessness, that the pope might send him a hat, but that Fisher should have no head to wear it. Another deed of blood was perpetrated a short time afterwards, which alone is calculated to consign the name of Henry VIII. to the execration of all future times. Sir Thomas More, the first Englishman of his day, one who had exalted the nation in the eyes of Europe, and whose fame was universal, was tried and executed for misprision of treason, in not taking the oath to maintain the succession. The legal pretext, if there was any, for the accusation, was grounded on the obnoxious clause of a recent act, which made it treason "to do any thing by writing or act which was to the slander, disturbance, or prejudice of the marriage with the Lady Anne, or to the disherison or disturbance of the king's heirs by her." Both More and

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[1] *History of England*, vol. ii. p. 175.

Fisher had abstained from either affirming or denying, first, that Henry's marriage with Catherine was invalid; secondly, that his marriage with Anne was valid; and, thirdly, they refused to disclaim all foreign authority in the kingdom, spiritual authority included. After his condemnation Sir Thomas avowed that he had studied the question for seven years, and could not escape from the conclusion that the king's marriage with Catherine was valid. For this scrupulous conscientiousness he expired upon the scaffold on the 7th of July 1535.

This wanton shedding of righteous blood excited the utmost indignation in foreign countries, particularly in Italy. Here Giovio, an historian, compared the tyranny of Henry to that almost preternatural wickedness which the Grecian legends had embodied under the appellation of Phalaris. Other individuals lashed the tyranny of the English monarch with the utmost rigour, and lamented, in strains of affecting eloquence, the fate of More, whom they designated the martyr of unshaken probity. Amongst the most eminent of these writers was Cardinal Pole, an Englishman, allied to the royal family.

Catherine, the former consort of Henry, expired at Kimbolton in the beginning of January 1536, having died as she had lived, mild, forgiving, and resigned. On her deathbed she wrote a most affectionate letter to her husband, whose iron nerves were touched by the perusal of it. His less prudent queen had the levity to express her satisfaction at the event. But if she expected that it would in any way be conducive to her further happiness, and a more devoted attachment on the part of her husband, she was most miserably disappointed. She soon after gave birth to a still-born child, and her brutal lord is said to have reproached her upon the occasion for the loss of his boy. His desire for male issue, and his repeated disappointments, seem to have at last weaned the affections of the fickle monarch from the idol whom he had worshipped with so much devotedness and ardour. A new passion had kindled in his breast, the object of which was Jane Seymour, a young lady of the queen's bed-chamber, which office Anne herself had held in that of Catherine. The circumstances connected with the queen's arrest may be briefly stated. On May-day 1536 a tilting match was held at Greenwich, in which her brother was the chief challenger, and Norris, groom of the stole, the opposing defendant. The queen having dropped her handkerchief, had it gallantly handed up to her by Norris, who was supposed to be her lover. The jealousy of the king burst out; he left the joust precipitately; and ere night his queen had passed through an examination, and was committed a prisoner. Such was the trifle "light as air," which to the jealous mind of Henry seemed a "confirmation strong as proofs of holy writ." By the researches of Mr Turner it has been discovered, that some days before the tournament certain individuals were appointed to inquire into the alleged misdeeds of Anne. The commission put their authority into execution upon the 10th of May, when a grand jury of Westminster was assembled. The charge against her was adultery, and its consequence in such a case, treason. Whether innocent or not, the unhappy Anne was deserted in her utmost need, and had not a friend to counsel her in this alarming emergency. On the day after the queen was committed to the Tower, Cranmer had written to the king imploring the king's mercy towards her, "his life so late, and sole delight;" but in vain. The archbishop had been forbidden to approach the court until desired by the king. The subsequent proceedings were as rapid as they were terrible. On the 12th of May, Norris, Weston, Brereton, and Smeaton, were tried in Westminster Hall for the crime of high treason. Smeaton pleaded guilty to the charge; the others resisted, but were convicted. Three days afterwards the House of Lords assembled for the trial of the queen. She was without counsel, and attended only by her ladies. Anne defended herself with modesty and firmness, but, upon evidence of which no traces now remain, she was condemned to suffer death. On hearing the sentence of her judges, she raised up her hands and exclaimed, "O Father and Creator! O thou who art the way, the truth, and the life! thou knowest that I have not deserved this death." It is difficult to reconcile such an ejaculation with a consciousness of guilt. She afterwards turned to her judges, and made a serious protestation of her innocence. On the 17th of May the other individuals who had been convicted were carried forth to execution. Smeaton, who had confessed to the guilt, probably from an erroneous impression that he would by this means save his life, was the last to suffer. Anne's brother Rochford was also tried and condemned on the same day with herself, and was executed with the others. The curtain dropped upon this horrible tragedy with the death of the queen, who was beheaded on the day after her supposed accomplices had suffered. For further particulars respecting this unhappy personage, see Boleyn.

That Henry sacrificed his queen in a fit of vindictive resentment against her, who, he too rashly believed, had dishonoured him, is all that can be urged in his favour. That he really believed her guilty, must also in common fairness be allowed. To think otherwise would be to attaint his name with one of the most horrid enormities that ever disgraced the annals of crime. It seems very improbable that the violent attachment which he had all along entertained for her should have cooled so suddenly, and been supplanted by such deadly hate, without supposing that some levities in the conduct of Queen Anne had fired his jealous soul, and roused him to demand her blood as an expiation for the guilt imputed to her. But he was not content with taking away her life under the charge of adultery and incest; he deprived her of the name and the right of wife and queen, and bastardized the daughter which she had born him, even when he acknowledged that daughter to be his own. His contempt for her memory was displayed in a manner which could be believed of few other individuals. He dressed himself in white on the day of her execution, and actually married Jane Seymour next morning.

In bringing this tale of blood to a termination, we have unavoidably outrun several important events. When the news of Sir Thomas More's execution reached the court of Rome, a bull was prepared against Henry. In this extraordinary instrument were embodied all the offences of the English monarch against the papal see, and he was allowed ninety days, and his fautors and abettors sixty, to repent, and to appear at Rome either in person or by attorney. In case of default, he was to be excommunicated, and deprived of his crown; his children by Anne were to be rendered incapable of inheriting for several generations; his subjects were to be absolved from their allegiance to him; and all treaties and alliances between him and other powers were to be null and void. This thunderbolt, however, though forged for the purpose of punishing the king's apostacy, it was resolved should be suppressed for a time, and lodged in the papal armoury until a more favourable opportunity should occur for launching it at the royal culprit.[1] The election of Henry as supreme head of the church we have already noticed, and also some of the events which followed his assumption of that presumptuous title. Henry, however, at first assumed it with wariness, and the language in which the statute is couched shows that his supremacy might be reconciled with the papal authority, if the jurisdiction of that power were only of a spiritual nature. But by the statutes of later years, the revolution in church government had been consummated in England. The ancient doctrine of the Roman Catholic faith was acknowledged; but the king was placed as a sort of lay patriarch at the head of the ecclesiastical establishment. Thomas Cromwell, who had now become Henry's chief minister (see CROMWELL, THOMAS), was at this time raised to the new office of the king's vicegerent, and empowered to send commissioners into the several counties of England to inspect the monasteries, and to report, with rigorous exactness, the conduct and deportment of such as were found there. This appointment, which had been made between the parliaments of 1536 and 1539, was confirmed by the recognition of the latter; and it was provided that the vicegerent should take his seat in the House of Peers before the Archbishop of Canterbury, and be ranked above all temporal lords, except some branches of the royal family. The first experiment which Cromwell made of his unlimited power was the gradual suppression of the various classes of religious houses, and the seizure of their possessions, at that time amounting to a large proportion of the landed property of the kingdom. This seizure of vested territorial possessions was, in a legal point of view, direct spoliation. But it was urged, on the other hand, that from the immorality, ignorance, and indolence in which those who enjoyed them indulged, they had forfeited their right, and might lawfully be deprived of these. By the inspectors of the religious houses, the public were informed of the existence of monstrous disorders in these communities. In 1536 the lesser monasteries were suppressed, amounting to nearly four hundred. Their revenues, computed at L.30,000 per annum, were confiscated to the king's use, besides their plate and other goods, estimated at L.100,000 more. The confiscation, however, was most unpopular, especially in those places where the ancient faith retained most sway, and occasional revolts broke out. Such a sweeping calamity must have brought ruin upon many innocent and even worthy and deserving persons. The spectacle of individuals, invested with the most sacred of all functions, expelled from their only habitations, where they had probably grown old, and were now unfit for bodily toil, was calculated to awaken feelings of sympathy for the sufferers, and probably of detestation for those who had driven them forth to perish in the wilderness. A disturbance broke out in Lincolnshire, where the first visitation of religious houses took place. But in the north a more serious affair, amounting to an insurrection, occurred. Between the Humber and the Tweed the people had rushed to arms, and they were joined by the inhabitants of Cumberland, Westmoreland, and a portion of Lancashire. This formidable body was led into the field by Robert Ask, a man of Yorkshire, and was preceded by priests bearing banners emblazoned with paintings of the sufferings of Christ. Several important towns fell into their hands; but the king met them with a superior force, which arrested their progress. They, however, succeeded in obtaining a general pardon, and then dispersed.

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[1] Thus far historians are perfectly agreed with regard to this bull. It is also certain, that in 1538 the suspension of the bull was revoked, and its publication ordered by the pope. But whether or not this really took place is a matter of doubt. Dr Lingard ob-

A second visitation of the monasteries took place shortly afterwards. Various circumstances had occurred to exasperate Henry against the Catholic clergy; and the alarming revolts, at which priests had presided, and principally instigated the people by their inflammatory addresses, were of a nature to inflame such a combustible temper as his. In this second spoliation, the richest and most revered shrines were pillaged and destroyed, and the sacred relics, objects of so much superstitious veneration, were held up to the derision of the public. Various historians have enumerated a great number of these, and some of them are certainly calculated to excite surprise at the depth of that superstitious feeling which could induce a people to believe that the parings of St Edmund's toes, or the felt of St Thomas of Lancaster, or the shirt of St Thomas of Canterbury, were infallible recipes for certain disorders. On this occasion the shrine of the latter saint was demolished, and the wealth which it yielded was enormous. These shrines were pillaged, on the allegation, too often true, that they were the scenes of imposture, where miracles were pretended to be wrought. The king, on the whole, suppressed upwards of six hundred monasteries, above two thousand chantries and free chapels, and about two hundred colleges and hospitals. The confiscation was closed by a statute passed in 1539, which provided that "all monasteries, and other religious houses, dissolved, suppressed, surrendered, renounced, relinquished, forfeited, or by any means come to his highness, shall be vested in him, his heirs and successors, for ever." It must be owned, that although great abuses may have been detected, revenue not reformation, plunder not punishment, were the objects which the visitors had in view. With respect to the important question regarding property, involved in this measure, we shall avail ourselves of the remarks of Sir James Mackintosh on the subject.

"Thus was completed the confiscation of a fifth or a fourth part of the landed property of England and Wales within the space of five years. It may be a fit moment therefore to pause here, in order calmly and shortly to review some of the weighty questions which were involved in this measure. There is no need of animadverting upon the means by which it was effected, though we must assent to the affirmation of a great man, 'that an end which has no means but such as are bad, is a bad end.' But the general question may be best considered, keeping out of view any of those attendant misdeeds which excite a very honest indignation, but which disturb the operation of the judgment. Property is legal possession. Whoever exercises a certain portion of power over any outward thing in a manner which, by the laws of the country, entitles him to an exclusive enjoyment of it, is deemed a proprietor. But property, which is generally deemed to be the incentive to industry, the guardian of order, the preserver of internal quiet, the channel of friendly intercourse between men and nations, and, in a higher point of view, as affording leisure for the pursuit of knowledge, means for the exercise of generosity, occasions for the returns of gratitude; as being one of the ties which join succeeding generations, strengthening domestic discipline, and keeping up the affections of the kindred; above all, because it is the principle to which all men adapt their plans of life, and on the faith of whose permanency every human action is performed; is an institution of so high and transcendent a nature, that every government which does not

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serves, "I cannot find any proof that it was ever published at all." Sir James Mackintosh is silent upon the point. Mr Turner, in his *History of the Reign of Henry VIII.* says, that in 1538 "it was given unblushingly to the world. This last order recites, that it had been suspended for three years on the persuasion of some princes. Cherubini, 623." In order to reconcile these conflicting statements, it may perhaps be supposed that it never was "published at all" in England, although it may have been "given unblushingly to the world" in other countries.

protect it, nay, that does not rigorously punish its infraction, must be guilty of a violation of the first duties of just rulers. The common feelings of human nature have applied to it the epithets of sacred and inviolable. Property varies in the extent of the powers which it confers, according to the various laws of different states. Its duration, its descent, its acquisition, its alienation, depend solely upon these laws. But all laws consider what is held or transmitted agreeably to their rules as alike possessing the character of inviolable sacredness. There may be, and there is, property for a term of years, for life, or for ever. It may be absolute as to the exercise of the proprietor's rights, or it may be conditional, or, in other words, held only as long as certain conditions are performed. There are specimens of all these sorts of property in the codes of most civilized nations. But in all these cases the essence of property is preserved, which consists in such a share or kind of power as the laws confer. The advantages may be extremely unequal. The inviolable right must, by the force of the terms, continue perfectly equal.

"The legal limits of the authority of the supreme legislature are not a reasonable object of inquiry, nor indeed an intelligible form of expression. But to conclude that, because the law may in some cases be said to create property, the law is to be deemed on that account as entitled rightfully to take it away, is a proposition founded on a gross confusion of two very distinguishable conceptions. It uses the word property in the premises for a system of rules, and in the conclusion for a portion of external nature, of which the dominion is acquired by the observance of these rules. It is only in the first of these senses that property can be truly called the creature of law. In the second sense it is acquired or transmitted, not by law, but by the acts of a man, when the acts are conformable to legal rules. It is impossible within our present limits to canvass the small or apparent objections which may occur to this scheme of reasoning. It is sufficient, perhaps, here to remark, that these are the generally acknowledged principles, and that deviations from them in practice are no more than partial irregularities, to which the disturbing forces of passion and interest expose human society.

"The clergy, though for brevity sometimes called a corporation, were rather an order in the state composed of many corporations. Their share of the national wealth was immense, consisting of land devised by pious men, and of a tenth part of the produce of the soil set apart by the customary law of Europe, for the support of the parochial clergy. Each clergyman had only in this case an estate for life, to which, during its continuance, the essential attribute of inviolable possession was as firmly annexed by law as if it had been perpetual. The corporate body was supposed to endure till it was abolished in some of the forms previously and specially provided for by law.

"For one case, however, of considerable perplexity there was neither law nor precedent to light the way. Whenever the supreme power deemed itself bound to change the established church, or even materially to alter the distribution of its revenues, a question necessarily arose concerning the moral boundaries of legislative authority in such cases. It was not, indeed, about a legal boundary; for no specific limit can be assigned to its right of exacting obedience within the national territory. The question was, what governments could do morally and righteously, what it is right for them to do, and what they would be enjoined to do hy a just superior, if such a personage could be found among their fellow-men. At first it may seem that the lands should be restored to the heirs of the original grantor. But no provision for such a reversion was made in the grant; no expectation of its occurrence was entertained by their descendants; no habit or plan of life had been formed on the probability of it. The grantors or founders had left their property to certain bodies under the guardian power of the commonwealth, without the reserve of any remainder to those who, after the lapse of centuries, might prove themselves to be their representatives. It is a case not very dissimilar to that of an individual who died without discoverable heirs, and whose property for that reason falls to the state. It appeared, therefore, meet and righteous that in this new case, after the expiration of the estates for life, the property granted for a purpose no longer deemed good or the best, should be applied by the legislature to other purposes which they considered as better. But the sacredness of the life estates is an essential condition of the justice of such measures. No man thinks an annuity for life less inviolable during his life, than a portion of land granted to him and to his heirs for ever. That estate might, indeed, be forfeited by a misperformance of duty; but perfect good faith is in such a case more indispensahle than in most others. Fraud can convey no title; false pretences justify no acts. There were gross abuses in the monasteries; but it was not for their offences that the monastic communities fell. The most commendable application of their revenues would have been to purposes as like those for which they were granted as the changes in religious opinion would allow. These were religious instruction and learned education. Some faint efforts were made to apply part to the foundation of new bishoprics; but this was only to cover the profusion with which the produce of rapine was lavished on courtiers and noblemen, to purchase their support of the confiscations, and to ensure their zeal and that of their descendants against the restoration of popery.

"It is a melancholy truth, and may be considered by some as a considerable objection to the principles which have been thus shortly expounded, that if in 'the seizure of abbey lands' the life estates had been spared, the monks, who were the main stay of papal despotism, and the most deadly foes of all reform, would have had arms in their hands which might have rendered them irresistible. It must perhaps be acknowledged, that it was more necessary to the security of Henry's partial reformation to strip the monasteries at that moment, than to dissolve communities which a better regulation might in future reconcile to the new system.

"We are assured by Sir Thomas More, 'that in all the time while he was conversant with the court, of all the nobility of this land he found no more than seven that thought it right or reasonable to take away their possessions from the clergy.' So inconsiderable was the original number of those who, not many years after, accomplished an immense revolution in property.

"To which it must be answered, that the observance of justice is more necessary than security for any institution; that many regulations might have stood instead of one deed of rapine; that the milder expedients would have provoked fewer and more reconcilable enemies; that if, on the whole, they afford less security, the legislature were at least bound to try all means before they who were appointed to be the guardians of right set the example of so great a wrong. Rulers can never render so lasting a service to a people as by the example, in a time of danger, of justice to formidable enemies, and of mercy to obnoxious delinquents. These are glorious examples, for which much is to be hazarded."

Henry had now so far separated himself from the communion of Rome, that it became in some measure necessary for him to concoct a creed of his own. The clergy were divided into two factions, denominated the men of the old and the new learning. The chief of the former was Gardiner bishop of Winchester, who was supported by Lee archbishop of York; Stokesly bishop of London, Tunstall of Durham, and Clarke of Bath and Wells. The latter acknowledged as leaders, Cranmer archbishop of Canterbury, Haxton of Sarum, Latimer of Worcester, and Fox of Hereford. These could depend on the powerful interest of Cromwell the vicar-general, and of Audley the lord chancellor; those on that of the duke of Norfolk, and of Wriothesley the premier-secretary. Various long debates took place upon the new creed, but it was neither completed nor sufficiently fenced round with suitable penalties, till an act was passed by the parliament, which sat in April 1539, entitled "an act for abolishing diversity of opinions." This convocation was opened by the chancellor informing the House of Lords that it was his majesty's earnest desire to extirpate from his kingdom all diversity of opinions with regard to religion; and as this enterprise was, he owned, difficult and important, he desired them to choose a committee from amongst themselves, who might frame certain articles, and communicate these afterwards to parliament. The lords named the vicar-general Cromwell, now created a peer; the Archbishops of Canterbury and York; and the Bishops of Durham, Carlisle, Worcester, Bath and Wells, Bangor, and Ely. But this small committee itself was agitated with such diversity of opinions that it could come to no conclusion. The Duke of Norfolk then moved, that since there was no hope of having a report from the committee, the articles of faith proposed to be established should be reduced to six, and a new committee be appointed to frame an act respecting them. As this peer was understood to speak the king's mind, his motion was immediately complied with; and, after a short prorogation, the bill of the six articles was introduced, and, having passed the two houses, received the king's assent. By this law the doctrine of the real presence was established, the communion in one kind, the perpetual obligation of vows of chastity, the utility of private masses, the celibacy of the clergy, and, lastly, the necessity of auricular confession. The denial of the real presence was punishable with death by fire, and the same forfeiture as in cases of treason, and admitted not the privilege of abjuring; an unheard of cruelty, unknown even to the inquisition itself. The denial of any of the other articles, even though afterwards recanted, was punishable by the forfeiture of goods and chattels, and imprisonment during the king's pleasure. An obstinate adherence to error, or a relapse, was adjudged to be felony, and subjected the delinquent to death. The marriage of priests was punished in the same manner. Their commerce with women was, for the first offence, forfeiture and imprisonment; and for the second, death. Abstaining from confession, and from receiving the eucharist at the accustomed times, subjected the person to fine, and to imprisonment during the king's pleasure; and if the criminal persevered after conviction, he was to suffer death and forfeiture, as in cases of felony. Commissioners were to be appointed by the king for inquiring into these heresies and irregular practices, and the criminals were to be tried by a jury.

Henry had now been a widower for above two years. In 1537 Jane Seymour, his third queen, had born him a son, afterwards Edward VI.; but she herself expired in less than a fortnight afterwards. The king afterwards made proposals of marriage to several foreign princesses, and others, without success. Under these repeated disappointments, he readily listened to the suggestions of Cromwell, who proposed to him Anne, sister of the Duke of Cleves, a considerable prince on the Lower Rhine, who had lately established Lutheranism in his principality. This choice showed the leaning of his secretary's mind, and the progress of men in general towards reformation. Henry had seen a painting by Holbein of this lady. The artist had invested her with fictitious charms, which captivated the sensual monarch, and inspired him with such eagerness to behold her, that he proceeded to Dover, where she was to disembark, his mind no doubt swelling with pleasing anticipations. But he was miserably disappointed, and could not conceal his chagrin. She was indeed of the standard dimensions, being large and tall as his heart could desire; for stature had now become an indispensable qualification in the individual who should aspire to gain the affections of the king of England. Without entering into the disgusting particulars connected with his marriage with Anne of Cleves, it is sufficient to state that the nuptials were solemnized, and that the lady was treated, not as a wife, but as a friend. The distress of Henry was great, and at last drew the attention of the House of Lords to the subject on the 6th of July 1540. These obsequious peers entreated him to make inquiry into the validity of his marriage with the Lady Anne of Cleves; and the Commons having concurred with them, the king granted their prayer. Of course this drama was all arranged, and the characters cast, some days before the meeting of parliament. The convocation appointed to examine into the matter declared the marriage to be null by the consent of Lady Anne herself, which was insured by the grant of an income of L.3000 annually; and the lady, it would appear, lived comfortably on her annuity for sixteen years in England. The bill for the nullity was passed by both houses, and received the royal assent on the 24th of July 1540. About a fortnight afterwards the king married his fourth wife, Catherine Howard, niece to the Duke of Norfolk. But let us look back upon the fate of Cromwell, who was instrumental in procuring the former union. It was indispensably necessary that the revolutions which took place in Henry VIII.'s palace and bed should in some way or another be marked with blood.

The arrest, condemnation, and execution of Cromwell, is another of those cruel and tyrannical measures which have entailed accumulated odium upon the name of Henry VIII. A bill to attaint the vicar-general of high treason was brought into parliament in June 1540; and before the end of the month it had passed through both houses. He was charged with heresy because he had favoured the new doctrines, and with treason because he had performed several acts of royal authority without the warrant of the king. Cromwell was condemned unheard, and executed in about a month afterwards. This was an act of gross injustice, but it was far from being unpopular. The nobility were glad to be rid of an individual who had raised himself from the shop of a fuller to the highest offices of state; and the Roman Catholic party, who were the most numerous, and had regained much of their ascendency, rejoiced at the fall of one who was the active conductor of that system of confiscation which struck such a blow at their power in England. In that business he certainly must have connived at much rapine and robbery, which it was out of his power to prevent. He has also been charged with Machiavelian policy; but there is no satisfactory evidence that he was unfaithful to his sovereign. Like Wolsey, he seems to have served his king more faithfully than his God; and it is remarkable that he fell into his own snare, having repeatedly shown the example of attainder without trial.

At this period the act of the six articles was in the fullest vigour of its cruelty; and many iniquitous executions took place. One of the most horrid of these was that of Courtney marquis of Exeter, with Lord Montague and Sir Edward Nevil. They were descended from Edward IV., and this seems to have constituted their only crime. Towards the close of 1538 they were first arrested and committed to the Tower; and shortly afterwards the Countess Margaret, the mother of the Poles, was also taken into custody. Exeter was charged with the offence of having conspired to raise Reginald Pole to the throne. This individual, best known as a cardinal, was the son of the above-named lady, who was daughter of the Duke of Clarence. Her son's life was principally passed in Italy, where he was much celebrated for his talents; and Henry appears to have been proud of him, for he munificently discharged his expenses. Their friendship, however, terminated with the king's divorce from Catherine, which the English monarch vainly besought Pole to sanction. The revenge of Henry, who seems now to have thought that without the shedding of blood there could be no remission of offences, fell upon the mother of the cardinal, and the last of the Plantagenets. She was attainted of high treason, and sent to prison, as above noticed. The noblemen committed about the same time were soon afterwards executed; but the lady lingered two years in confinement, and was at last conducted to the scaffold on the 27th of May 1541, where, to complete the horror of the transaction, from mismanagement on the part of the executioner, her neck was horribly mangled, and her grey hairs, clotted with blood, fell dishevelled over her face ere the bloody act was consummated.

To return to the domestic affairs of Henry, he had not been many months married to Catherine Howard before he received such information of her dissolute life before marriage as induced him to suspect that she might still continue it, and to cause a rigid inquiry to be made into her conduct. There was no doubt as to her vices previously to her union with the king; and some acts of infidelity after it were also brought home to her, but the details are too disgusting for human feelings. Cranmer was one of the individuals employed to communicate information to the king; and although there is no evidence that he was ever guilty of a malicious or vindictive act, yet he sometimes wanted the courage to resist crimes; and the slavish manner in which he, along with the rest of the ministers and parliament in general, bowed to the despotic will of the king, cannot be extenuated.

Two of Catherine's paramours were arrested, and confessed their crimes; and the queen herself acknowledged her guilt previously to the marriage, but denied having committed any act of infidelity subsequently thereto. This, however, was not believed; and on the 14th of February 1542 she was executed in the Tower, along with Lady Rochford, who in some way or another was implicated as an accomplice in the guilt of the queen.

To attaint without trial had now become fashionable; but to punish with death that which was not made criminal by any former statute, was altogether new. To countenance such severities as those which had lately taken place, it was enacted in the very bill of attainder, that every woman about to be married to the king or his successors, not being a maid, should disclose her unchastity to him, under the penalty of treason; that any person knowing the fact and not disclosing it, should be subject to the lesser penalty of misprision of treason; and that the commission of adultery by the queen or wife of the prince should be punishable with death.

These laws afforded some amusement to the people, who now said that the king must look out for a widow, as no reputed maid would be disposed to offer herself whilst such a dreadful statute was suspended over her head. This in reality took place, for on the 10th of July 1543 Henry espoused Catherine Parr, the widow of Lord Latimer, and a lady of mature age. She had read Lutheran books, and was inclined to support the doctrines of the reformers. She even went so far as to enter into controversy with her imperious lord, who valued himself not a little on his theological knowledge. He ordered Wriothesley and Gardiner to give orders for her imprisonment, and to prepare articles of impeachment against her. The third Catherine had very nearly been honoured with a place upon the list of victims which were sacrificed by this Blue Beard of the west, but she evaded the blow by her ingenuity and tact. During the remainder of her life, however, she never again ventured to provoke the vengeance of the royal polemic.

As head of the church, the attention of the king was now principally turned to the management of its affairs. He enforced an observance of the six articles both by Protestants and Catholics, and any deviation from them was punished with tyrannical severity. He was very impartial in his distribution of what he called justice; and it was not uncommon for individuals professing opposite faiths to perish at the same stake. The Christian of those days had a difficult part to perform; for whilst the king renounced in one respeect the authority of the pope, he acknowledged it in another by his adherence to the doctrines of the church of Rome; so that it frequently happened that those who were against the head of it were burned, and those who were for him were hanged. In connection with church affairs, Henry effected a further dissolution of colleges, hospitals, and other foundations of that nature, with the spoils of which he enriched his treasury. He also extorted from many bishops a surrender of their chapter lands, and in this manner he succeeded in pillaging the sees of Canterbury, of York, and of London. Amongst the religious orders suppressed was that of the Knights of Malta, or, more properly, St John of Jerusalem. They obstinately refused to surrender along with the other monasteries who laid their rights at the feet of the king, and he was compelled to have recourse to parliament for the purpose of obtaining its authority for dissolving the order, which was very rich, and whose spoil was therefore precious in his sight.

For the purpose of maintaining a rigid purity in speculative principles, he nominated a commission of divines to make out a creed for the benefit of his subjects. In connection with this appointment a circumstance occurred which strongly marks the character of this reign, as well as of those who composed the council of the nation. Before the reverend conclave had made any progress in its arduous undertaking, the parliament passed a law which went to ratify all the tenets which the divines might establish in accordance with the king's consent. This clearly shows that the individuals composing that body, as well as the parliament, were merely ciphers, and that Henry was the initial unit which gave them value. A small volume was published under the title of *The Institution of a Christian Man*, which was made the infallible standard of orthodoxy. But the king's inconsistency was as strikingly exemplified in his religion as in his morals. A new book was ordered to be composed, and three years were spent before it could be brought to that desirable state of perfection which the king wished. At length, however, it came forth under the title of *A necessary Doctrine and Erudition for any Christened Man*; and in order to distinguish it from the former work upon the same subject, it was called emphatically the king's book. It taught the same doctrines as the preceding compilation, with the addition of transubstantiation and the sufficiency of communion under one kind. The new creed was generally approved of, and all writings in opposition to it were prohibited. From the period of the publication of the "king's book" until the accession of the next sovereign, it continued to be the only authorized standard of English orthodoxy. Henry had formerly sanctioned the publication of the Bible in English, and permission was granted to all his subjects to peruse it. But he afterwards retracted the liberty which he had vouchsafed them, and prohibited the reading of the Scriptures by the lower orders of the people under the penalty of imprisonment. The mass book was also examined, and some alterations were made upon it.

But to return to the political affairs of the nation; in the beginning of the year 1543 Henry renewed his friendship with the emperor, which had been suspended by the divorce question. They concluded an alliance against Francis; and on the 14th of July 1544 Henry crossed the seas in a ship furnished with sails of cloth of gold. The principal event of this war was the surrender of Boulogne, into which the English monarch made a triumphant entry on the 18th of September. But he shortly afterwards returned to England. On the 7th of June 1546 hostilities were concluded by a treaty, of which the principal stipulation was, that within eight years Henry should receive two millions of crowns, with arrears and costs, which are enumerated; and, on payment of these sums, Boulogne and its dependencies were to be restored to Francis. Henry's warlike propensities were also exercised in reference to Scotland and Ireland; but peace was finally restored after both countries had suffered considerably, especially the former. These wars, however, exhausted the treasury of the English monarch. He was compelled to extort money from parliament in his usual manner, and also to depreciate the coinage of the realm, which he had not scrupled to do before.

The cruelty of Henry continued conspicuous to the very close of his life. Disease made dreadful ravages upon his worn-out and unwieldy frame, so that he had to be moved from place to place by machines contrived for the purpose; yet even these unequivocal tokens of approaching dissolution had no effect in subduing the vindictive spirit or humanising the mind of the sufferer. It was in this pitiable state that he perpetrated an act which has become memorable from the fame of the illustrious victim. This was the execution of Henry Howard, earl of Surrey, so justly renowned for his poetical genius. There had for some time existed a spirit of rivalry between the Seymours and the house of Howard. The Duke of Norfolk was indignant at the ascendency of the former in the royal favour; and his son, the Earl of Surrey, could not forgive the Earl of Hertford, a member of the other family, for having superseded him in the command of the garrison of Boulogne; he had also been heard to predicate that the time of revenge was not far distant. The house of Howard alone stood in the way of the Seymours in the pursuit of their aggrandisement under the approaching minority; and they accordingly employed every means of drawing down the vengeance of the king upon their heads. Norfolk and Surrey were accordingly committed to the Tower on the 12th of December 1546. Surrey was tried on the 13th of January following, on a charge of having quartered on his shield the arms of Edward the Confessor. He vainly defended himself with his usual eloquence and spirit, and showed that he had worn the arms fourteen years without giving offence, and that they had been assigned to him by a decision of the heralds. But the fact being admitted, it was taken as sufficient evidence that he aspired to the throne, and the jury condemned him to suffer death. About a week after the sentence was pronounced, this gallant and accomplished nobleman expired upon the scaffold. His father was also tried and condemned to perish in the same manner on the 29th of January. But on the morning of the 28th the spirit of Henry VIII. followed that of Surrey to the judgment-seat; and Norfolk, after remaining in prison for several years, was at length set at liberty.

Henry VIII. is one of the most repulsive sovereigns to be met with in the list of English kings. There is a gross brutality about the man, and a remorseless tyranny and blood-thirstiness about the king, which totally obscure any human features which his character may have possessed. Some of his crimes are of so dark a dye, and so peculiarly diabolical, as to make the mind shudder at the very mention of his name. It is difficult to extend charity to, or rank with ordinary humanity, one who could repeatedly hurry from his arms to the scaffold those whom he had loved and embraced with passionate tenderness, if such language may be used in reference to any feeling which animated the breast of such a barbarian. It was after the fall of Wolsey that the prominent features of Henry's moral deformity fully developed themselves; and they are such as have attached to his name a degradation which can neither be removed nor palliated. For the good which he was the means of doing, in sanctioning a reformation in the affairs of the church, he deserves no credit; for it originated in a spirit of vindictive revenge, and was perpetuated by plunder and cruelty. Henry was not destitute of ability; and the esteem which we may infer he entertained for literature, since he patronised learning, is one of the few traits of his character which are not repulsive and odious.

Henry was succeeded by his only son Edward, a boy of nine years of age. He was proclaimed king of England on the 31st of January 1547, and crowned in the month following. The most remarkable transactions of his reign are those connected with religion. The restraint which Henry VIII. had laid upon the Protestants was now taken off; and they not only maintained their doctrines openly, but soon became the prevailing party. Henry had fixed the majority of his son at eighteen years of age; and, in the mean time, appointed sixteen executors of his will, to whom, during the minority, he entrusted the government of the king and kingdom. But the first act of the executors was to choose the Earl of Hertford, afterwards Duke of Somerset, protector of the realm; and in him was lodged all the regal power, together with a privilege of naming his own privy council.

The Duke of Somerset had long been numbered amongst the secret partisans of the reformers; and, immediately on his elevation to his high dignity, he began to express his intention of reforming the abuses of the ancient religion. Under his direction and that of Cranmer, therefore, the reformation was vigorously carried forward; persecutions under the act of the six articles ceased, prisoners were released, and exiles were recalled. Homilies were composed by Cranmer, and ordered to be read by parish priests to their congregations. Visitors were appointed to inspect ecclesiastical establishments, and see that four sermons were yearly preached against the papal authority; that the worship of images should be denounced, and those who were the objects of pilgrimages and offerings should be destroyed; that the English Bible, with Erasmus's commentary on the gospels, should be placed in every church for the use of the people; together with many other points, which, without being very important in themselves, were calculated to assure the people that the government was no longer neutral in matters of religion. The principal person who opposed these innovations was Gardiner bishop of Winchester; a man of great learning, abilities, and resolution, but one of Henry's devoted agents in the suit for a divorce from Catherine, his first queen. He made a manly and becoming resistance to these injunctions, from principles of civil liberty, as much as of ecclesiastical discipline. To the disgrace of their own principles, the reformers now displayed as virulent a spirit of persecution as the Catholics had formerly done. Gardiner was committed to the Fleet prison, where he was treated with great severity. He was afterwards sent to the Tower; and having continued there two years, he was commanded to subscribe several articles, amongst which was one confessing the justice of his own imprisonment. To all the articles but this he agreed to subscribe; but that did not give satisfaction. He was then committed to close custody; his books and papers were seized; all company was denied him; and he was not even permitted the use of writing materials. Bonner of London, more violent and more subservient, escaped protracted imprisonment by obsequious submission. Several bishops also screened themselves by sacrificing a considerable share of their revenues; others were deprived of their offices; and Tunstal bishop of Durham, an eminent prelate, was ejected from the privy council, in order to impress on the people by a strong example the disinclination of the protector to the ancient faith. In November 1547 a parliament was assembled, in which several bills were passed to promote and enlarge the reformation. The communion was appointed to be received in both kinds by the laity as well as by the clergy, without condemning the usages of other churches. Bishops were to be nominated by the king, and process was to run in the king's name in ecclesiastical courts. The statutes against the Lollards were repealed, as well as all the acts of Henry VIII. upon religious matters, excepting those directed against the supremacy of the pope; and other acts relating to civil affairs were also abrogated. In the next session uniformity in public worship was established, in which the use of the book of common prayer, as prepared by the primate and his brethren, was enjoined. This composition is the foundation of that which, having undergone various alterations in subsequent reigns, continues in use at the present day. By one law the observance of fast days and of Lent was enjoined under penalties; and by another the English clergy were emancipated from compulsory celibacy.

The rest of this reign presents little but the history of the intrigues and cabals of courtiers. There was a war with Scotland, which began with injustice and was conducted with inhumanity. Insurrections also took place in Ireland, where the reformation made no progress. The details of these transactions will be given in the articles SCOTLAND and IRELAND. The protector was first opposed by his own brother Admiral Sir Thomas Seymour, who had married Catherine Parr, the late king's widow. She died soon after the marriage; and the widower is said to have then paid his addresses to the Princess Elizabeth. His brother the duke, who was at that time in the north, being informed of his ambitious projects, speedily returned, had him attainted of high treason, and at last condemned and executed. The Duke of Somerset himself, however, became unpopular, and a powerful confederacy was formed against him, at the head of which was Dudley earl of Warwick. This nobleman succeeded in overthrowing the power of the protector, and getting him committed to prison on the 13th of October 1549, whilst he himself was installed in the office of lord high admiral. In the month of February following Somerset was released upon payment of a fine and ransom; but towards the end of 1551 he was again sent to the Tower, tried for high treason and felony, and condemned. He was acquitted of the first charge, but not of the second, as he ought to have been. He suffered upon the scaffold on the 22d of January 1552. Warwick, now duke of Northumberland, had thus the reins of government entirely at his own disposal. Not satisfied with the office of protector, he aimed at altering the succession, and placing the crown upon the head of his son. He represented to Edward, who was now in a declining state of health, that his sisters Mary and Elizabeth, who were appointed by Henry's will to succeed to the crown, in failure of direct heirs, had both been declared illegitimate by parliament; that the queen of Scots, his aunt, stood excluded by the king's will; and being also an alien, lost all right of succeeding. The three princesses being thus excluded, the succession naturally devolved upon the Marchioness of Dorset, eldest daughter of the French queen, Henry's sister, who had married the Earl of Suffolk after her first husband's death. The next heir to the marchioness was Lady Jane Grey, the wife of Northumberland's fourth son, Lord Guildford Dudley. The king, who was accustomed to submit to the politic views of this minister, agreed to have the succession altered, and sketched with his own hand a draft of the new destination of the crown, which was submitted to a council. The judges, however, were far from acquiescing in the proposal contained in this instrument; and they hesitated to sign it, because it would subject those who had drawn and those who had advised it to the penalties of treason. Their hesitation excited the rage of Northumberland, who threatened them with his authority, and, pronouncing them traitors, declared that he would fight in his shirt with any man in so just a cause as that of Lady Jane's succession. A new paper was drawn up, by which the judges were screened from any consequences which might have resulted from their signing of it. By the new patent for changing the succession, the princesses Mary and Elizabeth were set aside, and the crown settled upon the heirs of the Duchess of Suffolk, who was contented to forego her own claim.

For some time the king had languished under a pulmonary complaint, and symptoms of an advanced stage of consumption began to make their appearance. After the settlement of the crown, his health visibly declined every day, and little hopes were entertained of his recovery. The deathbed devotions of Edward bear testimony to his love for his subjects, and his zeal for what he believed to be the purest form of Christianity. "O Lord, save thy chosen people of England, defend this realm from papistry, and maintain thy true religion." Such is a specimen of the supplications which this pious and short-lived prince breathed forth. On the 6th of July 1553, Edward, being then in the sixteenth year of his age and seventh of his reign, breathed his last. Whilst he filled the throne of England, no Roman Catholic had suffered death on account of his religion. By his gentleness and docility he was indisposed to shed blood, and, on the whole, his reign was more free from religious persecution than any administration of the same length, in any great country of Europe, since the rise of protestantism. In abilities he was equal, probably superior, to most boys of his years; but the flattering praises lavished upon him by his panegyrists are to be received with abatements. It was his dying wish that Lady Jane Grey, the companion of his infancy, should be his successor.

The death of Edward was carefully concealed for two days; but on the 8th of July the event was communicated to the ambassadors, and the civic functionaries of London were ordered to make preparations for the coronation of Lady Jane Grey. The intelligence was transmitted to Mary by her friends at court, and on the 9th she wrote a letter to the privy council, expostulating with them upon their conduct; and, solemnly affirming her right, she tendered a pardon to them if they would order her immediate proclamation. The council, however, adhered to the interests of Jane, and both parties prepared to decide the contest by an appeal to arms.

When Edward's death, and her own elevation to the throne, were announced to Lady Jane, she was thrown into a state of great agitation. The manner in which she was affected will be best understood from a passage in a letter of hers which she afterwards transmitted to Mary. "As soon as I had, with infinite pain to my mind, understood these things, how much I remained beside myself, stunned and agitated, I leave to those lords to testify who saw me fall to the ground, and who knew how grievously I wept." She urged the preferable claim of the princesses to inherit; but being pressed by the authority of the judges, she at length consented to accept of the royal dignity. She suffered herself to be conveyed to the Tower, and on the same day the heralds proclaimed the death of Edward and the succession of Jane. Mary was also proclaimed at Norwich, and it is somewhat singular that the populace took no interest in either of the proclamations. No shouts of applause or outward demonstrations of joy followed the announcement of the choice of a new sovereign. Northumberland was unpopular, a great part of the Protestants cooperated with the Catholic partisans of Mary, who were numerous and powerful; and the protector, by his supineness, allowed them to assemble in great force at Framlingham Castle, in Suffolk, where the princess had fixed her residence. Northumberland became alarmed, and although he had assembled a considerable army, his heart failed him when he saw the demonstrations which were made by the people in favour of Mary. He had taken the field in person, which was a fatal step; for his absence afforded an opportunity to the adherents of Mary who were in the council to make arrangements for exalting her to the royal dignity. It is sufficient to observe that they effected their purpose. Mary was proclaimed, and Jane, after a ten days reign, resigned the crown with a great deal more satisfaction than she had accepted of it. Northumberland had been compelled to proclaim Mary at Cambridge; but this did not prevent him from being led a prisoner to the Tower, which had lately been his palace.

Mary, accompanied by her sister Elizabeth, made her triumphal entry into London on the 3d of August 1553. Her attentions were first turned towards those who had suffered in her cause. She released several prisoners from the Tower, amongst whom were the aged Duke of Norfolk, and her kinsman Edward Courtenay, whom she soon afterwards created Earl of Devonshire. On the 18th of August the Duke of Northumberland, the Marquis of Northampton, and the Earl of Warwick, were tried for high treason; and on the following day Sir John Gates, Sir Henry Gates, Sir Andrew Dudley, and Sir Thomas Palmer, were tried for the same offence. Of the culprits who were condemned, three were selected for execution, Northumberland, Sir John Gates, and Sir Thomas Palmer, who suffered upon the scaffold on the 22d of August.

The mind of Mary now became solicitous about the affairs of religion. All the deprived Catholic bishops were restored. The acknowledged abilities of Gardiner soon raised him to the post of prime minister. He early received the custody of the seals, and not long afterwards he was appointed chancellor. The Protestant bishops, in the eyes of their Roman Catholic brethren, had incurred deprivation by marriage, or still more severe penalties by preaching heresy. On the 2d of September Cranmer was committed to the Tower, and on the 13th Latimer followed him into the same captivity. The latter, in point of moral heroism, was the antipodes of Cranmer, who was gentle and kind, timid and pliant. Latimer was brave, sincere, and inflexible. As he passed through Smithfield on his way to the Tower, he remarked, "Smithfield has long groaned for me." By an early proclamation Mary had declared that "she could not hide her religion, but that she mindeth not to compel any of her said subjects thereunto, until such time as a farther order by common consent shall be taken therein." The "farther order" did take place, although not in accordance with "common consent." On the 5th of October 1553, parliament assembled, and, in a session of nineteen days, passed only three acts; one for the abolition of all the treasons and felonies of Henry VIII.; another for the restoration in blood of Gertrude marchioness of Exeter; and a third for the like restitution of that lady's son, Edward Courtenay, now Earl of Devonshire. But on the 24th of the same month, several important acts were passed, by which the road was paved for the re-introduction of the Roman Catholic faith as the creed sanctioned by royalty. By these acts Henry's divorce was declared void, and his first marriage pronounced valid; so that the claim of Elizabeth, on whom the Protestants had fixed their eyes with anxious hope, was virtually set aside. But the progress of the revolution in religious matters was slow; and before the perfect re-union with the Church of Rome was consummated, several events of considerable importance took place. Mary having been crowned at Westminster with the usual solemnity on the last day of September 1553, it now became the interest of the Catholic party to obtain a suitable marriage for her. Of natives only two were proposed to her choice, both descended from the house of York; these were Cardinal Pole, and Edward Courtenay, the individual whom she had released from confinement. But the Emperor Charles having heard of Mary's intention to choose a husband, proposed his son Don Philip. This Spanish match was so broad and decisive a step towards Rome, that the House of Commons took the alarm, and presented an address to the queen, in order to dissuade her from her purpose. She returned a haughty answer; and on the 30th of October, having conducted the imperial minister into her private oratory, she there solemnly called God to witness that she plighted her troth to Philip prince of Castille. To obviate all clamour, the articles of marriage were drawn up as favourably as possible for the interests of England. It was agreed that though Philip should have the title of king, the administration should be entirely in the queen; that no foreigner should be capable of holding any office in the kingdom, nor should any innovation be made in the laws, the customs, and the privileges of the people; and that Philip should not carry the queen abroad without her consent, or any of her children without the consent of the nobility. Sixty thousand pounds a year were to be settled upon her as a jointure, and the male issue of this marriage were to inherit Burgundy and the Low Countries as well as the crown of England; and in the event of the death of Don Carlos, Philip's son by his former marriage, without any heir, the queen's issue were also to inherit the rest of the Spanish dominions.

All these concessions, however, were not sufficient to quiet the apprehensions of the people. They were considered merely as words of course, which might be retracted at pleasure; and the nation murmured loudly against a transaction so dangerous to its ancient liberty and independence. The Duke of Suffolk, a zealous Protestant, attempted to excite his tenants in Warwickshire to revolt; but with little success. His followers were routed by Lord Huntingdon, and he himself was betrayed into the hands of his enemies. An insurrection was also raised by Sir Thomas Wyatt, a Roman Catholic, at the head of four thousand men, who set out from Kent to London, publishing a declaration against the Spanish match and the queen's evil counsellors. Having advanced as far as Southwark, he required that the queen should put the Tower of London into his hands; that she should deliver four counsellors as hostages; and that, in order to ensure the liberty of the nation, she should marry an Englishman. But his force was still by far too inconsiderable to support such magnificent pretensions, although it was afterwards augmented to fifteen thousand men; and he unluckily wasted so much time without attempting any thing of importance, that the popular ferment entirely subsided, his followers gradually abandoned him, and he was at last obliged to surrender himself near Temple-Bar to Sir Maurice Berkeley, who committed him to the Tower, where, in a short time, he was joined by the chief of the surviving conspirators. The nobility and gentry immediately repaired to St James's to congratulate the queen on the suppression of the rebellion. But two were excepted; Courtenay duke of Devonshire, and the young Earl of Worcester, who, on the first approach of the enemy, had turned their horses' heads and fled. On the 3d of November 1553, Lord Guildford Dudley and Lady Jane Grey had been convicted of high treason. Lady Jane and her husband were both only in their seventeenth year, and no time was fixed upon for their execution; but the revolt of Suffolk, Lady Jane's father, proved an incentive sufficiently strong to prevail over the slender pity of bigots and politicians, and the sacrifice was consummated.

On the 8th of February Mary signed a warrant for their execution, and on the 12th of the same month it was put in force. Lord Guildford Dudley had requested an interview with his beloved wife, who, however, declined the meeting, justly fearing that it might unfit them for the dreadful scene through which they were about to pass. She saw him issue through the gate of the Tower to the scaffold; and soon afterwards, in chancing to look from the same window, she saw the bloody carcass, half covered in the vehicle which bore it back from the place where vengeance and injustice, disguised under the name of law, had done their worst. Lord Dudley was beheaded on Tower-Hill; but his wife, on account of her royal descent, was spared the ignominy of a public execution. Lady Jane Grey is celebrated as exhibiting a matchless union of beauty with genius, and learning with virtue and piety. She astonished the learned of Europe by her talents and accomplishments, and will be recognised by all posterity as one of the purest and most amiable of historical characters. Were Mary chargeable with no other atrocity than that of putting Lady Jane to death for the crime of a father (for it was on his account that the daughter suffered), it were quite sufficient to cover her memory with irremoveable degradation. "It was a death," says Sir James Mackintosh, "sufficient to honour and dishonour an age." Suffolk, her father, perished in the same manner a few days afterwards. Sir Nicholas Throgmorton was tried, but the defence which he made was found so good in law, that the jury acquitted him. Above sixty others of the conspirators were condemned to the block, amongst whom were Lord Thomas Grey the brother of Suffolk, and Wyatt the principal mover of the rebellion.

This revolt had very nearly proved fatal to the Princess Elizabeth, who for some time had experienced harsh treatment at the hands of her sister. Mary, upon whom the mantle of Henry VIII. had descended, felt antipathy to her on account of the quarrel between their mothers. This circumstance, in the mind of one whose tender mercies were cruel, was sufficient to change the milk of sisterly affection into mortal venom; and a favourable opportunity was only necessary to make her feel its deadly effects. Nearly a month was spent in labouring to extract information against Elizabeth from Wyatt whilst he lay in prison. But the unfortunate gentleman honourably acquitted her, although he might, in all probability, have saved his own life by implicating her in the late rebellion. At Ashridge, whither she had retired to escape the constrained participation in a worship which she disapproved, overtures had been made to her by the chiefs of the revolters; but her acceptance or consent was neither shown nor seriously alleged. Immediately after Wyatt's discomfiture, she was conducted to London in a very infirm state of health. It was doubted whether she would reach her destination alive; but youth and strength triumphed over the malady with which she was affected. Courtenay earl of Devonshire was also arrested, and committed to the Tower. Two councils were held on the fate of Elizabeth, and the judges were divided in their opinions as to her guilt. Gardiner, although he professed to think Elizabeth deserving of death, yet considered her confinement at Ashridge, and Courtenay's residence at St James's, as irreconcilable with a just conviction of treason. The head and front of her offending seems to have been misprision, or concealment of projects of revolt, which was now not a capital crime. It was fortunate for Elizabeth that one of the first measures of her sister, when she ascended the throne, was to sweep away the odious heap of treasons raised up by her father, and the punishment of misprision with death was one of them. But Elizabeth, although absolved from a capital charge, was nevertheless committed to the Tower; and shortly afterwards she was put under the charge of Sir Henry Bedingfield, keeper of Woodstock. During her stay in the Tower, the princess had no other expectation than that of mounting the scaffold which had been trodden long before by her unhappy mother, at her father's stern behest, and on which the blood of Lady Jane Grey, the purest of the pure, was scarcely dry. When Bedingfield came with his soldiers to conduct her to Woodstock, she asked, with her usual quickness and poignancy, "Is the scaffold of Lady Janet taken away?" A few days later, Courtenay was transferred from the Tower to Fotheringay Castle.

The rebellion had suspended for some weeks the proceedings relative to the queen's marriage. But in the beginning of March the English ambassador returned from the Continent with the ratification of the treaty; and Philip landed at Southampton on the 19th of July 1554, attended by a magnificent train of Spanish grandees and Burgundian lords. The marriage between him and Mary was solemnized by Gardiner in his cathedral at Winchester, before crowds of noblemen from all parts of Christendom, and with a pomp and splendour seldom surpassed. Philip was then in the twenty-ninth year of his age, and Mary in her thirty-eighth year. The countenance and form of the prince were far from being disagreeable; but the stately reserve of his Spanish manners was not calculated to lessen the repugnance of the English people to the union.

Soon after her marriage, Mary resolved to restore the religious polity of the kingdom to that state in which it had existed at the time of her birth. Accordingly, on the 12th of November a parliament was holden for this purpose, and a bill passed both houses "for the restitution in blood of the Lord Cardinal Pole." But a difficulty arose regarding the abbey lands; for it was feared that those who possessed them in spite of the indelible claims of the church might be called before the tribunal of the pious cardinal. However, on the 20th of November, Pole arrived at Dover, armed apparently with ample powers to do every thing necessary for the reconciliation of England with the church of Rome; and amongst these was full authority to do with the abbey lands as he thought fit. Nine days after his arrival, he made an oration to the two houses, exhorting them to return to the bosom of the universal church, at the same time absolving the kingdom from the papal interdict. The request was formally acceded to, and Pole was enabled to announce to the pontiff the success of his mission. In order to quiet the possessors of church property, the legate issued his dispensation, declaring that they should not be molested; and a statute passed confirming his sentence. By another, the acts which had abolished the papal supremacy were repealed. This new restoration of power to the papacy formed a sad and dark augury for the devoted Protestants. It was the first indication that the time approached when the fires of persecution were to blaze forth in every county of England, and when heaven was to be insulted by the profanation of its sacred name as sanctioning the foulest deeds of blood.

An act was passed by the parliament of 1554 for the revival of the statutes of former sovereigns against heretics, and especially against Lollards; which revival was to take effect from the 20th of January 1555. During the last reign, no Roman Catholic had suffered capital punishment on account of his faith, nor does there appear to have been any kind of jurisdiction or mode of procedure for the trial of heresy, although the law remained in full force against anabaptists and anti-trinitarians, whose doctrines were looked upon both by Catholics and Protestants as sapping the very foundations of Christianity. It has been alleged by the opponents of Protestantism, that in *The Reformation of Laws*, composed in the latter part of Edward's reign, there are indications of a preparation for lighting the faggot against the adherents of the ancient religion; and as the point is of some importance, we shall avail ourselves of the following observations by Sir James Mackintosh, which seem to put the matter in its true light. Referring to the allegation that severity against the adherents to Catholicism was about to be put in execution, he says,

"This statement is chiefly grounded on a text of that projected code, which directs that contumacious and incorrigible heretics, after all other means have been exhausted, shall be at length delivered to the civil magistrate to be punished. It is assumed that the punishment must be death. Yet in the very first article of the code, which relates to atheists and unbelievers in Christianity, death is denounced against them in express words.

"The admission of it into another article by mere implication is therefore unreasonable. It is too terrible an enactment to be admitted without express words. If punishment is held to be synonymous with capital punishment, by force of this clause death must be applied to all heresies. If it was intended to confer on the civil magistrate a large discretion in the infliction of inferior punishments for the enumerated heresies, the article is perfectly agreeable to the practice of the framers and the opinions of the times. It is incredible that capital punishment could be denounced against the whole of a long series of heresies, of which the catalogue nearly occupies twenty quarto pages, besides what is called a monstrous heap of other errors, less necessary to be specified, as being less prevalent in that age. Even admitting this unreasonable construction of the plan for a reformed code, it affects only the reputation of the projectors. It never was adopted by public authority. It was not laid before parliament. There is no reason to doubt that the Protestant parliament would have altered the very articles in question, if, when they were communicated to that assembly, they could be supposed to establish or countenance a practice perfectly at variance with that of the king and parliament of England in the reign of Edward VI. To hold that a few words in a Latin manuscript, of projected but not adopted laws, not printed till many years afterwards, could have been the incentive of those who kindled the fires of Smithfield under Mary, is one of the most untenable of all positions. Truth and justice require it to be positively pronounced, that Gardiner and Bonner cannot plead the example of Cranmer and Latimer for the bloody persecution which involved in its course the destruction of the Protestant prelates. The anti-trinitarian and the anabaptist, if they had regained power, might indeed have urged such a mitigation, but the Roman Catholic had not even the odious excuse of retaliation."

The year 1555 opened with gloomy forebodings for the reformed clergy; and ere a month had expired, the lowering tempest burst upon them with unexampled fury.

On the 28th of January a commission, with Gardiner at its head as lord chancellor, assembled in the church of St Mary Overies, in Southwark, for the trial of Protestants. From the station which this individual held, and from his commanding talents, there appears to be little doubt that he was instrumental in pushing forward this bloody work, although some writers have attempted to remove this reproach from his character. Whether he was the main author or not, is a matter of comparatively little importance. As lord chancellor, and as head of the commission, he sanctioned the whole proceedings. He must therefore be held responsible for the deeds of those who acted under his authority, and suffer the lash of posterity, in the same way as Cromwell, on whom Catholic writers have poured out the vials of their wrath, from his having acted as captain of the banditti who plundered the holy places in the reign of the eighth Henry.

The first martyrs in this persecution were Hooper bishop of Gloucester, and Rogers, a clergyman of Essex, both eminent divines of the reformed cause. They died with feelings of triumphant piety in the midst of suffocating flames; and other victims were rapidly hurried to the stake. The principal were, Archbishop Cranmer, Ridley bishop of London, and Latimer bishop of Worcester. (See CRANMER.) These persecutions soon became odious to the whole nation, and the perpetrators of them were all willing to shift the blame from themselves upon others. Many of the Catholic prelates, to their honour, exercised occasionally an effectual and perhaps hazardous humanity in their favour. Gardiner himself withdrew from this unavailing slaughter, and his place was supplied by Bonner bishop of London, a less scrupulous dealer in blood. Even Philip himself was moved to pity, and discountenanced these diabolical proceedings. To describe the sufferings of those persons of eminence and distinction who perished, would fatigue the patience and harrow the feelings of the reader. For four years the persecution was carried on with unsatiated cruelty; and, keeping out of view those who perished in dungeons under every form of misery, and also those who expatriated themselves, nearly three hundred individuals are calculated to have expired at the stake. We are positively informed by Lord Burghley, that in this number of victims are comprised no less than one hundred women and children. The perpetrators of these "more than heathen cruelties" deserve no quarter from posterity; such deeds as those laid to their charge stamp infamy deep on their names, and hold them up to execration now and for ever.

The other events of this reign unconnected with religion are, with the exception of the loss of Calais, unimportant. The reduction of this town had cost Edward III. a siege of eleven months, and the English standard had waved over its battlements for above two centuries. It surrendered to the arms of France after a siege of only eight days, and its loss so affected the queen, that when lying on her deathbed she said, "If you open me you will find Calais written on my heart." Philip, her husband, appears to have treated her with formal but cold respect.

He had succeeded to the greatest monarchy then in the world, and had been some time absent from England in superintending its affairs. He returned again, but his departure a second time left Mary to brood over her fruitless barbarity alone. She had more than once entertained the nation with rumours of her pregnancy, and was herself cheated with the illusive hopes of offspring. But this Shiloh of the ancient faith, like that of a celebrated dreamer of after times, was the manifestation of a deadly disorder. She died of dropsy on the 17th of November 1558, to the unspeakable relief of the greater portion of her subjects.

It is customary to load the name of Queen Mary with every kind of opprobrium. But in estimating human character, care should always be taken to distinguish between acts committed under the influence of religious principles, and agreeably to conscience, however erroneous such convictions may be, and those perpetrated from the sheer brutality of passion, or from an instinct of cruelty and bloodshed. That the atrocities of Mary belong to the former class of crimes, we have little hesitation in saying, even with the case of Lady Jane Grey before us. Her ministers, also, must share with her no inconsiderable portion of the odium which is always associated with her reign, for to their errors or prejudices much of the misery which she caused must be ascribed.

Although in the private life of Mary there is much to praise, yet her nature was sour and unamiable, and almost destitute of that tenderness which peculiarly distinguishes the female character. Whether or not she was a tyrant like her father, she was at all events pre-eminently fitted for becoming the tool of tyrants. She was not remorseless, for she is reported to have suffered much on account of her conduct towards the Protestants, but unfortunately her conscience never took effect in time.

After the death of Mary, the Princess Elizabeth succeeded to the throne without opposition. She was at Hatfield when the news of her sister's death were brought to her, and hastening to London immediately, she was received there with great joy. For the preservation of her life this princess was indebted to Philip, the husband of Mary. The Spaniard was aware that her death would remove the only obstacle which stood between Mary of Scotland and the throne of England. That sovereign had been married to the heir-apparent of France, his great political enemy; and the balance of power which might thus be thrown into the hands of the latter would have endangered the stability of Philip's throne; a circumstance which induced him to this unusual act of liberal humanity. The first measure of Elizabeth was to assemble around her throne a body of counsellors who had recommended themselves to public notice by the power of their talents or the steadiness of their principles. Her state council was composed of both Catholics and Protestants, although her more confidential advisers were confined to a select portion of the latter, and amongst these was Sir William Cecil, whom she appointed her first secretary. Precautionary measures were taken to meet any invasion on the part of France in order to raise Mary Queen of Scots to the throne; for the government of that country had made demonstrations to this effect, by instigating Rome to hostilities against Elizabeth. Mary had left a vacant treasury, and one of the first cares of the new administration was to obtain pecuniary supplies; and, from the high character and popularity of the queen, these were immediately granted by the people. Her coronation was then celebrated with all possible splendour and festivity.

To establish the Protestant religion was Elizabeth's most ardent desire. With this view the statutes passed in the late reign for the support of the ancient faith were repealed; and the acts of Henry VIII. in derogation of the papal authority, and of his successor in favour of the reformed church, were for the most part revived. There were some deviations in the new book of common prayer from the liturgy of Edward VI., but of these only two are important. The first consists in the omission of a prayer to be freed from the "tyranny of the bishop of Rome and all his detestable enormities;" which certainly displayed a conciliatory spirit towards the Catholic church. The second was an alteration of the language which spoke of the sacrament as being only a remembrance of the death of Christ, and the substitution of words which indicate the real but not corporeal presence. Towards the middle of 1559 the Protestant liturgy was introduced, and the oath of supremacy administered. Strong opposition to it was evinced on the part of the clergy, especially amongst those of a dignified station; and out of sixteen bishops only one took the oath tendered to them. But the lower orders were less scrupulous; and it is probable that in many instances necessity induced them to make a compromise with their consciences. Those of the clergy who refused compliance with the new code of religious doctrines were deposed, and their places supplied by professors of the reformed religion. According to the standard of punishments which followed contumacy in these ages, the treatment of the bishops was mild. Bonner was imprisoned; but he was a man so empurpled with blood as to be odious to all parties. This was the highest degree of suffering to which any of the nonconformists were subjected.

During the time that the queen and her counsellors were thus settling the religious affairs of the nation, negotiations were carried on between England and France for a peace, which was at last concluded on the following terms, viz. that the French king should restore Calais at the expiration of eight years; that in case of failure, he should pay five hundred thousand crowns, and Elizabeth's title to Calais should still remain; that for the payment of this sum he should find the security of eight foreign merchants, not natives of France; and that until such security was provided he should deliver five hostages. If during this interval Elizabeth should break the peace with France or Scotland, she was to forfeit all title to Calais; but if the French king was to make war on Elizabeth, he was to be obliged to restore the fortress immediately.

The reign of Elizabeth for the first eleven years, that is, from the twenty-fifth to the six and thirtieth year of her life, was distinguished for the internal quiet and happiness of the country. During this interval she displayed the very best qualities of a sovereign; firmness, prudence, vigilance, activity, and foresight. These qualities were tempered with habitual amenity, and a rational piety. By her subjects she was admired, applauded, and imitated; and during this halcyon period her throne received an accession of strength which enabled it to stand unshaken amid the tumultuous storms with which it was afterwards assailed. She was repeatedly advised to engage in a matrimonial alliance, but uniformly declined to do so, declaring her resolution of remaining single for life. Amongst her suitors were various foreign princes, Catholic as well as Protestant; and some of her own subjects even presumed to intrude their offers upon her "maiden meditation," but without success. During the religious war which raged in France, Elizabeth, ever ardent in the cause of the reformation, assisted the Huguenots with arms and money.

In the mean time the pretensions of Mary, queen of Scotland, to the crown of England, involved Elizabeth in transactions which have left a stain upon her name. Mary, who was espoused to the dauphin of France, had quartered the arms of England with those of France and Scotland upon her escutcheon; and to this she was advised by the Catholics, who looked upon Elizabeth as a usurper, having been illegitimised in her youth by the cruel mandate of her father at the time when he consigned her mother to the block. The result of this appropriation of the armorial bearings of the English sovereign was a quarrel between the two princes, which only terminated with the execution of the unfortunate queen of Scotland. See the articles MARY and SCOTLAND.

In 1569 Elizabeth was excommunicated by Pope Pius V. These anathemas, by absolving subjects from the oath and the duty of allegiance, and suspending the offices of religion, and even those of humanity, were sometimes most disastrous to a country, upon which they descended like a deadly epidemic. But the majority of the queen's subjects were of the same religion with herself, and had thrown off the papal yoke; so that it was in the present instance productive of no other effect than the publication of a severe act against all who held any communication with the bishop of Rome. Severe measures were also taken with the puritans and other dissenters. At this time the English nation was divided into three theological and political parties; the *Churchmen*, who considered the ecclesiastical revolution as already perfect; the *Puritans*, who sought further reformation by agitating the minds of the people; and the *Catholics*, who, supported by the great continental powers, did not yet despair of seating their religion upon the throne. But men of all these persuasions united in their abhorrence of anabaptists; and, in order to extirpate them, the fires of Smithfield were, after an interval of seventeen years, re-kindled. Fox the celebrated martyrologist dared to interfere in behalf of this hated sect; but his courageous humanity obtained for them only a temporary respite. Two men were burned, and numbers were imprisoned or otherwise corporally punished. These events took place about the middle of the year 1575, and this was the first blood spilt by Elizabeth on account of religion; it, however, forms a dark stain upon her government, which may be pronounced mild when compared with others of the same period. The blood of Henry VIII. was not yet sufficiently purified in this its first descent from the fountain-head.

Amongst the other domestic events connected with the history of England, was that of the rebellion of Percy earl of Northumberland, and Neville earl of Westmoreland. This revolt partook both of a civil and of a religious character, for the noblemen at its head were adherents of the ancient faith, and were encouraged to embark in their lawless enterprise by the Catholic states. But on the approach of the royal troops under Sussex, the insurgents broke up and fled. Northumberland was made prisoner in Scotland, and executed at York; and Westmoreland died in Flanders, in the humble capacity of commandant of a Spanish regiment. Other treasonable transactions originated with the Duke of Norfolk, whose vaulting ambition aspired to the hand of Mary queen of Scots. Indeed he and the two insurgents just named, together with several other nobles, united in a conspiracy against Elizabeth. The timely arrest of Norfolk, however, disconcerted the confederacy, of which the northern rising was merely a premature explosion. Mary of Scotland is positively asserted to have been a participator in the plot. Norfolk was brought to trial; and there seems little doubt that he had incurred the penalties of treason, by having had intercourse with Catholic princes who had undertaken to land in England with a hostile army, and by his clandestine renewal of negotiations for the delivery and espousal of Mary, at that time a prisoner in the hands of Elizabeth. He was condemned to death, and executed, after a great deal of hesitation on the part of the queen.

England now began to distinguish herself in her natural career of maritime enterprise. Amongst the most distinguished of the nautical adventurers of this age was Sir Francis Drake, whose exploits will be found related under the article DRAKE. A vague rumour had for some time pervaded Europe, of vast naval preparations by the king of Spain, for the invasion and conquest of England. In 1587 Sir Francis Drake having been dispatched with a fleet to attack the Spanish ships which lay in the bay of Cadiz, was completely successful in his enterprise, burning and destroying above one hundred vessels laden with ammunition and naval stores. The fruits of his expedition were of vast importance. Philip's preparations were disturbed, and his project of invasion put off for twelve months, during which period Elizabeth had time to make head against the storm which was gathering in that quarter. These were the obvious results of Drake's bravery; but who can estimate the moral effect which it had produced? It gave a heroic impulse to the nation, and inspired it with confidence in its own strength and resources. It taught English seamen to look without terror upon the towering bulk of the Spanish vessels; whilst the Spaniards themselves must have in a proportional degree lost the confidence of having an advantage over the enemy by means of their floating castles.

The king of Spain having once more completed his complement of vessels, manned them with the ablest seamen and soldiers, under the command of the most renowned leaders. This Armada was truly imposing and magnificent; it was baptized The Invincible, but not with English blood. Never before had the ocean borne a more splendid fleet than that which sailed from the Tagus on the 25th of May 1588. The ships and their equipments had been fitted out in every port of its king's dominions. In Flanders, the forest of Waes had been felled; the dockyards of Antwerp, Dunkirk, Newport, and Gravelines swarmed with artificers; and the rivers and canals were covered with boats adapted for the transport of soldiers destined to serve in the expedition. On the 20th of May the following enumeration of the vessels was made: "The general sum was 130 ships, of 57,868 tons; 19,295 soldiers and 8450 mariners, with 2088 slaves, and 2630 great pieces of cannon of all sorts; also twenty caravals for the service of the others, with ten salvers of six oars a piece." Towards the end of June another armament of eighty sail left Lisbon to join them.[1] To meet this overwhelming armament the royal navy of England mustered 181 ships, containing between seventeen and eighteen thousand seamen. There were only eight ships above five hundred tons burden, and the largest was only eleven hundred. The aggregate burden of the whole English fleet amounted to 31,985 tons, being little more than one half of that of the Spaniards. The preparations made on land displayed equal spirit and enthusiasm. A loyal patriotism and active magnanimity pervaded the whole kingdom. The city of London set a noble example. The lord-mayor, in the name of the metropolis, put at the disposal of his sovereign ten thousand soldiers and thirty vessels. The whole nation emulated this wise liberality; and every city, town, and hamlet poured forth its ardent patriots to take their stand upon the coast and repel the insulting invader. About fifty thousand men under the command of Earl Hunsdon, a brave and able general, guarded the queen's person. The Thames at Tilbury was watched by Leicester with a considerable force. Sir Walter Raleigh was stationed at Portland Castle, in Dorsetshire, and the Earl of Sussex at Portsmouth. In the other parts of the country the wisest measures of defensive warfare were adopted. At sea one division of the fleet under Lord Henry Seymour guarded the narrow seas; whilst the main body under Lord Charles Howard, the high admiral, was stationed in the Western Ocean. The gallant Sir Francis Drake and the able navigators Hawkins and Frobisher were in this division.

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[1] Strype, p. 538-9, from the Spanish book, which rather styled the whole "Felicissima Armada."

Under the Duke of Medina Sidonia, the Spanish Armada set sail for the invasion of England. It was for some time retarded by a tempest, which also harassed the English fleet; and news were brought to the queen of England that Medina's Armada had been so injured and scattered that the expedition was for the present abandoned. The English ships withdrew to various ports, where they might have been surprised and burned, had not intelligence accidentally arrived that the Spanish fleet was bearing down full sail upon the coast. On the 20th of July the English admirals came in sight of the enemy, and next day the first engagement took place. The plan of Lord Howard was to evade a direct attack; for his vessels being so much inferior in bulk and weight of metal to the enemy's ships, were incapable of grappling in close action with them; but being superior in mobility and expedition, he resolved to annoy their rear, and to cut off the sluggish sailers. In the first attack neither fleet suffered much. Early in the morning of the 23d the second conflict began, and both fleets fought with valour; but the advantage was at last on the side of the English, over whose smaller vessels the iron shower from the higher sides of the Spanish ships flew harmless, whilst their own took full effect. On the 24th a pause took place in the battle, which was, however, renewed next day; but the mighty armament forced its way unbroken to the vicinity of Calais. They were now prepared to act in concert with the Duke of Parma, who had completed his preparations. He possessed in the harbours of Newport and Dunkirk transports which carried about twenty-eight thousand men, and which waited the general's command to make the grand attempt.

The concentration of the Spanish Armada off Calais suggested to the English admiral the idea of employing fireships to destroy it. Eight vessels were thereupon hastily prepared for this purpose, and during the night of the 29th, which was cloudy and boisterous, they were sent down blazing with combustible materials into the heart of the Spanish fleet. A cry of horror burst from the Spaniards, and, seized with an irresistible panic, they cut their cables with the intention of standing out to sea. But in their terror and confusion they inflicted severe injury upon one another; and, to augment their distress, a fierce gale sprung up, which scattered the Armada along the coast from Ostend to Calais. Some struck on the shallows at Flanders, whilst others beat out to sea; the remainder, amounting to about forty sail, were assailed by Drake and the rest of the English fleet. This was the most severe engagement which had yet taken place, and was maintained with great bravery for a whole day. The Spaniards lost several of their best ships; and after vainly endeavouring to regain their position in the narrow strait, where Parma could alone join them, they resolved to return to Spain by making a circuit round Great Britain. The want of ammunition compelled the English to refrain from pursuing the invaders at a time when they might have annihilated them. But this was reserved for an enemy even more formidable than that before which they fled. A storm overtook them on their unfortunate voyage, and the coasts of Scotland and Ireland were strewed with the wrecks of the Invincible Armada, so that only a feeble remnant of that splendid fleet reached the shore from whence it had sailed, in all the pomp and circumstance of war, as if to an assured triumph.

The events of Elizabeth's reign which followed the discomfiture of the Spanish attempt to invade England may be briefly related. The Earl of Leicester, who had for a long time maintained an enviable place in the queen's favour, was invested with fresh honours. A new and unprecedented office was created for him, that of lord lieutenant of England and Ireland, which exalted him to an authority only a little lower than that of sovereignty. But the ink was scarcely dry upon the warrant which wanted but the royal signature to complete the triumph of the favourite, when he was cut off by a violent disease, which, whether it arose from natural causes, or from poison being administered, at all events speedily terminated his career. Of this nobleman little need be said. He is one of a numerous class of historical characters who possess a degree of notoriety, not on account of any brilliant endowments which they themselves possessed, but from their proximity to or connection with distinguished personages. He possessed no intellectual or moral qualities which, deprived of adventitious aid, would have thrown him into the foreground of his country's history; whilst, if we listen to the opinion of his contemporaries, he must be looked upon as dissolute and unprincipled, notwithstanding his affectation of piety. He is a satellite only conspicuous from the light which is reflected upon him by his sovereign.

The English navy, emboldened by its late triumph, now made several very successful descents upon the Spanish coast, not so much for the purpose of obtaining permanent conquest, as of harassing the enemy. These expeditions were conducted by the most able commanders, amongst whom were some of the brightest names in the history of maritime discovery and enterprise, such as those of Raleigh, Drake, Cavendish, Hawkins, and Howard. It was then that the English navy assumed the empire of the sea, which it has ever since maintained with triumphant heroism.

On the death of Leicester, the young Earl of Essex succeeded him as prime favourite of the queen. But the desire of glory or the hope of plunder induced this volatile young nobleman to join the armament preparing to sail for Spain. The expedition was unfortunate, and when Essex returned to England, he found two rival candidates for royal favour, Sir Walter Raleigh and Sir Charles Blount. By the superior influence of these noblemen, the former was driven to cultivate a portion of land which had been granted to him in Ireland; and with the latter Essex fought a duel, in which he was wounded. But by the queen's command they were reconciled to each other, and in process of time they became sincere and attached friends.

In the year 1596, a new expedition was fitted out for Spain, which was completely successful. The Spanish fleet was defeated, and lost thirteen men-of-war. Cadiz was taken, and its defences, which rendered the town the strongest fortress in the country, were razed to the ground. This was the severest blow which the king of Spain received from his daring enemy subsequent to the repulse of the Armada. Matters might have been still worse with him had not dissension sprung up amongst the English commanders, the majority of whom, against the suggestion of Essex, who was one of the leaders, declared for an immediate return to England. The town, with the exception of the churches, was reduced to ashes; and the troops, taking with them the most valuable portion of the plunder, re-embarked, and the fleet returned to Plymouth in less than ten weeks after it had set sail. Essex, on his arrival in England, was compelled to appear before the queen in council, and answer to several charges connected with the late enterprise. These charges merely related to pecuniary matters, and the favourite was acquitted; but this was the commencement of numerous subsequent quarrels which he had with his sovereign, none of which are important to history except the last. Having been appointed lord deputy of Ireland, he suddenly left his command in that country and returned to England. He was committed a prisoner, and called upon to account for his extraordinary conduct. The queen, however, was unwilling to carry matters too far against her favourite. He was allowed to go about as a prisoner on parole; but this high-spirited and aspiring nobleman could not remain content with the humiliating circumstances to which he was now reduced. He attempted to excite the city of London to revolt against the queen's authority; but the rebel was taken prisoner, tried for high treason, condemned, and executed. This proved a severe blow to Elizabeth, who was now tottering upon the brink of the grave. She had been all her life subject to fits of indisposition, which were occasionally violent; but it was not till the beginning of March 1603 that her mortal illness came on. Her mind became depressed with gloomy recollections, especially those connected with the shedding of Essex's blood; and her nervous melancholy and general decline increased, accompanied by symptoms which indicated a disease of the heart, and by a laboured and convulsive respiration. She was questioned by her confidential advisers as to her successor, and signified her desire that the king of Scotland should succeed to the throne. Her speech soon afterwards failed entirely, and all hope of her recovery vanished. She tranquilly breathed her last, about three hours after midnight, on the 24th of March 1603, in the sixty-seventh year of her age and forty-fifth of her reign.

In the opinion of her contemporaries, whose judgment has been ratified by posterity, Elizabeth ranks amongst the greatest and the most fortunate of English sovereigns. The domestic tranquillity which signalized her rule during nearly half a century; her triumphant repulse of the Spanish monarch, and the severe retaliation which she inflicted upon that lord of empires; the spirit displayed by her navy in its numerous warlike expeditions by sea, and also by her army on land, are indications of uncommon vigour on the part of the sovereign, and of sagacity on that of her counsellors. She found England comparatively inferior to other nations of Europe, but she left it amongst the proudest and the most powerful. It was during her reign and that of her successor, that the human intellect sprung up at once to full maturity, and produced those works which are the peculiar glory of English literature. Hers was the Augustan age of poetry, the age of Spenser, Shakspeare, and others; and during her reign Bacon began to put forth those gigantic energies of mind which were destined to change the whole aspect of science, and even the condition of man as a civilized being. The human failings ascribed to Elizabeth are, excessive vanity, love of popularity which is part of it, parsimony, and a leaning towards despotism. But those whose interest it has been to vaunt the glory of her sister's reign, and the purity of her life, have not failed to charge Elizabeth with great personal depravity; yet if we discredit every defamatory story which can be clearly traced to her enemies, the imputations will not have much weight, or attach any grave stigma to her name.[1] She is not, however, free from the stain of blood, the shedding of which cannot be justified, however it may be palliated by taking into account the circumstances of the times, and the critical situation in which she stood; but in this respect her conduct is almost purity itself compared either with that of her sister or of her father. For an account of the private life and literary character of this great queen, see the article ELIZABETH.

She was succeeded by James the Sixth of Scotland and First of England. From that period, the history of the countries is given under the article BRITAIN.

PART II.

STATISTICS.

I.—*Situation, Extent, Face of the Country, Soil, and Climate.*

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England, the southern, and by far the most fertile division of Britain, corresponds in latitude with Holland and the north of Germany, extending from 50° to 55° 45′ N. Its figure is nearly triangular, and its extent of coast is very great, both from being much indented, and from the sea bounding it on all sides except along a width of seventy miles on the Scottish border. The adjacent seas are the German Ocean on the east, St George's Channel on the west, and the English Channel on the south. No country can be more fortunately situated; its climate is temperate; its extent is sufficient for its political security; whilst its insular position not only presents the greatest capabilities of aggrandisement in a commercial sense, but has, by rendering a great military force unnecessary, in all probability been the chief cause of preventing the executive branch from usurping absolute power, as in the countries of the Continent.

Its superficial extent had long been a question of considerable doubt, and the different estimates varied no less than ten millions of acres. Mr Pitt, on the authority of Arthur Young, assumed, in 1798, the superficial extent of England and Wales to be nearly 47,000,000 of acres; a later calculation by Dr Beeke, approaching more to accuracy than any preceding one, fixed it at 38,500,000 acres;[2] but, according to Arrowsmith's map, which, as it is principally founded on the trigonometrical survey, cannot involve any material error, the area of England and Wales amounts to 57,960 square miles of 69·15 to the degree, or to 37,094,400 imperial acres. This is the measure that is now adopted in all the parliamentary reports.

Face of the country.

England is, in general, a level country. In the north, Westmoreland, and a considerable part of Cumberland, Lancashire, and Yorkshire, are mountainous; but most of the other counties present a succession rather of picturesque eminences than of great elevations, forming a striking contrast to the barren ridges of the northern part of the island, and still more to the abrupt and awful scenery of Switzerland or the south of Germany. The highest mountains of England are in the north-west, where there are several exceeding 3000 feet in height; of these, the most noted, if not the highest, is Skiddaw. Between Lancashire and Yorkshire there is a range of nearly equal altitude; in Shropshire there are various hills; also in Somerset, Devon, and Cornwall, none of which, however, reaches the height of 2000 feet. There is a long hilly range which traverses the southern counties, in a line nearly due east and west from Dorsetshire to Kent; and another that stretches in a north-east direction from Wiltshire to the East Riding of Yorkshire; but both are of inconsiderable elevation. The traveller who proceeds northward from London to York meets very few hills, and hardly one mountain, in a distance of 200 miles. To the east of this road, the country, particularly Cambridgeshire, Lincolnshire, and part of the East Riding of Yorkshire, is almost entirely level, and bears a great resemblance to Holland; consisting of fens apparently gained in a very remote age from the sea. In Wales the face of the country is altogether different, being mountainous throughout, and some of the hills, in particular Snowdon and Cader Idris, attaining a height nearly 3600 feet above the level of the sea.

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[1] See Turner's *Elizabeth*, vol. iv. p. 564.

[2] Observations on the Produce of the Income Tax, &c. 1800.

Sea-coast.

The sea-coast of England presents a very different aspect in different situations; in some quarters, as in Cornwall, Kent, part of Norfolk, and Wales, it is steep and elevated; in other parts it is low, sandy, or marshy; exhibiting, on the whole, a variety which hardly admits of being brought under a uniform description, and which, though partaking much more of a level than rugged character, still differs greatly from the opposite shore of Flanders, Holland, and Friesland, which is one continued flat for more than 300 miles.

Rivers.

Of the rivers of England, the largest are the Thames, the Severn, and the Trent. The Thames has no pretensions to romantic effect in any part of its course, nor is its body of fresh water large; but it is navigable for more than 120 miles, and, in the approach to London from the Nore, presents to the admiring spectator a prospect which, whether we consider the quantity of shipping, the thickening population, or the high state of improvement of its banks, is wholly without parallel. The Severn, though not equal to the Tay in quantity of fresh water, is superior to the Thames, and during the first part of its course preserves the characteristics of a mountain stream, being clear, and at times bordered by picturesque scenery; but on leaving Wales, and entering a more level country, it assumes a different aspect, and becomes a full slow-flowing river, admitting of easy navigation, and facilitating greatly the commerce of Shropshire, Worcestershire, and Gloucestershire. Towards its mouth it receives the Wye, a large navigable river from Wales. The Trent rises in Staffordshire, and after a course, often tortuous, but generally in a north-east direction, falls into the Humber, which soon after becomes a broad estuary. The Mersey, as a river, is of no great importance, but as an arm of the sea it affords, from the west, a very capacious inlet to the trade of Liverpool, and facilitates the conveyance of the produce of the interior. The Tyne is a large stream, having Newcastle on its banks, and Shields near its mouth. The Medway, as a fresh-water river, is small and sluggish, but acquires, by the influx of the tide, such a depth of water at Chatham as to adapt it to the reception of the largest men of war. Speaking generally, it is only the rivers of Wales, Westmoreland, Cumberland, and a few mountainous districts, that are rapid or transparent; the great majority of English rivers, particularly in the eastern and central part of the kingdom, are slow in their course, and owe the degree of beauty which they possess, less to the effect of the water or scenery, than to the high cultivation and elegant disposition of the adjacent grounds.

Lakes and forests.

A similar remark applies to the lakes of England. Nothing can exceed the beauty of Winandermere, Keswick, and Ulleswater; whilst the unvaried and uninteresting collections of water, such as Whittleseameer, and others in the fen district, are to be compared only to those in North Holland or Friesland. In regard to wood, England is very well provided, without having many of those extensive forests which are met with on the Continent upon great mountain ranges, such as on the Jura ridge between France and Switzerland, and the Suabian Alps upon the Upper Rhine. It is in private plantations of limited extent, but of very frequent occurrence, and sometimes of great beauty, that the chief stock of English timber is to be found. Several very extensive tracts, such as the New Forest in Hampshire, the Forest of Dean in Gloucestershire, and Sherwood in Nottinghamshire, belong to the crown.

Soil and produce.

The soil of England is suited to a great variety of products; but it has not the exuberant fertility of southern climates, much labour and vigilance being requisite to obtain from it a grateful return. The quantity of moisture makes it admirably adapted for pasture; a characteristic which does not particularly strike those whose travels have never extended beyond their own country, but is of the highest importance in the view of those who have visited the Continent, and have witnessed the parched and arid state of the richest plains in the months of autumn. In regard to husbandry, it happens, by a singular coincidence, that in England, as in Scotland, the best is practised in the east part of the island, particularly in Norfolk and Northumberland. As to mineral treasures, the eastern counties of England, to the south of Yorkshire, are remarkable for containing no mines either of coal or of metal: these valuable deposits are to be sought in the more uneven districts of the north and west, viz. in Northumberland, Durham, Westmoreland, Lancashire, Shropshire, Worcestershire, Devon, and Cornwall, in Wales, and in the midland counties of Warwick, Stafford, and Derby. In the east, particularly in Lincoln and Cambridgeshire, vast improvements have been made in the present age by draining; but there are still the means of making further and valuable acquisitions. Much also remains to be done in bringing into culture extensive heaths and moorlands in almost every county in the kingdom. The soil of these is in general poor, but the tillage required would seldom be obstructed, as in many parts of Scotland, by the ruggedness of the surface. Comparing the soil of England with that of the adjacent countries, we find it greatly superior to that of Scotland, except along our eastern coast; it is perhaps better also than that of Ireland, fertile as the latter naturally is; nor needs it, on the whole, dread a comparison even with the soil of France, where, amidst districts of great beauty and luxuriance, the eye of the traveller is often struck with extensive tracts of heath or marsh.

The following table exhibits the area of each county in England and Wales, in acres and square miles, according to Arrowsmith's map. It also gives an estimate, 1*st*, of the extent of the arable, meadow, and pasture land in each county; 2*dly*, of the waste land in each capable of being converted into arable, meadow, and pasture; and, 3*dly*, of the extent of surface in each susceptible of cultivation, or of conversion into meadow or pasture, consisting of unimprovable mountain and moor, lakes, rivers, roads, canals, woods, fences, &c.

Counties.	Total Area in Square Miles.	Total Area in Statute Acres.	Arable Meadow and Pasture Land.	Waste Land capable of becoming Arable or Pasture.	Surface incapable of becoming Arable or Pasture.
ENGLAND.					
		Acres.	Acres.	Acres.	Acres.
Bedford	463	296,320	248,000	31,000	17,320
Berks	756	483,840	380,000	75,000	28,840
Buckingham	740	473,600	440,000	5,000	28,600
Cambridge	858	549,120	500,000	17,000	32,120
Cheshire	1,052	673,280	594,000	40,000	39,280
Cornwall	1,327	849,280	550,000	190,000	109,280
Cumberland	1,478	945,920	670,000	150,000	125,920
Derby	1,026	656,640	500,000	100,000	56,640
Devon	2,579	1,650,560	1,200,000	300,000	150,560
Dorset	1,005	643,200	573,000	25,000	45,200
Durham	1,061	679,040	500,000	100,000	79,040
Essex	1,532	980,480	900,000	10,000	70,480
Gloucester	1,256	803,840	750,000	6,000	47,840
Hants		1,041,920	900,000	80,000	61,920
Hereford	860	550,400	495,000	24,000	31,400
Hertford	528	337,920	310,000	8,000	19,920
Huntingdon	370	236,800	220,000	3,000	13,800
Kent	1,537	983,680	900,000	20,000	63,680
Lancashire	1,831	1,171,840	850,000	200,000	121,840
Leicester	804	514,560	480,000	5,000	29,560
Lincoln	2,748	1,758,720	1,465,000	180,000	113,720
Middlesex	282	180,480	155,000	17,000	8,480
Monmouth	498	318,720	270,000	30,000	18,720
Norfolk	2,092	1,338,880	1,180,000	78,000	80,880
Northampton	1,017	650,880	555,000	50,000	45,880
Northumberland	1,871	1,197,440	900,000	160,000	137,440
Nottingham	837	535,680	470,000	28,000	37,680
Oxford	752	481,280	403,000	50,000	28,280
Rutland	149	95,360	89,000	1,000	5,360
Salop	1,341	858,240	790,000	20,000	48,240
Somerset	1,642	1,050,880	900,000	88,000	62,880
Stafford	1,628	734,720	560,000	85,000	89,720
Suffolk	1,148	967,680	820,000	88,000	59,680
Surrey	1,512	485,120	400,000	50,000	35,120
Sussex	758	936,320	625,000	170,000	141,320
Warwick	1,463	577,280	510,000	30,000	37,280
Westmoreland	902	488,320	180,000	110,000	198,320
Wilts	763	882,560	500,000	200,000	182,560
Worcester	729	466,560	400,000	30,000	36,560
Yorkshire	5,961	3,815,040	2,500,000	600,000	715,040
	50,535	32,342,400	25,632,000	3,454,000	3,256,400
WALES.					
Anglesey	271	173,440	150,000	10,000	13,440
Brecknock	754	482,560	300,000	80,000	102,560
Cardigan	675	432,000	245,000	80,000	107,000
Carmarthen	974	623,360	342,000	60,000	221,360
Carnarvon	544	348,160	160,000	60,000	128,160
Denbigh	633	405,120	360,000	20,000	25,120
Flint	244	156,160	130,000	10,000	16,160
Glamorgan	792	506,880	305,000	60,000	141,880
Merioneth	663	424,320	350,000	20,000	54,320
Montgomery	839	536,960	240,000	100,000	196,960
Pembroke	610	390,400	300,000	20,000	70,400
Radnor	426	272,640	235,000	10,000	27,640
	7,425	4,752,000	3,117,000	530,000	1,105,000
ENGLAND AND WALES.					
Totals	57,960	37,094,400	28,749,000	3,984,000	4,361,400

This table, originally given in the Report of the Committee of the House of Commons on Emigration, was compiled by Mr Couling, civil engineer. It can of course only be regarded as an approximation; but as Mr Couling has bestowed great attention to the subject, we do not suppose that it involves any material error.

Climate.

The climate of England is that of an insular country of limited extent, subject in consequence to rain, and exempt from intensity of either heat or cold. Compared with the adjacent countries, it is less humid than Ireland, which, like Portugal, in a different latitude, is the first land to intercept the vapours of the Atlantic; but, on the other hand, the climate of England is less dry than the opposite shores of Holland and Germany, to which every wind but the west arrives across a tract of continent. The climate of the south of England resembles much that of the opposite coast of Brittany, Normandy, and Flanders; whilst that of the north is very similar to the temperature of Denmark, which, like the north of England, is a narrow country inclosed on either side by the sea. In regard to the relative degrees of heat or cold, if England have not so much summer warmth as continental countries on the same parallel, she generally escapes in winter that intensity of frost, which in less than forty-eight hours of easterly wind so frequently seals up their harbours. On the other hand, our weather is much more variable than in the inland part of the Continent, and our sky is less clear; still it by no means follows that the balance of disadvantage is on our side. The moderate heat and frequent returns of rain preserve throughout the year that verdant pasture which in autumn the Continent enjoys only in its maritime districts; whilst those droughts in spring, which are so noxious in the south of France and in similar latitudes of the Continent, are hardly known among us. In point of salubrity, also, we may fairly stand a comparison with our neighbours; for, variable as is our atmosphere, no country perhaps exhibits a larger proportion of examples of longevity.

There exists, however, a considerable difference in the climate of different parts of England. The west, exposed to the Atlantic, and containing hills and mountains which intercept the clouds, is much more rainy than the east, where the aspect of the country is level, and the expanse of adjacent water much less considerable. Another and equally remarkable difference arises from latitude, the season being a fortnight or three weeks later in the north than in the south of England. Notwithstanding all the skill of the Northumbrian farmers, the traveller who leaves the harvest finished in the south of England in the first week of September, and who sees the corn cut, if not carried, in the midland counties, will generally find it, in the middle of that month, untouched and standing in most parts of the country to the northward of York. In winter this difference in the temperature of the north and south of England is less perceptible. As to the spring months, March is proverbially raw and cold, from the prevalence of easterly winds, particularly in that part of the kingdom adjacent to the German Ocean. April is in general wet and favourable to vegetation; but May, though a pleasant month, can hardly be said with us to bring more " indulgent skies." It is in June, July, and August, that our climate assumes a more settled aspect; whilst, at the same time, the power of taking exercise on almost any day is indicative of a very gratifying advantage over the sultry atmosphere of our southern neighbours on the Continent. November, though frequently wet and foggy, is only a prelude to winter; even December does not often bring intense frost, which is commonly reserved for January; and during the last twenty years we have been repeatedly without any frost of consequence, or heavy falls of snow, until a considerable time after the days had lengthened.

Variations of temperature.

During the six winter months from October to March, the mean temperature of the central part of England is commonly between 42° and 43° of Fahrenheit. In December, January, and February, it is generally below 40°; in July and August 62° to 65°. The variations of temperature within the space of twenty-four hours are felt most strongly in the equinoctial months, March and September. In these there is often a difference of 18° or 20° between the day and the night, whilst in the summer months this difference seldom exceeds 12° or 15°, and in December or January is only from 6° to 8°. The mean annual temperature, noon and night, of the central part of England, is about 50°. The greatest summer heat seldom exceeds 80°, and the cold of December or January is rarely below 20° or 25°. In mild situations in Devonshire and Cornwall, the winter temperature is 2°, 3°, 4°, and even 5° higher than in London. Penzance is the spot in England least visited by severe cold; and it is consequently much recommended in pulmonary cases.

Of rain, the largest proportion falls in the north-west of England, particularly in Westmoreland and Lancashire, owing to the neighbourhood of the sea and the height of the mountains. There the average quantity is found to be forty-five, fifty, and, in some situations, sixty inches, whilst the average of the kingdom at large is from thirty to forty inches.

Prevaili winds.

The prevalent winds in England are west and southwest. Our outward-bound merchantmen are often detained, from the want of a northerly or easterly wind; but it rarely happens that our homeward bound are kept beating in the channel by the want of a westerly breeze. In these respects, also, the case is the same on the opposite shores of the Continent; the Dutch and French outward-bound vessels often experiencing detention from the continuance of westerly winds.

II.—*Divisions, Civil and Ecclesiastical.*

The civil divisions of England are those of counties, hundreds, and parishes. The county divisions, like several of our national improvements, date from the reign of Alfred, and, though subsequently increased by the acquisition of the three northern counties from the Scotch, have not, in other respects, experienced much alteration since his time.

Civil div sions.

The twelve counties of Wales added to the forty counties of England, make a total of fifty-two. The name of " county corporate" is given to most of the cities of England, and to some of the towns; and this distinction, little attended to by the public, and seldom mentioned but in law papers, implies that the district in question is governed by its own sheriffs and other magistrates, to the exclusion of the officers of the county at large.

The division into hundreds must have originated in reference to the existing population, and consequently implied a district containing either a hundred able-bodied men or a hundred families. As population increased very differently in different situations, great inequality ensued in regard to these divisions; and, in the reign of Henry VIII., many of the larger hundreds were partitioned into smaller districts. Hundreds were further subdivided in the time of Alfred into tithings, or associations of ten men, for the purpose of mutual defence. But both these subdivisions were unknown in the northern counties, from their not having been subject to the Saxon legislator: the latter, on their subsequent annexation to the crown of England, were divided into " wards" and " wapentakes;" terms sufficiently expressive of the warlike character of the age, and of the exposed situation of a frontier province.

Ecclesias tical div sions.

The ecclesiastical division of England is into two archbishoprics and twenty-four bishoprics. The archbishopric or " province" of York, though by much the smaller of the two, comprises Northumberland, Durham, Westmoreland, Cumberland, Cheshire, Lancashire, the chief part of Yorkshire, and the Isle of Man; and Canterbury extends over all the rest of the kingdom, including even Jersey and Guernsey. The bishoprics are very different in extent of jurisdiction, as well as in annual emolument. The third and most familiar of the ecclesiastical divisions of England is into parishes. This mode of division seems to have existed from a very remote period, and to have continued during the last five centuries on the same footing, with very slight variation, as at present. The total number of parishes in England and Wales is 10,674.

III.—*Harbours, Roads, Canals, Bridges.*

Harbours. Portsmouth, Milford Haven, and Plymouth, are the finest harbours in England, and are surpassed by few if any in the world. Of these, Portsmouth is entitled to the pre-eminence. This noble harbour is about as wide at its mouth as the Thames is at Westminster Bridge, expanding within into a capacious basin, almost sufficient to contain the whole navy of Great Britain. Its entrance is unobstructed by any bar or shallow; and it has throughout water adequate to float the largest man-of-war at the lowest tides. The anchorage ground is excellent, and it is entirely free from sunken rocks, sand-banks, or any similar obstructions. The western side of the harbour is formed by the island of Portsea; and on its south-western extremity, at the entrance to the harbour, is situated the town of Portsmouth, and its large and important suburb of Portsea. Here are docks and other establishments for the building, repair, and outfit of ships of war, constructed upon a very large scale, and furnished with every conveniency.

Portsmouth harbour has the additional and important advantage of opening into the celebrated road of Spithead, lying between the Hampshire coast and the Isle of Wight, and forming a safe and convenient retreat for the largest fleets.

Milford Haven deeply indents the southern part of Pembrokeshire. It is of great extent, and has within it many bays, creeks, and roads. The water is deep and the anchorage ground excellent; and being completely landlocked, ships lie as safely in it as if they were in dock.

Plymouth, which, after Portsmouth, is the principal naval depôt of England, has an admirable double harbour. The roadstead in Plymouth Sound has recently been much improved by the construction, at a vast expense, of a stupendous breakwater more than 1700 yards in length. This bulwark protects the ships lying inside from the effects of the heavy swell thrown into the Sound by southerly and south-easterly winds.

London stands at the head of the river ports of Great Britain. Considering the limited course of the Thames, there is probably no river that is navigable for large ships to so great a distance from the sea, or whose mouth is less obstructed by banks. London is mainly indebted for the unrivalled magnitude of her commerce to her favourable situation on this noble river; which not only gives her all the advantages of an excellent port, accessible at all times to the largest ships, but renders her the emporium of the extensive, rich, and populous country comprised in the basin of the Thames.

The Mersey, now the second commercial river in the empire, is more incommoded with banks than the Thames, and is in all respects inferior, as a channel of navigation, to the latter. Still, however, it gives to Liverpool very great advantages; and the new channel which has recently been discovered in the banks promises to be of much importance in facilitating the access to and from the port.

Bristol and Hull are both river ports. Owing to the extraordinary rise of the tide in the Bristol Channel, the former is accessible even to the largest ships. The Humber is a good deal impeded by banks; but it also is navigable as far as Hull by very large vessels. The Tyne admits vessels of very considerable burden as far as Newcastle, which, next to London, is the most important shipping port in the empire.

Roads. It was not until after 1660 that the public took an active part in regard to the highways. Turnpikes were at that time placed on the great North Road, in the counties of Hertford, Huntingdon, and Cambridge; but it was not till after the peace of 1748 that adequate exertions were made to redeem our public roads from their wretched condition. After 1760 the increasing price of agricultural produce, and the general spirit of improvement, had the most beneficial operation in this respect; and in the fourteen years from that time to 1774, no less than 452 acts were passed for the amelioration of our roads. It was then also that our inland navigation assumed an aspect of activity. The Bridgewater and Trent Canals were commenced; yet the number of canal acts which passed between 1760 and 1774 was only nineteen. The American war interfered considerably with public improvement; and it is only from the date of its cessation that we enter upon an active and prosperous era.

The total length of paved streets and paved roads in England and Wales may be taken, according to a parliamentary return in 1818, at about 20,000 miles; the total length of all other roads at nearly 96,000 miles. In France the highways are under the care of government, and are kept in repair out of the general taxes, without any tolls or turnpike dues; in England they are managed by the respective counties, represented by commissioners, and no part of the expense comes out of the public treasury. It is defrayed partly by local imposts, partly by dues levied; and the local impost is discharged either by labour or by composition money, thus:

The value of labour in kind (on an average of the years ending October 1812, 1813, and 1814) was	L.535,423
The average amount of composition money	278,506
The average amount of dues or rents levied	601,954
Annual average of the expenditure on the roads of England and Wales	L.1,415,883

being at the rate of nearly L.12. 6s. 8d. per mile. In the Highlands of Scotland, where the travelling is so much less, one third of this allowance is sufficient for the annual repair of the roads.

Canals. The canals of England are extremely numerous; in fact, no country except Holland can enter into competition with us in this respect. Amongst the principal are the Grand Junction, advancing from London above 100 miles into the midland counties; the Grand Trunk, extending from the Severn northward into Staffordshire, a distance of 139 miles; the Liverpool and Leeds, extending 130 miles; the Oxford, ninety-one miles. To proceed with the enumeration would be almost endless; suffice it to observe, that the English canals are of moderate size, being from twenty-five to thirty, thirty-five, and forty feet in width, and, in general, from five to six feet in depth; the barges navigating them are very long, frequently seventy or eighty feet, on a width of ten, twelve, or fourteen feet; but in many cases their dimensions, at least their width, are necessarily smaller, the less frequented canals being narrower than those we have mentioned. Could the application of steam to navigation have been foreseen, the canals of England would probably have been made wider. For full details with respect to the canals of England, and the recent improvements in their construction, and in travelling by them, the reader is referred to the article NAVIGATION INLAND.

Bridges. The principal bridges in the kingdom are the six erected across the Thames at London, three of which have been opened since 1817. Of these, two, the Southwark and Vauxhall, are of cast iron, the one being of three very large arches, and the other of nine arches, each of seventy-eight feet span. The first example of an iron bridge on a large scale, either in England or any other country, was that erected in 1796 at Wearmouth in Durham, the span of which was 240 feet. In the same year was finished at Buildwas, near Colebrook Dale, over the Severn, an iron bridge of 130 feet in span. See article BRIDGE, in this work.

IV.—*Agriculture.*

Of the state of English agriculture in former ages we can form some idea from a reference to the acts of the legislature. In these we find, at a very early date, the traces of that policy which expects abundance and cheapness to result from discouraging the exportation of corn. No permission to export seems to have been granted till 1394, and then only on the payment of certain duties; in 1436 some additional latitude was given, and exportation was allowed when the quarter of wheat did not exceed a price corresponding to nearly 13s. of our present money. The reign of Elizabeth was the epoch of a great rise in the prices of corn, originating, not, as was vulgarly asserted, in the "decay of tillage," but in the sudden depreciation of money, produced (as has been explained in the article CORN LAWS) partly by degradation of the coin, and partly by the influx of silver from the mines of America. The complaints of the "decay of tillage," if they express any thing more than the ordinary discontent of the ignorant part of the consumers, are to be accounted for by the gradual consolidation of small farms, and by inclosing land for pasture, with a view to the exportation of wool. In these days, however, government participated in the prejudices of the people; and the general purport of the acts passed under Elizabeth and her successors was to shackle exportation and prevent a rise of price. It was not till the reign of Charles II. (1670) that the exportation of corn was exempted from taxation; and it is from 1689 that we are to date that fundamental change in our corn laws which encouraged exportation by a bounty.

Clover, turnips, and potatoes were introduced into England in the seventeenth century. In the *Improver Improved*, published by Blythe in 1649, we find the first traces of what may be termed the modern system of husbandry; that is, of a rotation of crops, and of the occasional substitution of green for culmiferous crops. But the practice, though thus early introduced, and though it lies at the foundation of all good husbandry, made but little progress for a very long period. The writings and the example of the famous Jethro Tull, in the early part of last century, notwithstanding he carried his theory to an excess, did much to introduce the practice of drilling, and had a very favourable influence on agriculture. Nothing, however, did half so much to accelerate the march of improvement, as the wonderful increase of manufactures and commerce, and consequently of the town population, subsequently to the peace of Paris in 1763. The greater number, and still more the improved circumstances, of the people, occasioned, in particular, a very great increase in the demand for butchers' meat. And it is to this circumstance that we are mainly indebted for the extraordinary improvements which have been made during the last sixty or seventy years in stock husbandry. But the indirect influence of the augmented demand for butchers' meat has been equally conspicuous, and has proved of the utmost advantage to arable husbandry, inasmuch as it caused a corresponding increase in the demand for green food, that is, for turnips, clover, &c. This did incomparably more than anything else to introduce that intermixture of green and culmiferous crops which is so essential to good husbandry; and it was the real cause of the greatest of all agricultural improvements, namely, the substitution of turnips for fallows on all light lands. This has increased the productive power of the soil in a degree not easy to be conceived; and, coupled with the frequent substitution of beans for naked fallows on stiff clay lands, has in all probability more than doubled the available raw produce of the kingdom.

For a lengthened series of years England exported large quantities of corn. But notwithstanding the vast additions made to the supplies of corn by the improvements alluded to, the still greater increase of wealth and population, after occasioning, first a diminution, and next a cessation of exportation, has for many years past made the balance incline on the side of importation. It has been supposed by some that this change was owing to the alterations effected in the laws with respect to the importation of corn in 1772; but we have elsewhere shown that there is no room or ground for any such opinion. (See CORN LAWS AND CORN TRADE.) There cannot, indeed, be the shadow of a doubt that our having changed from being an exporting to an importing country, is entirely owing to the demand having shot a head of the supply, in despite of the wonderful increase of the latter. If doubt should remain in the mind of any one as to this being the real cause of the change, it would be removed by attending to the progress of the inclosure bills. The first act for effecting an inclosure was passed in the reign of Charles II. Since the revolution the progress has been as follows·

	Number of Acts passed.	Number of Acres inclosed.
In Queen Anne's reign	2	1,439
In George I.'s reign	16	17,660
In George II.'s reign	226	318,778
In George III.'s reign to 1797	1532	2,804,197

According to this statement, taken from the report of the committee on waste lands, it appears that each inclosure act passed during that period of the reign of George III. which terminated with 1797, inclosed at an average 1830 acres. Now it appears from the official returns, that from 1798 to 1833 both inclusive, 2103 inclosure acts had been passed; and supposing each to have inclosed, as before, 1830 acres, the total would amount to 3,848,490 acres, making, when added to the quantity inclosed previously to 1798, an aggregate of no less than 6,652,687 acres inclosed since 1760. But as it seems probable that the earlier acts would apply to a larger extent of land than the later ones, we may perhaps estimate the total extent of land inclosed and divided by act of parliament from 1760 to 1833 at from 5,500,000 to 5,800,000 acres. And it may be safely affirmed, that in consequence of its inclosure, the produce of this immense extent of land has been increased at least from *four* to *five* fold.

As might be expected, a decidedly greater number of inclosure acts were passed in 1802, and during the five years ending with 1814, when prices were enormously high, than in any other equal period of time.

Account of the Number of Inclosure Acts passed, and of the average Price of Wheat, in England and Wales, each Year from 1798 *to* 1833, *both inclusive.*

Years.	Acts.	Price of Wheat per Quarter.		
		L.	*s.*	*d.*
1798	52	2	10	3
1799	65	3	7	6
1800	63	5	13	7
1801	80	5	18	3
1802	122	3	7	5
1803	96	2	16	6
1804	104	3	0	1
1805	52	4	7	10
1806	71	3	19	0
1807	76	3	13	3
1808	91	3	19	0
1809	92	4	15	7
1810	122	5	6	2
1811	107	4	14	6
1812	133	6	5	5
1813	119	5	8	9
1814	120	3	14	0
1815	81	3	4	4
1816	47	3	15	10
1817	34	4	14	9
1818	46	4	4	1
1819	44	3	13	0
1820	40	3	7	11
1821	36	2	16	2
1822	15	2	4	7
1823	13	2	13	5
1824	19	3	4	0
1825	23	3	8	7
1826	20	2	18	9
1827	22	2	16	9
1828	17	3	0	5
1829	25	3	6	3
1830	20	3	4	3
1831	10	3	6	4
1832	10	2	18	8
1833	15			

Crops cultivated: extent of ground under cultivation.

The principal crops cultivated in England and Wales are wheat, oats and beans, barley and rye, turnips and potatoes, with clover, hops, flax, &c. It is to be regretted that no estimate has been formed on which much reliance can be placed, either of the extent of land under different crops, or of the average product per acre. Mr Middleton, in his *Survey of Middlesex* (vol. ii. p. 640), estimated the whole land under tillage in England and Wales at 12,000,000 acres; and Mr Comber, in his *Treatise on National Subsistence* (p. 52), estimated it at 11,591,000 acres. We incline to think that these estimates are not very wide of the mark as to the number of acres; but in both, the extent of land under wheat seems to be materially underrated, whilst that under fallow seems to be equally exaggerated. The following may, we believe, be regarded as a pretty fair estimate of the extent of land under the different species of crops, and in fallow, in England and Wales, on an average of the last half dozen years.

	Acres.
Wheat	3,800,000
Barley and rye	900,000
Oats and beans	3,000,000
Clover	1,300,000
Roots (turnips, potatoes, &c.)	1,200,000
Hops, gardens of all sorts, &c.	150,000
Fallow	1,650,000
	12,000,000

Quantity and value of crops.

In 1800 a committee of the House of Lords was appointed to inquire into the causes of the scarcity which then prevailed. Under the directions of this committee the board of agriculture circulated queries, and investigated with considerable minuteness the subject of the average productiveness of the different species of crops in the different countries of Great Britain. The result of these inquiries are given in the appendix to the Report of the Committee; and from these it appears that the average produce of wheat throughout England and Wales may be taken at from two and a half to three quarters (Winchester measure) per acre, barley at four quarters per ditto, oats four and a half, peas two and a half, beans three and a half, and potatoes at 250 bushels. We have, however, been assured that the wheat culture has since been so much improved, that making due allowance for the greater quantities produced in the best wheat counties, as Kent and Essex, the average produce may be safely reckoned at three quarters an acre; and taking these results, and the average prices of the last ten or twelve years, we get the quantity and value of the principal crops as follows:

Crops.	Acres.	Produce per Acre. Quarters.	Total Produce. Quarters.	Price per Quarter.	Value.
				s.	*L.*
Wheat	3,800,000	3	11,400,000	60	34,200,000
Barley and rye	900,000	4	3,600,000	30	5,400,000
Oats and beans	3,000,000	4½	13,500,000	25	16,875,000
Roots	1,200,000	£5 5 0 per acre.			13,125,000
Clover	1,300,000				
Totals,			28,500,000		69,600,000

The oats and beans are here blended together and reckoned at the price of oats; whereas beans are about 10s. a quarter higher. Allowing for this, the two may be worth together L.17,500 000. The grounds occupied as gardens, hop-plantations, &c. may produce, at an average, about L.15 an acre, or L.2,250,000 a year; making the total value of the different crops raised in England and Wales L.72,475,000.

Expense of cultivation.

Attempts have frequently been made to estimate the expenses attending the cultivation of land at different periods; but we have not seen any statement of the sort on which we should be disposed to place much reliance. A good deal of the expense is of a very fluctuating nature, depending on the prices of grain and stock, the rate of wages, amount of capital employed and interest thereon, rent, public burdens, &c. It may probably be considered, and taking all things into account, that the expenses of cultivation in England and Wales are at this moment about thirty per cent. higher than in 1792.

Cattle and sheep, &c. Owing to the improvements in the breed and in the feeding of cattle, the weight of those now annually slaughtered has increased from a third to a half above what it is stated by Dr Davenant to have been at the beginning of last century. Various discordant estimates have been formed of the number of cattle in England and Wales; but the best authorities seem to think that they may amount to 4,000,000 or 4,500,000.

Horses. Horses are of course far less numerous than cattle, and are proved by the tax returns not to exceed 1,400,000 or 1,500,000. (See M'Culloch's *Commercial Dictionary*, art. *Horses.*)

Sheep. According to the elaborate tables of Mr Luccock, revised by Mr Hubbard, there appears to be in England and Wales nearly 15,000,000 of short, and rather more than 4,000,000 of long woolled sheep, with about 7,000,000 lambs. The weight and value of the fleece varies very much according to breed, keep, &c. But, at an average, the weight of the fleeces of short-woolled sheep may be taken at from three to four pounds, and those of the long-woolled at from seven to nine pounds. The total quantity of wool annually produced in England and Wales is estimated by the same gentlemen at 385,000 packs, of 240 pounds each. Merinos were introduced about the beginning of the present century, and were imported in large numbers after our alliance with Spain in 1809. Opinions differ in regard to their utility, the carcass not having answered so well as the fleece. Considerable advantage, however, has been derived from crossing them with our own breeds, and further experience may lead to more beneficial results.

The great pasturage counties are Leicester, Northampton, Lincoln, and Somerset. Of the counties producing butter and cheese, the principal are Cheshire, Gloucestershire, and Wiltshire. But notwithstanding the immense supplies of these articles produced at home, the demand is such, that at an average we import about 130,000 cwts. a year of foreign butter, and about an equal quantity of cheese, principally from Holland. The average annual importation of Irish butter into England cannot be precisely ascertained; but in 1825 it amounted to 425,000 cwts. and may now (1834) be taken at 500,000.

Produce of grass-lands. The produce of grass-lands may be determined in two ways; either by ascertaining the quantity and value of the different articles annually produced, or by taking a general rough average value per acre. The former would be the most satisfactory mode; but the details are too numerous and too loose to admit of their being put forward with much confidence. We believe, however, that the annual value of the various products derived from pasture-land may be estimated, on an average, at about L.3. 10s. an acre; being equivalent, upon 17,000,000 acres, to L.59,500,000.

This sum of L.59,500,000 consists, probably, of the following items:—

Cattle 1,000,000, at L.20 each	L.20,000,000
Calves 200,000, at L.3	600,000
Sheep and lambs 6,800,000, at L.1. 10s.	10,200,000
Wool (exclusive of slaughtered sheep) 338,000 packs, at L.12	4,056,000
Hogs and pigs 450,000, at L.1. 10s.	675,000
Horses 200,000, full grown, annually produced	3,000,000
Poultry, eggs, rabbits, &c.	1,000,000
Meadow and grass for work and pleasure horses	10,000,000
Dairy produce, or milk, butter, and cheese	9,969,000
	L.59,500,000

The total annual value of the agricultural produce of England and Wales may, therefore, be estimated at about L.132,000,000 (L.72,475,000 + L.59,500,000).

Rent. The rent of land in England and Wales is usually estimated at from one fifth to one fourth of the value of the produce, which, taking the latter at L.130,000,000, would give from L.26,000,000 to L.32,500,000, or L.29,250,000 at an average, as the rent of the kingdom. We incline to think that this is pretty near the real amount. In 1810 the rent of England and Wales, as ascertained by the property-tax commissioners, was L.29,500,673; and the general opinion amongst persons well informed as to such matters seems to be, that the rent at present is about equal to the rent in 1810; the rise that took place in the four succeeding years having been balanced by the fall that has taken place since.

Farmers capital, profits, The capital employed in the cultivation and stocking of the land in England cannot be estimated, at the present prices, at less than from L.6 to L.7 an acre; which, excluding waste land, would give a total capital of from L.172,494,000 to L.201,243,000. It appears from the property-tax returns for 1810, that the profits made by the occupiers were almost identical with the rent. But it will be observed, that, besides the interest on, or return for, the capital employed in farming, the profits in question included all that the occupiers received on account of their trouble in superintendence, and for the greater part of their own labour and that of their families.

Size of farms. We have already, in the article AGRICULTURE, treated of the points of superiority in our husbandry over that of the Continent; ascribing it to various causes, and to none more than the medium size of our farms, which differ equally from the large unmanageable tracts held by Polish noblemen, and the diminutive occupancies so common amongst the French peasantry, particularly since the Revolution.

The size of farms in England is greatest in the best cultivated districts, that is, in the counties to the east of the metropolis, viz. Kent, Essex, Suffolk, and Norfolk. Farms are also extensive in Northumberland. In these counties the engagements of farmers are for larger sums than in East Lothian, Berwickshire, or any part of Scotland, rents being frequently from L.800 to L.1200 and L.1500 a year. In more retired districts, particularly in Cumberland, Westmoreland, and Wales, the occupancies, whether farmed or held in property, are in general very small; and an average of all the farms of England and Wales would not much exceed L.150 a year.

Leases. Leases in England are, with the exception of particular districts, granted for seven years only; when the term is longer the case is peculiar, and applies to land which evidently requires very extensive improvement. But by far the largest portion of England is held by tenants at will, or by tenants holding only from year to year. There is in such cases something like an assurance, on the part of the landlord, that the tenant shall not be removed for a certain number of years, or that otherwise the improvements shall be considered and allowed for. When a tenant holds from year to year there is a written agreement, with specified covenants, the tenant being subjected to fines in the event of a deviation from them. Both methods are highly injudicious; and it is in the prevalence of these, more than in the existence of tithes and poor's rates, that we are to look for the backward state of agriculture in many of our finest counties. No class of men have more liberality than the English landholders; but it would be in vain to expect a tenant to lay out much capital on the improvement of a farm of which his tenure comes to an end in seven years, or may be disturbed by the commission of a trespass or the occurrence of a death.

A tenant so situated loses the habit of reflecting on improvements, and even of carrying into effect those which he is aware would in time be advantageous. If he succeed in saving money, he is much more likely to place it out at interest than to employ it in his own business.

Compari- son with Scotland and the Continent.

In Scotland the rent bears a higher proportion to the gross produce than in England, being in general not less than from one fourth to one third. This is owing not certainly to greater capital, and still less to superior soil, but to an exemption from tithe and poor's rate, the use of long leases, and partly, and principally, we believe, to greater economy, particularly in the number of and expenditure upon horses. It is in tillage, not in pasturage, that the Scotch farmers lay claim to superiority. On comparing English agriculture with that of the Continent, we find that our chief superiority consists in machinery and in live stock. Thrashing machines are in a manner unknown on the Continent, and all iron manufacture is of inferior quality. In regard to live stock, the countries which approach nearest to us are Jutland, Holstein, Holland, Flanders, and Normandy, all evidently indebted for their extensive pasturages to the vicinity of the sea; in the interior of the Continent, pasturage is, in general, very indifferent. Even in these maritime provinces, the cattle, though frequently large, are not fattened in the same gradual manner as in our grazing counties; and the meat, consequently, is not of equal flavour. In horses the inferiority is more apparent to the eye, and holds both as to size and shape. Flemish horses are large, but heavy; whilst the Norman breed, though capable of much labour, is small in size when compared with the English. Nowhere are horses seen of such bulk and strength as the drays in London. If they are, as is supposed, of foreign origin, they have greatly surpassed the primitive stock, since neither the Netherlands nor Holstein can now match them.

We cannot close this part of our subject without a few remarks on the connection between the state of our agriculture and the extent of our financial burdens. Those who compare the heavy pressure of our taxes with the lighter burdens of our continental neighbours, have in general the satisfaction of finding some counterpoise in the superior dexterity of our people, and the productiveness of our capital. This holds true in regard to our navigators, our merchants, and our manufacturers; and it holds in agriculture in regard to grazing, because in grazing little personal labour is requisite, whilst capital and active habits of business are of the most beneficial operation. But, in the department of tillage, much remains to be done ere England can claim any great superiority. Farms are yet too small in more than two thirds of England, and leases are generally too short. The course of husbandry is frequently injudicious, the ploughs are on a bad construction, and there exists a gross misapplication of animal strength. However light the soil, and however strong the horses, it is still customary to put three, four, and frequently five, in a plough, throughout almost all the west and south-west counties. These are the main causes of the comparative unproductiveness of our finest counties, and of our being obliged to pay so heavy a premium in the shape of corn laws to support our agriculture. Without the corn laws, our lower classes would be supported on nearly the same terms as their continental neighbours; and there would be no occasion, with all our taxes, to dread the competition of foreigners in almost any branch of industry; but if the manufacturers of England are obliged to pay for their support thirty per cent. more than those of France and Germany, whilst their wages are very little higher, what other prospect have we than that of increasing emigration and the augmentation of the poor's rates?

The quantity of land still remaining uncultivated in the shape of wastes and commons is a frequent topic of animadversion; persons unacquainted with agricultural calculation calling loudly for this island being brought into culture, whilst the landed interest object to passing a general inclosure act, or, in other words, to giving unlimited scope to speculative cultivation. We by no means participate in the apprehensions of the latter; but we would abstain from giving any artificial stimulus to this, more than to any other branch of industry. Let the progress of inclosure be regulated by the gradual increase of our population, and the discovery of better methods of turning such land to account. No benefit can be derived from applying to this purpose any more capital than would go to it voluntarily; and every experienced farmer is aware, that the best prospect of profit lies, not in reclaiming new soils, but in bestowing further labour and expense upon the land already under culture.

V.—*Mines—Quarries—Iron, Copper, Tin, and Salt Works.*

In regard to minerals, England does not yield to any country in Europe in natural abundance, and takes the lead of all in the extent to which these rude treasures have been converted to purposes of utility. Our great superiority lies in our coal-mines, which are not only more productive, but much more advantageously situated, than those of the Continent. To the mines along the coast a ready conveyance is afforded by our insular position, and to those in the interior by our inland navigation. The consumption of coal in England for domestic use has been estimated at 20,000,000 tons annually. Large as this quantity is, and larger as it must be when we add to it the vast consumption of manufactories, such as iron-works, copper-works, salt-works, glass-houses, and the like, there is no reason to apprehend the exhaustion of this precious mineral; the depth of the coal beds being very great, and the extent of ground containing them amounting to many hundred thousand acres. The principal coal-beds lie in Northumberland, Durham, Derbyshire, Staffordshire, and Glamorganshire. The ports for shipping coal in large quantities are Newcastle, Sunderland, Swansea, and Whitehaven. The motive of the tax on coal exported to foreign countries is thus neither an apprehension of eventual scarcity, nor even a calculation of revenue, so much as a dread of giving our continental neighbours the means of rivalling our manufactures. Coal is not wanting in France and Germany, but the mines are at a distance from water carriage, and as yet very imperfectly wrought · whilst for the purpose of domestic fuel the inhabitants give a preference to wood.

A material advantage was conferred on the coal trade, and on all the southern parts of the empire, by the late abolition of the tax of six shillings a chaldron on all sea-borne coal. Mr M'Culloch, founding upon the calculations of Mr Ruddle and other eminent practical authorities, estimates the total number of persons engaged in the coal trade at from 160,000 to 180,000. (*Commercial Dictionary*, art. *Coal.*) The conveyance of coal from the Tyne and the Wear to London, and other southern counties, constitutes by far the most important part of the foreign trade of the empire.

In 1832 the exports of coal to foreign countries amounted to 588,446 tons, of the real or declared value of L.228,615, producing a revenue of L.56,706. We subjoin an account of the quantity of coal brought coastwise and by inland navigation into the port of London in 1831 and 1832, specifying the ships employed and the quantities furnished by each of the shipping ports:—

Ships.		Ports whence Shipped.	Tons.	
1831.	1832.		1831.	1832.
3845	3627	From the port of Newcastle	1,151,851	1,171,227
2041	2145	From the port of Sunderland	561,234	600,217
337	783	From the port of Stockton	62,749	172,930
223	190	From the ports of Blythe and Seaton Sluice	59,862	48,938
167	199	From Leith, Inverkeithing, Kirkaldy, and other ports in Scotland	39,337	49,579
121	195	From Swansea, Llanelly, Milford, and other places in Wales	26,302	45,065
272	389	From Hull, Goole, Gainsbro', and other places in Yorkshire	43,957	51,122
		Quantity which passed the Boundary Stones on the Grand Junction Canal at Grove Park, Herts, and on the River Thames, at Staines	8,381	10,742
7006	7528		2,053,673	2,149,820

Quarries.

In quarries, whether of stone or slate, England is not rich, particularly the eastern half of the kingdom; and hence the almost universal use of brick in ordinary buildings. It is not till the traveller reaches Durham that he finds stone commonly used. In the northern counties quarries occur frequently; in the southern, those of Portland and Bath are the most considerable. Still the annual profits of the whole are small when contrasted with the product of our mines.

Iron mines and works.

No branch of our industry has increased more rapidly in the present age than our iron-works. A century ago it was computed that we required an annual importation of 20,000 tons of foreign iron; an importation which for many years seems to have been on the increase, so as, after the middle of last century, to carry the quantity required to 30,000, 40,000, and even to 50,000 tons. This supply was brought to us from Sweden and Russia, and, though burdened with duty, it was in quantity more than double our native produce. But fortunately, after the year 1780, discoveries were made which increased greatly our supply at home. Bar iron had been manufactured in England, as on the Continent, with charcoal fuel only, coal being deemed inapplicable to that purpose. Under that impression, the rapid consumption of the wood in the neighbourhood of our different iron-works had necessitated a removal, at a great expense, of materials from one spot to another, and was on the point of causing an alarming decay in the business, when our iron-masters, after long perseverance, succeeded in applying coal to their manufacture. They had to contend with various prejudices, particularly the supposed inferiority of iron so made; but, in the course of years, the manufacture acquired such an extent that there were, in 1805, two hundred and twenty blast-furnaces, making 250,000 tons of pig iron.

The transition from war to peace did a good deal of injury to some branches of the iron trade; but the effect of the change was not of long duration, and the production of iron has since been astonishingly increased. In 1820 the produce was calculated at 400,000 tons. The excitement and speculation of 1824 and 1825 had a wonderful influence on this department. According to careful inquiries made at the time, the furnaces at work in England and Wales in 1827, with their produce, were as under:

Staffordshire	95 furnaces	216,000 tons.
Shropshire	31	78,000
South Wales	90	272,000
North Wales	12	24,000
Yorkshire	24	43,000
Derbyshire	14	20,500
Totals	266	653,500

Owing to the failure of various rail-road and other projects set on foot in 1825 and 1826, the supply of iron seems to have greatly exceeded the demand; and there was a very heavy fall of prices in 1828, 1829, and 1830. But within the last two years prices have again risen to more than their former level; and the iron trade is at this moment in a state of great activity. The produce of the various furnaces of England and Wales may be estimated at 650,000 tons, worth at an average L.6. 10s. a ton, making a grand total of L.4,225,000. For more ample details, the reader is referred to the article IRON.

Copper-mines have long been known in England, but they were wrought with very little skill or effect until towards the year 1700. Even at that time the annual produce, after smelting the metal from the ore, was only a few hundred tons of copper; and it hardly exceeded 1000 tons annually down to the middle of last century. From that time forwards the increase became considerable, as well in Cornwall as in Devon, North Wales, and Derbyshire; in all of which copper-mines were discovered and wrought. In North Wales there were two mines, Parys and Mona, which, for some time after the year 1780, yielded annually a large quantity of ore, but they are no longer so productive: the mines of Devon and Derbyshire continue to be wrought, but the great product is from Cornwall, the mines of which yield 145,000 tons of ore annually; the metal obtained, varying from five to fifteen in the hundred parts, may be stated at 12,000 tons of copper. It is the Welsh collieries which afford to Cornwall, as to Devonshire, the means of smelting; and as the ore is less heavy than the coal required for this operation (one ton of ore requiring from two to two and a half tons of coal), the practice is to convey the ore in vast quantities to Wales, particularly to Swansea. The total quantity of coal consumed for this purpose at Swansea is nearly 350,000 tons a year, exclusive of a further consumption of coal at the copper-mines of Cornwall, in working the ponderous steam-engines used in throwing out the water from the pits. In this, as in other minerals, France is greatly behind England. She has various copper-mines, but her coal-mines, at least those hitherto wrought, are at too great a distance to make such undertakings profitable; and she consequently requires an annual importation from England.

The entire produce of the copper-mines of England and Wales is at present about 14,000 tons a year of pure metal; and taking the price at L.100 a ton, its aggregate value will be L.1,400,000.

In 1831 there were exported brass and copper manufactures of the value of L.803,124, of which India, China, atistics.

and Ceylon took L.348,045, the United States L.169,533, France L.91,580, &c.

Tin.

Cornwall is also the great seat of the tin-mines of England. A century ago the average produce of our tin mines hardly exceeded.............................1500 tons.

From 1720 to 1740 the average produce was	2100
1740 to 1760	2570
1760 to 1780	2740
1780 to 1800	3100
1826 to 1829	4677

The produce of the mines at present does not materially differ from the last of these averages. From abroad we receive tin from one quarter only, viz. the East Indies, in particular from the island of Banca. Of this we imported, in 1831, 776 tons, the chief part of which was re-exported to the Continent of Europe. Of our own tin, about the half is used at home, and the other half finds its way to foreign countries, particularly Russia, France, and Italy.

Lead.

The lead-mines of England are principally in Cumberland, Northumberland, and Derbyshire; the whole being calculated to produce from 12,000 to 15,000 tons annually. Black lead is found in abundance in Cumberland, in the romantic district of Borrowdale; but the mine is opened only periodically, in order that the market may not be overstocked.

Salt.

Salt is already a very important product in England, and is likely to become much more so from the measures urged of late years on the legislature, part of which have been adopted, whilst a further part seems only to wait a season of less financial pressure. (*Report of Committee on the Salt Duties*, June 1818.) Salt is obtained in several ways; partly from brine springs, partly from the rock, partly from sea water. In the last manner it is manufactured in various salt-pans along the coast, viz. in Hampshire, Kent, and Essex; also in the northern counties of Durham and Northumberland, where the abundance of coal reduces materially the expense of the process. But the great supply is from the rock salt and brine springs of Cheshire, situated in the southern part of the county, near Northwich. From these springs it is obtained (see the article Cheshire) at the rate of one gallon of solid salt from four gallons of liquid, whilst common sea water does not yield above one in twenty-eight. The consumption of salt in this country is immense. Necker estimated its consumption in those provinces of France which had purchased an exemption from the gabelle (*pays francs redimées*) at about 19½ lbs. (Eng.) for each individual. (*Administration des Finances*, tome ii. p. 12.) From all that we have been able to learn on the subject, we believe that the consumption of the people of this country may be estimated a little higher, or at 22 lbs.; the difference in our food and habits, as compared with those of the French, fully accounting for this increased allowance. On this supposition, and taking the population at 16,000,000, the entire consumption will amount to 352,000,000, or 144,200 tons.

Exclusive of this immense home consumption, we annually export about 10,000,000 bushels, which, at 56 lbs. a bushel, are equivalent to 250,000 tons. The Americans are the largest consumers of British salt, the exports to the United States in 1829 having amounted to 3,515,924 bushels. During the same year we exported to the Netherlands 1,583,517 bushels, to the British North American colonies 1,472,000 ditto, to Russia 1,388,490 ditto, to Prussia 949,834 ditto, &c.

The cheapness of this important necessary of life is not less remarkable than its diffusion. Its present cost may be estimated, at a medium, at from 14s. to 16s. a ton.

Salt has been at all times a favourite subject of taxation. In this country it was first taxed in the reign of William III. In 1798 the duties amounted to 5s. a bushel, but they were subsequently increased to 15s. a bushel, or about forty times the cost of the salt. So exorbitant a duty was productive of the worst effects, and, in particular, occasioned a great deal of smuggling. The duty having in consequence become exceedingly unpopular, was finally repealed in 1823.

Statistics.

VI.—*Fisheries.*

A season of peace is always favourable to the extension of our fisheries; and, if we may judge from the progress lately made, this branch of our national industry is likely to be carried further than at any former period of our history. Of this we shall treat more fully under the article Fishery. At present our space allows no more than a brief notice of the principal branches of our fisheries.

Mackerel.

The mackerel fishery is strictly English, and is carried on with great vigour on the coasts of Kent and Sussex, in May, June, and July. Large as the supply is, it would still admit of augmentation; and herrings also might be caught in vast quantities on the coast of Kent in October and November. The desideratum with the fishermen, now that peace has reduced their expense, is not so much a high price as a certain market; and the most effectual way to procure that is, to quicken, by every possible means, the conveyance to London, which has been accomplished by the employment of steam-boats. The conveyance of fish by land-carriage from Brighton, and other parts of the Sussex coast, to London, has also been accomplished by improvements in the roads.

Pilchards.

The pilchard fishery takes place chiefly on the coast of Devonshire and Cornwall, and, though subject to great fluctuations, as well from the seasons as from our political situation relatively to the Continent, forms on the whole an important branch, employing a number of seamen both in catching the fish and in carrying it to foreign markets. Its season is generally from June to September.

Herrings.

The herring, the most important of all our fisheries, is happily now in a state of rapid extension. It formed, during the seventeenth century, the great employment of the Dutch seamen, and was contemplated by their neighbours with very jealous eyes. Accordingly, in the reign of Charles II., particularly after the rupture with Holland in 1672, several acts were passed for the encouragement of our fishermen, and in a spirit of hostility to the Dutch. The subsequent accession of William to our throne, and the long friendship between the two countries, relaxed the exertions of government; and it was not till after the peace of 1748 that a large bounty was given on the tonnage of the busses, or masted vessels, so employed. Still our fishermen proved unable to compete with the experience and patient perseverance of the Dutch, and it was found necessary to raise the bounty from 30s. to 50s. per ton. This had the desired effect, and the number of busses increased; but the additional 20s. being withdrawn in 1771, the fishery again declined. The American war, and, subsequently, the wars of the French revolution, proved extremely adverse to its extension. At last, in 1808, an act was passed carrying the bounty to L.3 a ton on the busses, with a further grant of 2s. per barrel on all herrings caught, whether in busses or boats. This act was further confirmed in 1815, and the bounty per barrel raised to 4s. with the qualification that the herrings should be gutted before curing.

In consequence of the encouragement thus afforded, the fishery was materially extended; but this was effected at a great expense, and had, besides, several bad consequences. The bounties given by government tempted persons without capital or skill to enter into the business, to the great injury of the regular fishermen; so that notwithstanding the extension of the business, it was found, as is invariably the case with all departments carried on by means of a bounty, to be in a very unhealthy state. In consequence partly of the circumstances now stated, and partly in consideration of the real and substantial relief given to the fishery by the abolition of the duties on salt, it was resolved gradually to withdraw the bounty, which totally ceased in 1830. And we are happy to have to state, that though the fishery fell off whilst the bounty was in the course of being withdrawn, it has since been materially increased, and is now in a better situation than at any former period.

The curing of herring in Scotland is still subjected to the supervision of a public board; but we are not aware that its interference has been or can be productive of any good effect; and it will, we hope, be dispensed with.

Account of the Quantity of Herrings Cured, Branded for Bounty, and Exported, from 1811 *to* 1831 *both inclusive.*

Years ending 5th April.	Total Quantity of Herrings Cured.			Total Quantity of Herrings Branded for Bounty.	Total Quantity of Herrings Exported.		
	Gutted.	Ungutted.	Total.		Gutted.	Ungutted.	Total.
1811	65,430	26,397½	91,827½	55,662½	18,880	19,253	38,133
1812	72,515½	39,004	111,519½	58,430	27,564	35,256	62,820
1813	89,900¾	63,587½	153,488¼	70,027½	40,100½	69,625	109,725½
1814	52,931½	57,611	110,542½	38,184½	34,929	83,474½	118,403½
1815	105,372¼	54,767	160,139¼	83,376	68,938	72,367¼	141,305¼
1816	135,981	26,670¾	162,651¾	116,436	81,544½	26,143½	107,688
1817	155,776	36,567½	192,343½	140,018½	115,480½	23,148	138,628½
1818	204,270¼	23,420¾	227,691	183,089½	148,147½	14,192	162,339½
1819	203,777½	37,116½	340,894	270,022½	212,301½	14,860½	227,162
1820	347,190½	35,301	382,491½	309,700½	244,096	9,420	253,516
1821	413,308	28,887¾	442,195¾	363,872	289,445½	5,360	294,805½
1822	291,626½	24,897¾	316,542¼	263,205½	212,890½	2,065½	214,956
1823	225,037	23,832	248,869	203,110	169,459½	985½	170,445
1824	335,450	56,740¾	392,190¾	299,631	238,505½	1,125	239,630½
1825	303,397	44,268¼	347,665¼	270,844½	201,882½	134	202,016½
1826	340,118	39,115¾	379,233¾	294,422½	217,053¼	20	217,073¼
1827	259,171¼	29,324	288,495¼	223,606	165,741	695	166,406
1828	339,360	60,418	399,778	279,317½	210,766	893	211,659
1829	300,242½	55,737	355,979½	234,827	202,813½	3,062	205,875½
1830	280,933½	48,623½	329,557	218,418½	177,776	3,878½	181,654½
1831	371,096	68,274	439,370	237,085	260,976	3,927	264,903

Whale fishery.

Greenland was first discovered by the English; but in this, as in other branches of navigation, we long allowed the Dutch to take a lead. It was not till after 1750 that, government having granted a bounty of 40s. a ton on every vessel employed in the whale fishery, a considerable increase took place in this branch.

In 1750, the vessels employed were only nineteen; in 1756 they had increased to sixty-seven. The war soon caused a decrease of one half; but at the return of peace in 1763 this fishery revived, and in 1770 the vessels employed amounted to fifty, in 1773 to fifty-five, in 1775 to ninety-six. The American war again caused a decrease, and in 1782 the vessels so employed were only thirty eight. In 1784 they increased to eighty-nine, and in 1785 to 140. After this they exceeded 200 annually till 1793; but the long continuance of the late wars reduced them below the half, and the advantages of peace have been counteracted by causes which have as yet prevented the English vessels from regaining the number employed previously to 1793. In 1832, the whale fishery employed thirty-nine English and forty-two Scotch ships, of the aggregate burden of 26,393 tons.

The Newfoundland fishery has been considerable for fully a century past. As a nursery for seamen, it is accounted of such consequence as to have formed the object of a specific article in most of our treaties of peace. The fish caught, particularly in time of peace, is sent less to Britain than to the Catholic countries in the south of Europe; a market subject to all the interruptions attendant on a change of political relations. The number of vessels employed in this fishery at different times was as follows:

In 1731.. 70
1764..140
1774..254

The American war caused a diminution; but in
1784 the number was........................236
1785..292

At this rate the fishery continued until the war of 1793, after which, particularly after our rupture with Spain in 1797, it fell off greatly; the fishing vessels in 1798 being only 140.

The continuance of war, and the aggrandisement of the French in Italy, occasioned additional depression; so that in 1810 the number of our vessels employed at Newfoundland did not exceed ninety-two. The peace seemed to promise a revival of this important nursery of seamen; and in the year 1816 the number of vessels which arrived in Newfoundland was 795, manned by 6000 seamen (*Report of Committee* in June 1817, p. 7); but the trade, both then and in 1817 and 1818, proved unprofitable, in consequence of indifferent seasons, of the high duty imposed on fish imported in British vessels into Naples, and of the competition of the French fishermen, supported by a high bounty from their government. Of late years very few British ships have gone to the Banks; but we carry on an extensive fishing along the coast of Labrador, and on the shores of Newfoundland. But the more convenient situation of the New Englanders, who are very expert fishermen, give them advantages with which the British find it very difficult to contend; and, partly from this cause, and partly from the forcing system of the French, and the greater duties laid on the importation of salted fish into most Catholic countries, the business appears to be rather in a depressed state. Mr M'Gregor estimates the total produce of the British fisheries in the seas and islands of America, on an average of the five years ending with 1832, at L.857,210 a year.

It is matter of surprise to foreigners that a maritime nation should not have more effectually cultivated this great means of facilitating the support of our population. The ample supply which might have been afforded by the Nymph Bank, on the south-east coast of Ireland, has been avowedly neglected; and it was only in 1818 that we made the discovery of a bank of almost equal productiveness in the vicinity of Orkney. Fish is little known to the mass of the people in our inland counties. Whilst the value of butcher's meat annually consumed in England exceeds L.30,000,000 sterling, the value of the fish caught upon our coasts and in our rivers hardly exceeds L.2,000,000. Yet its price, with the economy and improved arrangements attendant on a state of peace, would not exceed 20s. a cwt., whilst other animal food costs more than twice that sum. But the truth is, that fish has never been a favourite article of food with the bulk of the English people; and, notwithstanding all that has been said to the contrary, we are by no means satisfied that they would gain materially by a change in this respect.

VII.—*Manufactures.*

Voollen manufac-ory.

In this great department of our productive industry we begin with woollens, which, although no longer the largest of our manufactures in point of exportation, nor even in the value annually made, is entitled to the first place from the priority of its establishment, as well as from the substantial basis on which it rests. England, from the extent of her pastures, abounded in wool from a very remote age, and the inhabitants were doubtless capable of manufacturing it into rude clothing; each weaver working in his separate cottage, and with very little aid from machinery. In the twelfth and thirteenth centuries we appear to have had only the most humble fabrics, and to have imported all cloth of finer texture; sending abroad our wool in quantities to Flanders, a country the inhabitants of which were at that period much further advanced than the rest of Europe, with the exception of Italy. It was in the middle of the fourteenth century that a better system was introduced. Flemish manufacturers were invited over to England, and improved greatly the quality of our home-made woollens. The seats of this branch of industry appear at that time to have been Kent and Essex; afterwards Gloucestershire, and subsequently the West Riding of Yorkshire. It occupied at first the southern and more improved districts, and spread afterwards to the northward, on account of the cheapness of labour, the abundance of coal, and the convenience of waterfalls for the machinery. The general character of the woollen manufacture of England has been that of slow progress, but of little fluctuation; the latter evidently a consequence of its depending more on home consumption than on exportation. In the long period from 1700 to 1780, the exports experienced a regular but not rapid rise, amounting in the latter years to about L.3,500,000, whilst our home consumption increased in proportion to our augmenting numbers. More recently the manufacture has been materially improved by the adoption of various important mechanical inventions in the spinning, weaving, and dressing departments. On the whole, however, improvement has been much less rapid in it than in the cotton manufacture; so that whilst our exports of cotton stuffs and yarn have increased beyond all precedent, those of woollens have been comparatively stationary.

As we shall enter fully, in the article WOOLLEN MANUFACTURE, into the details connected with its history, progress, and present state, it would be useless, even if our limits permitted, to anticipate these here. We shall only observe, therefore, that the entire value of the manufacture is estimated by the best authorities at L.18,000,000, which is believed to be distributed nearly as follows:

Raw material (wool)	L.6,000,000
Oil, dye-stuffs, soap, &c.	1,200,000
Wear and tear of capital and profit	3,500,000
Wages	7,300,000
Total	L.18,000,000

Now, supposing that each person, young and old, male and female, engaged in the manufacture, earns, at an average, L.20 a year, the total number employed will be 365,000.

By far the largest proportion of the raw material of the manufacture is the produce of our own flocks; but for many years past, and especially since the peace, we have imported large quantities of wool, principally from Germany. The subjoined accounts give a full view of the state of the foreign woollen trade in 1831, the last year for which the details have been published.

Account specifying the Countries to which Woollen Goods were exported in 1831, *exhibiting the Quantity and declared Value of those sent to each.* (Parliamentary Paper, No. 550, September 1833.)

Countries to which Exported.	Woollen Manufactures, viz.				
	Entered by the Piece.		Entered by the Yard.		Hosiery and Small Wares.
	Quantity.	Declared Value.	Quantity.	Declared Value.	Declared Value.
NORTHERN EUROPE.	Pieces.	L.	Yards.	L.	L.
Russia	31,796	94,599	112,320	6,609	478
Sweden	1,935	1,903	2,702	254	251
Norway	4,774	12,807	3,364	236	733
Denmark	1,094	1,827	10,851	489	358
Prussia	95	323	528	59	10
Germany	337,183	359,482	728,044	56,572	8,938
The Netherlands	90,011	161,101	392,775	24,579	14,525
Carry forward	466,888	L.632,042	1,250,584	L.88,798	L.25,293

Countries to which Exported.	Woollen Manufactures, viz.				
	Entered by the Piece.		Entered by the Yard.		Hosiery and Small Wares.
	Quantity.	Declared Value.	Quantity.	Declared Value.	Declared Value.
	Pieces.	L.	Yards.	L.	L.
Brought forward	466,888	632,042	1,250,584	88,798	25,293
SOUTHERN EUROPE.					
France	5,034	9,090	24,999	2,144	279
Portugal, Proper	51,011	138,914	50,930	4,739	2,975
——— Azores	2,336	8,659	7,700	564	56
——— Madeira	1,153	4,912	2,612	200	109
Spain and the Balearic Islands	47,885	97,017	64,710	6,296	1,381
——— Canaries	1,314	3,832	10,799	715	134
Gibraltar	5,251	12,376	23,267	2,102	981
Italy and the Italian Islands	97,091	196,126	87,915	5,877	2,183
Malta	1,853	7,576	6,713	623	108
Ionian Islands	175	681	1,510	151	192
Turkey and Continental Greece	5,117	17,275	8,633	898	125
Morea and Greek Islands	......	......	......	......	......
AFRICA.					
Egypt (Ports on the Mediterranean)	72	380	356	26	50
Tripoli, Barbary, and Morocco	......	......	80	10	......
Western coast of Africa	2,623	4,620	5,082	339	2,217
Cape of Good Hope	8,253	23,274	60,035	3,726	1,208
St Helena	128	936	7,538	581	32
Mauritius	2,865	6,939	3,427	294	340
ASIA.					
East India Company's Territories, Ceylon and China	224,641	634,074	105,398	8,945	2,563
Sumatra, Java, and other islands of the Indian Seas	11,216	25,115	3,660	232	......
Philippine Islands	240	455	7,776	518	......
New South Wales, Van Diemen's Land, and Swan River	3,918	16,145	93,774	8,404	1,711
New Zealand and South Séa Islands	138	483	13,500	1,220	......
AMERICA.					
British Northern Colonies	89,203	271,484	900,124	58,226	19,281
British West Indies	23,072	62,009	149,952	10,439	3,521
Hayti	1,454	5,156	675	87	......
Cuba and other Foreign West Indies	8,737	31,263	74,077	5,065	990
United States of America	833,110	1,890,838	2,586,409	266,198	75,143
STATES OF CENTRAL AND SOUTHERN AMERICA, viz.					
Mexico	15,094	61,938	15,467	2,080	473
Colombia	3,244	16,835	18,109	1,810	595
Brazil	24,175	76,865	71,323	5,407	1,063
States of the Rio de la Plata	14,910	58,137	49,119	5,077	1,705
Chili	21,282	137,307	18,315	1,353	759
Peru	15,911	101,333	19,385	2,488	2,164
ISLES OF GUERNSEY, JERSEY, ALDERNEY, MAN, &c.	7,954	26,816	52,693	5,324	1,524
Total export	1,997,348	L.4,580,902	5,797,546	L.500,956	L.150,155

Imports of Wool.—During the year 1831 we imported 31,652,029 lbs. of wool, of which 22,437,022 lbs. came from Germany, 3,474,823 lbs. from Spain, 2,493,337 lbs. from New South Wales and Van Diemen's Land, with smaller quantities from France, Portugal, Prussia, &c.

For an account of the prices and qualities of wool, &c. the reader is referred to article WOOL in this work, or in M'Culloch's *Commercial Dictionary.*

Our cotton manufacture is entitled to the greatest attention on different accounts. Of all our manufactures, it affords the largest export, and exhibits the most rapid improvements in machinery. Its introduction, though not remote, is less recent than is commonly supposed. It appears to have taken place about two centuries ago, when it was established at Manchester; but it was long conducted upon a very limited scale. The raw material, imported at first only from the Levant, in particular from Smyrna, began, after 1660, to be supplied by our West India colonies. The quantity imported amounted, about the year 1700, to 3500 bales; but, increasing with the extended cultivation of our colonies, it averaged, about the year 1720, something more than 7000 bales. From the colonial conquests of the war of 1756, our import of cotton received a further augmentation; but the manufacture increased very slowly, a great part of our cotton being re-exported to Holland, for the supply of Dutch and German weavers. It was not till after the peace of 1763, and the invention, first of the carding machine, and next of the spinning jenny, that this manufacture became considerably extended. In 1775, the average import of cotton approached to 18,000 bales. A variety of inventions, unequalled in the history of manufacturing industry, were now made (see our article on the COTTON MANUFACTURE), which gave an astonishing stimulus to the business. Fine calicoes and muslins were introduced; the workmen were withdrawn from their detached dwellings, and collected into large factories, and the price of the finished article experienced a reduction, notwithstanding a rise in the raw material, and in the wages of labour. The period which followed the peace of 1783 is perhaps unexampled for the reduction of price and the consequent extension of sale that took place in regard to cotton goods. The commencement of hostilities in 1793 gave a pretty severe shock to the business; but the improvements in machinery continuing, the manufacture soon recovered, and has gone on increasing, under many vicissitudes, with a rapidity unparalleled by any other business, either in this or any other country. Neither does there seem to be any ground for fearing that this progress will be speedily checked. On the contrary, our superiority in all that contributes to the advancement of the manufacture is so very decided, that, provided the public tranquillity be preserved unimpaired, we have nothing to fear from the competition of others.

The reader is referred to the article COTTON MANUFACTURE in this work for an account of the rise and progress of this great branch of national industry. But the following tabular statements are interesting, as exhibiting the present magnitude and importance of the trade, the sources whence the raw cotton is derived, and the foreign markets for the finished articles.

Mr M'Culloch gives, in the second edition of his *Dictionary*, the following estimate of the total value of the cotton manufacture of Great Britain, and of the amount of capital, and the number of persons employed in it.

Total value of every description of cotton goods annually manufactured in Great Britain		L.34,000,000
Raw material, 240,000,000 lbs. at 7d. per lb.	L.7,000,000	
Wages of 800,000 weavers, spinners, bleachers, &c. at L.22. 10s. a year each	18,000,000	
Wages of 100,000 engineers, machine-makers, smiths, masons, joiners, &c. at L.30 a year each	3,000,000	
Profits of the manufacturers, wages of superintendence, sums to purchase the materials of machinery, coals, &c.	6,000,000	
		L.34,000,000

The capital employed may be estimated as follows:

Capital employed in the purchase of raw material	4,000,000
Capital employed in payment of wages	10,000,000
Capital vested in spinning-mills, power and hand-looms, workshops, warehouses, stocks on hand, &c.	20,000,000
	L.34,000,000

Of 288,674,000 lbs. of cotton wool imported into the united kingdom in 1831, 219,333,000 lbs. were from the United States, 31,695,000 lbs. from Brazil, 25,805,000 from the East Indies, 7,714,000 lbs. from Egypt, 2,401,000 lbs. from the British West Indies, 334,000 lbs. from Colombia, 366,000 lbs. from Turkey and Continental Greece, 344,000 lbs. from Malta, &c. (*Parl. Paper, No.* 550, *Sess.* 1833.)

Burns' *Glance*, a tabular statement, annually published at Manchester, and admitted to be drawn up with great care, contains an account of the cotton spun in Great Britain in 1832, and how that spun in England was disposed of, with several other interesting particulars.

Statement of Cotton spun in England and Scotland in 1832, *and the Quantity of Yarn produced; showing also the Quantity spun in England, and how disposed of.*

	Number of Bags consumed.	Average Weight of Bags in lbs.	Total Weight in lbs.	Weekly Consumption of Bags.
American cotton	615,402	345	212,313,690	11,834·34
Brazil ditto	135,298	180	24,353,640	2,601·46
Egyptian ditto	45,864	220	10,090,080	882·00
West India ditto	6,454	300	1,936,200	124·06
East India ditto	55,416	330	18,287,280	1,065·36
Taken from inland stock	33,160	310	10,279,600	637·36
Total number of bags consumed	891,594		277,260,490	17,146·20
Allowed for loss in spinning, 1¾ oz. per lb.			30,325,366	lbs.
Total quantity of yarn spun in England and Scotland				246,935,124
Deduct yarn spun in Scotland				24,338,217
Total quantity of yarn spun in England				222,596,907
HOW DISPOSED OF.				
Exported in yarn during the year			71,662,850	
——— thread			1,041,273	
——— manufactured goods			61,251,380	
Estimated quantity of yarn sent to Scotland and Ireland			5,700,000	
Exported in mixed manufactures not stated in the above named articles, consumed in cotton banding, healds, candle and lampwick, wadding, and loss in manufacturing goods			12,000,000	
Balance left for home consumption and stock			70,941,404	222,596,907

This annual quantity of 222,596,907 lbs. gives a weekly supply of 4,280,709 lbs. Mr Burns estimates the quantity spun per spindle, per week, at 8½ oz. making the total number of spindles employed in England and Wales, in 1832, amount to 7,949,208. Those employed in Scotland during the same year are estimated, in the same way, at 881,020. Mr Burns further calculates the number of looms employed in England and Wales at 203,703. The consumption of flour in the manufacture is much greater than any one not pretty well acquainted with it would really suppose. The average quantity required for each loom is estimated at 4 lbs. per week; making the total annual consumption in England and Wales 42,301,584 lbs. or 215,824 barrels of 196 lbs. each.

Account of the Export of Cotton Goods and Yarn in 1831, *specifying the Countries to which they were sent, and the Quantity and Value of those sent to each.* (Parl. Paper, No. 550, September 1833.)

Countries to which Exported.	Cotton Manufactures.			Cotton Twist and Yarn.	
	Entered by the Yard.		Hosiery, Lace, and Small Wares.		
	Quantity.	Declared Value.	Declared Value.	Quantity.	Declared Value.
	Yards.	*L.*	*L.*	*Lbs.*	*L.*
Northern Europe, Russia	1,960,634	68,412	7,252	13,959,666	790,371
Sweden	18,280	615	216	708,510	34,885
Norway	434,744	13,704	1,829	34,440	1,553
Denmark	312,461	6,213	992	118,316	5,716
Prussia	1,456	80	20	19,448	1,556
Germany	41,520,616	940,441	205,527	20,435,442	1,195,718
The Netherlands	13,285,524	383,127	214,123	9,091,238	794,536
Southern Europe.—France	946,660	35,357	13,613	2,616	1,127
Portugal Proper	23,377,245	373,916	13,454	281,096	17,534
———Azores	780,099	17,126	383	3,240	149
———Madeira	569,794	14,577	677	......	......
Spain and the Balearic Islands	4,756,652	129,778	9,503	36,170	3,147
———Canaries	631,079	15,646	515	2,500	131
Gibraltar	9,909,009	238,732	6,158	39,196	3,178
Italy and the Italian Islands	38,164,564	1,035,748	44,172	8,444,518	438,834
Malta	1,967,953	49,594	1,403	342,740	13,468
Ionian Islands	216,159	5,210	615	62,450	3,643
Turkey and Continental Greece	24,565,580	585,473	3,335	1,735,760	90,015
Morea and Greek Islands	344,893	6,540	......	11,000	600
Africa.—Egypt, ports on the Mediterranean	2,354,628	56,088	26	93,600	6,000
Tripoli, Barbary, and Morocco	7,810	123	......	......	......
Western coast of Africa	2,384,000	75,058	446	280	34
Cape of Good Hope	2,904,106	83,612	3,807	193	19
St Helena	73,371	2,173	254		
Mauritius	2,432,894	65,185	3,400		
Asia.—East India Company's territories, Ceylon and China	43,385,852	1,182,574	13,972	6,624,823	467,861
Sumatra, Java, and other islands of the Indian Seas	5,915,088	194,889	1,730	312,000	22,653
Philippine Islands	1,132,583	33,639	13	18,800	1,796
New South Wales, Van Diemen's Land, and Swan River	1,905,428	61,567	8,380	7,233	380
New Zealand and South Sea Islands	5,014	135	......	......	......
America.—British Northern Colonies	15,618,106	413,737	25,536	307,997	10,376
British West Indies	21,975,459	606,923	31,568	14,416	835
Hayti	6,828,576	178,743	4,731	320	30
Cuba and other Foreign West Indies	11,569,441	364,547	11,329	200	10
United States of America	68,587,893	2,518,824	344,427	317,392	19,063
States of Central and Southern America, viz. Mexico	12,150,426	471,208	23,712	784,215	37,972
Colombia	5,757,562	177,559	9,060	28,880	1,580
Brazil	26,271,527	681,461	20,540	2,740	334
States of the Rio de la Plata	6,242,134	176,874	9,743	800	30
Chili	12,793,220	431,323	26,851	4,800	130
Peru	6,312,931	222,708	19,605	......	......
Isles of Guernsey, Jersey, Alderney, Man, &c.	1,013,852	44,364	35,755	4,405	755
Total export	421,385,303	12,163,513	1,118,672	63,821,440	3,975,091

Such being the vast extent and importance of the cotton manufacture, the probability of our preserving our ascendency in it becomes a very interesting topic of inquiry. But it is obvious that a great deal of conjecture must always insinuate itself into our reasonings with respect to the future state of any branch of manufacturing industry. They are all liable to be affected by so many contingent and unforeseen circumstances, that it is impossible to predicate, with any thing like certainty, what may be their condition a few years hence. But abstracting the effects of national struggles and commotions, which can neither be foreseen nor calculated, we do not think there is any thing in our state, or in that of the different commercial and manufacturing countries of the world, which should lead us to anticipate that the gloomy forebodings of those who contend that the cotton manufacture of England has reached its zenith, and that it must now begin to decline, will be realized. The natural capabilities we possess for carrying on the business of manufacturing are, all things considered, decidedly superior to those of any other people. But the superiority to which we have already arrived is perhaps the greatest advantage in our favour. Our master manufacturers, engineers, and artisans, are more intelligent, skilful, and enterprising, than those of any other country; and the extraordinary inventions they have already made, and their familiarity with all the principles and details of the business, will not only enable them to perfect the processes already in use, but can hardly fail to lead to the discovery of others. Our establishments for spinning, weaving, printing, bleaching, &c. are infinitely more complete and perfect than any that exist elsewhere; the division of labour in these is carried to an extent incomparably greater; the workmen are trained from infancy to industrious habits, and have attained that peculiar dexterity and sleight of hand in the performance of their separate tasks, which can only be acquired by long and unremitting application to the same employment. Why, then, having all these advantages upon our side, should we not keep the start which we have already gained? Every other people who attempt to set up manufactures must obviously labour under the greatest difficulties as compared with us. Their establishments cannot at first be sufficiently large to allow the division of employments to be carried to any considerable extent, at the same time that expertness in manipulation, and in the details of the various processes, can only be attained by slow degrees. It appears, therefore, reasonable to conclude that such new beginners, having to withstand the competition of those who have already arrived at a very high degree of perfection in the art, must be immediately driven out of every market equally accessible to both parties; and that nothing but the aid derived from restrictive regulations and prohibitions will be effectual to prevent the total destruction of their establishments in the countries where these are set up. (M'Culloch's *Commercial Dictionary*, article *Cotton Manufacture.*)

The seats of the cotton manufacture of England are, first, Manchester, which takes decidedly the lead of all other places; and, secondly, Preston, Bolton, Blackburn, and Wigan, all situated in Lancashire. After these come several other places, partly in Lancashire, in Cumberland, and the West Riding of Yorkshire. The introduction of cotton works into the last, the great seat of the woollen manufacture, is owing to the practicability of the same workmen turning, in case of need, from wool to cotton, and *vice versa.*

ardware. We have already noticed the surprising increase in the produce of our iron mines since 1780. This increase of the raw material, joined in some cases to the command of coal in the vicinity, and in all to a facility of conveyance of coal and iron by canals, has, in the last forty years, given a great extension to our hardware manufacture. In it we take the lead of foreigners as decidedly as in our cottons; and if the ratio of increase has not been altogether so rapid, it is owing, not to inferior ingenuity in the workmen, but to radical differences in the two manufactures. In no department has the subdivision of employment been carried to so great a length; in none are its effects in cheapening production so conspicuous. Birmingham and Sheffield are the two great work-shops for our hardware; the latter is confined to iron and steel; whilst, in the former, not only iron and steel, but copper and brass, constitute the materials of labour. Sheffield fabricates articles which are less for ornament than utility, and which possess, in general, a certain bulk, such as grates, spades, sickles, files, knives, fenders, fire-irons; whilst in Birmingham there is, in addition to articles of solidity, a surprising variety of toys, fancy goods, and petty manufactures; each trifling when considered separately, but the whole forming an aggregate of great value. The most insignificant of these, such as a brass cock or a button shank, passes through a number of hands; and each artisan performs only a single operation. He thus acquires an extraordinary dexterity in his limited department, and, in the course of a day, dispatches several hundred, perhaps even a thousand articles, through his particular stage; the result of all which is, that the price, when sold in quantities, is incredibly low. Another and very interesting feature in the situation of Birmingham, is the populousness of its neighbourhood. Yet in none of our large towns is living less expensive; an advantage owing partly to the abundance of coal, partly to the ready supply of milk and vegetables from the wide space occupied by the population.

The nail trade is carried on, not in the town of Birmingham, but in a part of the surrounding district: it is computed to employ 30,000 men, women, and children; for even this heavy article admits of a subdivision of employment, which lightens the labour, and enables the workman to avail himself of the aid of his family. Of the two towns, Sheffield is by much the more ancient; the command of coal and iron in the same neighbourhood having rendered it, so far back as the thirteenth or fourteenth century, a place for the fabrication of the homely articles used in these days by our ancestors. It is about a century since its razors, knives, and files began to take a more delicate shape. Birmingham, however, embraced a wider range, and advanced with much greater rapidity; but Sheffield also has its adjacent district inhabited by manufacturers, though to a much less extent than the vicinity of Birmingham. This district, called Hallamshire, extends six or seven miles to the west of Sheffield.

Hardware is made in several other places, such as Bilston, Wolverhampton, Dudley, and Walsall. Each of these towns is situated in Staffordshire, and, in point of manufacture, is small only in comparison with Birmingham or Sheffield. Articles apparently very trifling are manufactured to a surprising extent in different places, such as pins at Gloucester, needles at Red-ditch in Worcestershire, watch movements and main springs at Prescott in Lancashire. The total value of our articles of iron, steel, brass, and copper, including the manufacture from its earliest to its most finished stage, is necessarily fluctuating, but may be computed at L.16,000,000 annually; two thirds of which appear to be consumed amongst ourselves, whilst the other third is exported to two great markets, the Continent of Europe and the United States of America. A return during three years of peace, but of unequal mercantile prosperity, will suffice to show the average of annual export.

Quantity and Real Value of Metals and Hardware exported from Britain in 1831.

	Quantity.	Real Value.
1. Metals, as a RAW MATERIAL, or in the first stage of manufacture.		
Iron and steel, wrought and unwrought	Tons 124,312	L.1,123,372
Lead and shot (partly from Scotland)	... 6,777	96,333
Tin, unwrought	Cwts. 21,763	77,718
2. MANUFACTURES in a finished state.		
Hardware and cutlery	... 336,194	1,622,429
Brass and copper manufactures	... 181,951	803,124
Plate, plated ware, jewellery, and watches	... .	188,144
Tin and pewter wares, and tin plates	... .	230,143

The number of persons, young and old, employed in the hardware manufacture, is reckoned at between 300,000 and 400,000. In no branch of industry is the transition from war to peace more sensibly felt; government, the great customer for arms and artillery, withdraws entirely from the market; whilst the stagnation of commerce, the postponement of new buildings and new machinery, in short, the various evils inseparable from a sudden and general change, which have been so cruelly felt throughout Britain since the peace, all operate most materially against the sale of the heavier and more useful articles. Similar causes cast a damp over the purchase of ornamental and fancy goods; so that in no department of our population have the sufferings of the labouring classes or the augmentation of the poor's rate been greater. But there is happily a point beyond which depression cannot go; the reduced price of a commodity rendering it applicable to more extended uses, and adapting it to the means of humbler customers. Iron has not been found suitable as a substitute for stone in paving the streets of the metropolis; but, if its price continue low, it is likely to supplant timber for a variety of purposes, of which the public at large are not as yet aware. Reduction of price will lead also to a demand from the Continent for our hardware; the article in which of all others the French and Germans are most behind us. Their mines of iron are seldom adjacent to their mines of coal, and, with the exception of a few places, such as Liège in the Netherlands, and St Etienne near Lyons, the hardware workmen are not collected in such large associations as to admit of the necessary subdivision of labour. As improvement advances, and a taste for comfort becomes diffused, the inhabitants of the Continent will extend their purchases; they will see in the keys, the locks, and other neat and convenient articles of English fabric, a substitute for the bolts, the latches, and other coarse contrivances, with which they have hitherto been obliged to content themselves. In the United States, iron and coal are found, it is said (Mellish's *Travels in America*, chap. 67), in abundance, in a quarter (Pittsburgh in Pennsylvania) where land and provisions are certainly much cheaper than in Britain; but the scattered state of American population must, during several ages, oppose serious obstacles to the division of employment necessary in all the nicer branches of the hardware manufacture; particularly as the ease with which the Mississippi and Ohio are navigated by steam opens even the western states to the importation of British goods. Upon the whole, therefore, we look on our hardware manufactures, notwithstanding their present depression, as resting on a solid basis, because in them we combine several advantages;—the raw material, the command of cheap fuel, and the use of machinery, which, the more it is adopted, will bring a greater proportion of the work within the compass of women and boys, and thus lessen the proportion borne by wages in the cost of the finished article.

Linen manufacture.

Linen has never formed one of the staple manufactures of England, flax having been less cultivated amongst us than on the opposite shore of the Netherlands; a country which, in the fourteenth and fifteenth centuries, supplied the rest of Europe with the finest linens and woollens. When England subsequently advanced in manufacturing arts, the abundant supply of wool pointed out the most suitable branch; and we were contented to continue our imports of linen from the Netherlands, from France, and from Germany, or to favour the manufacture of the sister island in a department which did not excite our jealousy. In Ireland, the linen manufacture dates about two centuries ago, and is said to have owed much of its extension to the measures of the unfortunate Wentworth in the reign of Charles I. The annual consumption of linen in England a century ago was probably not far below that of her double population at present, owing to the very general substitution in our time of cotton articles. Then, as at present, the linen manufacture of England was established chiefly in Lancashire, in Cumberland, and in a county very remote from these, namely, Dorsetshire. In 1745 government, apprised of the extension of the manufacture of coarse linen in Silesia and other parts of Germany, and actuated by the fallacious notion of making a monopoly of all kinds of productive industry, granted a bounty of 1½d. per yard on the exportation of all British linen of a value from 6d. to 18d. per yard; in other words, a premium of 20 or 25 per cent. on the prime cost of all inferior qualities exported. So large a grant soon augmented the manufacture of osnaburgs and other coarse cloths, particularly in Scotland, although the ratio of increase was infinitely smaller than in the case of cotton, where there was no premium, but a rapid improvement of machinery. The demand for bounty, in the ten years ending in 1785, was about L.33,000 annually. More recently these impolitic issues were greatly increased; but at length the impolicy of forcing a manufacture in this way having become obvious to every one, the bounties, after being gradually reduced, ceased finally in 1830.

Ireland and Scotland, particularly Dundee, are both superior to England in the manufacture of linen. But some of the flax mills established at Hull are on a more extensive scale than any other in the empire. The reader will find under the head of LINEN, in this work, an account of the value of the manufacture in each division of the empire, of the amount of capital, and the number of hands employed in it, &c.

Silk man facture.

In the silk manufacture, as in linen, we have had to contend with a formidable opposition in other countries, particularly in France and Italy; and we have also had to import the whole of the raw material. It would therefore hardly have been attempted by our countrymen, but for the great profits expected from an article of general use amongst the higher classes. Its introduction amongst us goes back to the fifteenth century. About the beginning of the seventeenth it seems to have been carried to a considerable extent, owing certainly not to the luxury of the age, nor to any great proportion of affluent persons in the community, but to silk being almost the only article of apparel in which the vanity of dress could display itself. Towards the end of the reign of Charles II., about the year 1680, raw silk began to be imported in quantities from India; and the English manufacture received a substantial addition by the numbers and ingenuity of the Frenchmen who settled in this country after the revocation of the edict of Nantes in 1683. Various circumstances thus contributed to preserve and extend the manufacture, which continued rather upon the increase till the general substitution of cottons for silks about 1790. This gave a serious shock to the manufacture, from which it recovered only by slow degrees. Its situation had not indeed been at any time prosperous; and the continued complaints of the manufacturers occasioned within these few years a fundamental change in the policy under which it had previously been conducted.

From the first introduction of the manufacture into England down to 1825, foreign silks were either positively or virtually excluded. But the monopoly which was thus secured to the manufacturers produced, what all monopolies invariably do, an indifference to improvement. Instead of trusting to the ingenuity or to the superior skill which they might have called to their aid for preserving their ascendency in the market, the manufacturers depended upon custom-house regulations, and additional penalties on smuggling. In consequence, invention was quite at a stand. Such indeed was the influence of the system in this respect, that in 1826 the member for Coventry (Mr Edward Ellice) affirmed in his place in the House of Commons that the improved silk looms in use in various parts of the Continent enabled the workman to execute *five* times as much work as he could do here; whilst in every business not protected by a monopoly the result was precisely opposite. At length, after a great deal of discussion, it was resolved to adopt a more liberal system. In 1825 a bill was in consequence passed, allowing the importation of foreign silks on payment of an *ad valorem* duty of 30 per cent., accompanied, however, by the effectual reduction of the singularly oppressive duties which had previously been imposed on the imports of raw and thrown silk. This measure, though vehemently opposed at the time, has proved most successful. We are quite sure that we are within the mark when we affirm that the silk trade has made more progress since 1826, when the new system was introduced, than it did during the whole of the preceding century. The following is an account of the raw and thrown silk imported since 1820:—

Years.	Raw and Thrown Silk. lbs.	Years.	Raw and Thrown Silk. lbs.
1820	2,641,866	1827	3,610,727
1821	2,542,195	1828	4,765,241
1822	2,680,568	1829	3,805,933
1823	2,880,634	1830	4,318,181
1824	3,477,648	1831	4,621,874
1825	3,894,770	1832	4,224,897
1826	2,665,225		

This table shows conclusively that the manufacture has increased nearly 50 per cent. since the adoption of those sound and liberal measures which have been the theme of so much ignorant invective. It is of importance too to observe, that not only our imports of raw silk, but also our exports of manufactured silk goods, are rapidly increasing. The following table shows this.

Declared Value of all Sorts of British Manufactured Silk Goods exported each Year since 1820.

Years.	Declared Value.	Years.	Declared Value.
1820	L.371,775	1823	L.251,409
1821	374,473	1824	442,596
1822	381,703	1825	296,736
1826	L.168,801	1830	L.521,010
1827	236,344	1831	578,874
1828	250,870	1832	529,990
1829	267,931		

It is plain, therefore, that the manufacture is not increasing merely by reason of an increased demand in the home market, but because we are rapidly gaining on our rivals in the markets of foreign countries. This affords unquestionable evidence of the improvement as well as the extension of the manufacture. In 1832 our exports of wrought silks to France itself amounted to about L.75,000.

Leather manufacture.

Leather, however little it may figure as an article of export, is necessarily one of extensive home consumption in every civilized country, particularly in such a climate as ours, and where there are so many rich and sumptuous equipages. It is matter of regret that we should have so very few *data*, official or otherwise, on which to form an estimate of the export or import of hides in former ages. Such an estimate would possess interest, as indicating the extent of our pasturage and the number of our cattle in comparison with our population. Whatever may have been the case at a remote date, the custom-house returns, for many years past, show, by the annual imports, that the demand for leather has greatly exceeded the home supply of hides. For a long time this importation took place from the Continent of Europe, and from the least civilized quarters; from countries, such as Lithuania and Poland, where the quantity of hides furnished by the cattle materially exceeds that of the leather required by the inhabitants. But since the opening of the trade to South America, it has been found more advantageous to import hides from that continent, where the herds of wild cattle are so numerous as to meet the eye of the traveller in almost every point of the horizon.

On an average of the two years ending with 1832 there were imported 199,033 cwts. of untanned, and 24,334 cwts. of tanned hides. The quantity of leather annually made in England and Wales may be estimated at about 45,000,000 lbs. The largest tanneries are at Bermondsey in Southwark; but there are also very extensive establishments of the kind in the country, as in Cheshire, Lancashire, Westmoreland, Cumberland; and also in Lincolnshire. The late war, by its long continuance, and the magnitude of our army and navy, produced great orders from government for our leather manufacture. Shoes were and still are made wholesale in several towns of Staffordshire, Cheshire, and Northamptonshire; but those made in London, by the principal dealers, are, though expensive, by far the best.

Of the annual value of the leather manufactured into shoes, boots, harness, saddlery, &c. there are no means of forming a correct estimate; but we have merely to consider the population of England, and the unavoidable extent of their wants, to be satisfied that from ten to twelve millions sterling are rather below than above the mark. But whilst our home consumption is so considerable, our export is comparatively small, and does not exceed half a million sterling. To Ireland, the leather we ship is merely tanned; to other countries our exports are in a manufactured shape. The duty on leather was wholly abolished in 1830.

Glove trade.

Connected with our general manufacture of leather is the glove trade, a branch of no inconsiderable extent, being carried on in several of the midland and western counties, viz. at Woodstock, Worcester, Ludlow, Hereford, Yeovil in Somersetshire, &c. This branch of industry enjoyed for a lengthened period the protection of monopoly, which, however, was abolished in 1825. Many contradictory statements have been made as to the effects of this measure. We believe, however, that the depression so much complained of has not been produced by it, but by the substitution of cotton gloves for those of leather; and we have no doubt that, had it not been for the greater cheapness and improved quality of leather gloves, caused by the abolition of the monopoly, this substitution would have been carried much farther than it has been. The increased imports of the lamb and kid skins used in the manufacture show conclusively that it is not declining.

Brewery.

We come next to a branch of industry of a very different description, namely, the brewery. The amount of capital and labour invested in brewing establishments in England is very large, and particularly striking to those who have lived on the Continent, and have contrasted our situation with that of the wine countries of the south of Europe. It is only in Flanders and Germany that breweries are numerous; and, in the latter, from the limited capital, and the scattered state of their population, there are hardly any of those large establishments which exist in our metropolis. In London this important branch of business is chiefly in the hands of about a dozen great houses, who, conjunctly with the smaller establishments, brew at an average 1,800,000 barrels of porter.

The following account exhibits within a brief compass all the information that can be desired with respect to the consumption of malt and beer in England, and the duties thereon.

Account of the Quarters of Malt charged with Duty in England and Wales, with the Amount and Rate of such Duty; of the Malt used by Brewers and Victuallers in the same; of the Number of Barrels of each sort of Beer, and the Duties thereon; in each year from the 5th January 1821 *to the 5th January* 1833.

Years ended 5th January.	Malt in England.							Beer in England.					
	Quarters charged with Duty.	Rate per Quarter.		Amount of Duty.			Quarters used by Brewers and Victuallers.	Strong, at 9s. 10d. per Barrel.	Table, at 1s. 11½d. per Barrel.	Intermediate, at 4s. 11d. per Barrel.	Amount of Duty.		
		s.	*d.*	*L.*	*s.*	*d.*		Barrels.	Barrels.	Barrels.	*L.*	*s.*	*d.*
1821	2,985,530	28	10½ $\frac{6}{21}$	4,311,446	2	6	No account has been kept of the quantities used during these years.	5,666,817	1,518,696	...	2,838,149	1	1
1822	3,267,304	...		4,718,360	10	0		5,969,891	1,528,575	...	2,987,366	8	6
1823	3,336,064	20	8	3,624,242	8	0		6,306,981	1,570,043	...	3,153,661	5	7
1824	3,105,644	...		3,203,502	17	6		6,395,835	1,483,045	7,018	3,190,908	12	8
1825	3,451,922	...		3,560,693	0	0	2,704,514	6,660,968	1,544,048	15,660	3,326,277	14	2
1826	3,696,592	...		3,813,072	7	6	2,820,946	7,014,395	1,606,899	6,160	3,495,597	9	1
1827	3,416,996	...		3,586,084	19	8	2,629,626	6,697,133	1,603,653	7,707	3,268,655	9	9
1828	3,137,042	...		3,241,610	6	0	2,571,879	6,403,302	1,532,308	17,158	3,131,662	6	0
1829	3,814,727	...		3,941,884	19	1	2,640,621	6,570,310	1,530,419	62,617	3,222,807	2	11
1830	2,928,509	...		3,026,126	6	9	2,406,991	5,961,048	1,380,469	55,498	2,923,118	1	5
1831	3,362,613	...		3,474,699	16	10	2,364,939	3,570,332	1,066,262	41,834	...		
1832	4,120,436	...		4,257,781	10	10	2,284,949	...	...	...	...		
1833	3,958,721	...		4,090,678	9	11	3,235,519	..	...	...	...		

The duty on beer having ceased on the 10th of October 1830, there are no subsequent accounts of the quantities brewed. There can be no doubt, however, from the increased quantity of malt, that the production of beer has been materially increased.

Spirituous liquors form one of the branches of manufacture in which England is dependent on her neighbours, as she imports an annual supply of corn spirit from Scotland and Ireland, rum from the West Indies, and brandy from France. It has been generally supposed that the consumption of gin has increased materially in England since 1825, when the duties were reduced. We are, however, inclined to doubt whether such be really the case, and are disposed to believe that the effect is more apparent than real; in fact, that it has resulted rather from a diminution of smuggling than from a positive increase of consumption. That such has been the case in Scotland and Ireland is beyond all question; and there seems no reason to conclude that it is otherwise in England. We subjoin a statement of the quantity of the different sorts of spirits entered for home consumption in England in 1832, and of the duties thereon. The consumption of British spirits has declined about 500,000 gallons during the last three years. The annual average consumption of brandy is about 1,200,000 gallons. Its increase in 1832 is to be ascribed to the notion then prevalent, but since exploded, that brandy potations formed one of the best antidotes to cholera.

Consumption of and Duty on Spirits in England in 1832.

	Gallons.	L.
Brandy........................	1,508,924	1,697,095
Geneva	13,833	15,567
Rum...........................	3,377,507	1,518,994
Home made Spirits.	7,259,287	2,722,233
Total....	12,159,551	5,953,889

Lesser m nufactur glass, hat pottery.

To the remaining manufactures our limits allow of little space, though several of them would be accounted of great importance in any other country than England. The extent to which such articles as soap and paper are made among us is amply shown by the excise returns; but the list of our exports is of more consequence to the political economist, not from the vulgar notion that it is by export only that national profit is realized, but as indicative of those commodities for which we possess, in our soil, our climate, or our colonial possessions, advantages that give us a superiority over our neighbours. Thus, in the case of glass, the abundance and cheapness of our coal outweigh the disadvantages arising from the duty, and enable us to make an annual export of between L.400,000 and L.500,000. In the manufacture of hats, likewise, our command of wool for the coarser kind, and of furs from our North American colonies for beaver hats, enables us to ship to an extent of nearly L.200,000 real value a year. In earthenware we have the advantage of clay, of fuel, and of ready communication by canals. These, joined to the taste and ingenuity of individuals engaged in the manufacture, carried it, in the course of the eighteenth century, to an extent which has rendered it a national object; a tract of seven or eight miles in Staffordshire, called the Pottery District, being almost entirely appropriated to it. The population of this tract is about 60,000. The great outlet is Liverpool, and the shipments take place partly to the United States, partly to the continent of Europe. Our exports, comprising porcelain, average from L.400,000 to L.500,000 real value.

The stocking manufacture is carried on chiefly in the counties of Nottingham, Derby, and Leicester. It formerly employed vast numbers of women in knitting; but in this, as in most other branches, machinery has greatly superseded manual labour. Lace is made in vast quantities in the midland counties; and here also machinery has of late years been extensively applied. And so extraordinary has been the progress of invention in this department, that British lace at present commands a ready sale in all foreign markets, and is largely smuggled even into France.

We shall give, in a subsequent section, an account of the number of persons supposed to be employed in trade and manufacture, according to the returns obtained under the population act for 1821.

VIII.—*Commerce and Shipping.*

Much of what relates to the commerce of England has been already treated of under the preceding section, and the colonial part of our trade shall be noticed in the next. At present we are to exhibit a brief sketch of our commercial intercourse with Ireland and the continents of Europe and America.

With Ireland the intercourse of England is very great, that country sending us grain, salted and fresh provisions, live cattle, butter, &c. to the amount of six or seven millions annually, and taking largely in return our manufactures, particularly cotton, woollen, and hardware.

North of Europe.—From Russia our chief imports are tallow, hemp, flax, corn, linen, timber, pitch, &c.; from the Swedish dominions, iron and timber; from Poland, wheat, timber, and potash; from Prussia, wheat, timber, and flax. All these countries take our cottons, hardware, and colonial produce.

Central part of Europe.—From Holland our imports are not foreign merchandise, as in the seventeenth century, when the Dutch were the carriers of Europe, but agricultural produce, as oats, wheat, seeds, hemp, cheese, butter; also gin; the whole to a large amount; in return for which the Dutch take our hardware, cottons, and woollens. From France our imports have long been burdened with heavy duties, but still they are large and increasing; consisting chiefly of wine and brandy, and also of silk, lace, and gloves. With Germany our chief intercourse is through the medium of Holland and Hamburg. Our exports are large, particularly in cottons, hardware, and colonial produce. Our imports are also very various and large, consisting of wool, corn, flax, timber, linen, and wine, from the vicinity of the Rhine.

South of Europe.—Here we enter on countries of much less industry. From Portugal we take wine in very large, and fruit in smaller quantities, in return for our cottons, our woollens, and our hardware. From Spain we receive wool, wine, brandy, oil, fruits, barilla, &c. Italy, without any commercial treaty, takes annually a large quantity of our manufactures, and gives in return silk, oil, and fruit. With the Levant our traffic is similar; consisting of an export of manufactures, particularly printed cottons and hardware, and of an import of silk, fruit, and drugs.

The *United States* are, notwithstanding their tariff, our best customers, receiving from us manufactures of almost every kind to a great amount, and sending us in return vast quantities of cotton, tobacco, rice, and flour; but the merchandise received from them being far inferior to the value of our exports, the difference is paid by remittances in money from the Continent of Europe, arising from American merchandise sold there. With South America a wide field of commercial intercourse has been opened; at present, however, the chief articles received from that vast region are bullion, hides, skins, indigo, and cochineal. The trade is, and will long be, subject to the various disadvantages of a newly-settled country, bare of capital, deficient in industry, and possessing but a small number of consumers of European commodities in proportion to its extent and fertility.

From *Asia* we import tea, indigo, cotton, coffee, sugar, piece goods, ivory, drugs, &c. Our principal article of export is cotton goods, for which, how singular soever it may appear, India has, since the opening of the trade in 1814, become one of our very best markets. Besides cotton stuffs and yarn, we send to Asia woollen goods, copper, and a great variety of other articles.

From *Africa* we import drugs, ivory, teak wood, hides, &c. Our exports are but inconsiderable, consisting principally of cotton and linen manufactures. The hopes so frequently entertained, of opening an advantageous trade with the interior of Africa, have hitherto been altogether disappointed, and we do not suppose that they are destined to be more successful in future.

Foreign trade.

The following accounts refer to the trade of Great Britain. It appears, however, from the statement of the customs duties collected in the different parts of the empire in 1831, and which are given in a subsequent part of this article, that the foreign trade of Scotland does not, on an average, exceed an eleventh or twelfth part of that of England. The trade of Ireland is about as great as that of Scotland.

I.—*Official and Declared*[1] *Value of Exports of British and Irish Produce and Manufacture, and Official Value of Exports of Foreign and Colonial Merchandise from Great Britain, and Official Value of Imports into the same, for the following Years.*—(Parl. Paper, No. 243, Sess. 1830; and Finance Accounts.)

Year ending the 5th of January.	Exports.			Imports.
	British and Irish Produce and Manufactures from Great Britain.		Foreign and Colonial Merchandise from Great Britain.	Into Great Britain.
	Official Value.	Declared Value.	Official Value.	Official Value.
1799	L.18,556,891	L.31,252,836	L.8,760,196	L.25,122,203
1800	22,284,941	35,903,850	7,271,696	24,066,700
1801	22,831,936	36,929,007	11,549,681	28,257,781
1802	24,501,608	39,730,659	10,336,966	30,435,268
1803	25,195,893	45,102,230	12,677,431	28,308,373
1804	20,042,596	36,127,787	8,032,643	25,104,541
1805	22,132,367	37,135,746	8,938,741	26,454,281
1806	22,907,371	37,234,396	7,643,120	27,334,020
1807	25,266,546	39,746,581	7,717,555	25,554,478
1808	22,963,772	36,394,443	7,624,312	25,326,845
1809	24,179,854	36,306,385	5,776,775	25,660,953
1810	32,916,858	46,049,777	12,750,358	30,170,292
1811	33,299,408	47,000,926	9,357,435	37,613,294
1812	21,723,532	30,850,618	6,117,720	25,240,904
1813	28,447,912	39,334,526	9,533,065	24,923,922
1814[2]	......	......	......	......
1815	32,200,580	43,447,373	19,157,818	32,620,771
1816	41,712,002	49,653,245	15,708,435	31,822,053
1817	34,774,521	40,328,940	13,441,665	26,374,921
1818	39,233,467	40,349,235	10,269,271	29,910,502
1819	41,960,555	45,180,150	10,835,800	35,845,340
1820	32,983,689	34,252,251	9,879,236	29,681,640
1821	37,820,293	35,569,077	10,525,026	31,515,222
1822	40,194,681	35,823,127	10,602,090	29,769,122
1823	43,558,488	36,176,897	9,211,928	29,432,376
1824	43,166,039	34,589,410	8,588,996	34,591,264
1825	48,024,952	37,600,021	10,188,596	36,056,551
1826	46,453,022	38,077,330	9,155,305	42,660,954
1827	40,332,854	30,847,528	10,066,503	36,174,350
1828	51,279,102	36,394,817	9,806,343	43,489,346
1829	52,019,728	36,150,379	9,928,655	43,536,187
1830	55,465,723	35,212,873	10,606,441	42,311,649
1831	60,492,637	37,691,302	8,535,786	44,815,397
1832	60,090,123	36,652,694	10,729,943	48,161,661
1833	64,582,037	36,046,027	11,036,759	43,237,417

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[1] For an explanation of the difference between official and real value, see EXCHANGE.

[2] Records destroyed by fire.—From the year ending the 5th of January 1815 inclusive, British produce and manufactures have been included in the returns of Irish produce, &c. from Ireland, and consequently omitted in the column headed Exports, Foreign, Colonial, and British, under which they had been previously returned.

II.—*Account of the Official Value of the Imports into the United Kingdom, and of the Exports of British and Irish Produce and Manufactures, and of Foreign and Colonial Merchandise, in the year* 1831, *specifying the Imports from and Exports to each Country.*—(Parl. Paper, No. 336, Sess. 1833.)

Countries.	United Kingdom.											
	Official Value of Imports.			Official Value of Exports.								
				British and Irish Produce and Manufactures.			Foreign and Colonial Merchandise.			Total Exports.		
	L.	s.	d.	L.	s.	d.	L.	s.	d.	L.	s.	d.
Europe—Russia	4,696,368	17	11	1,746,972	12	5	856,856	14	8	2,603,829	7	1
Sweden	212,639	13	1	94,587	5	1	67,788	12	8	162,375	17	9
Norway	91,678	10	1	92,599	1	1	58,225	5	6	150,824	6	7
Denmark	410,981	7	2	173,280	1	11	83,423	8	3	256,703	10	2
Prussia	1,200,102	7	5	264,618	2	1	564,684	12	10	829,302	14	11
Germany	1,684,165	8	3	7,667,147	0	3	1,806,480	8	9	9,473,627	9	0
Netherlands	1,276,081	12	3	3,179,298	13	6	3,270,927	0	11	6,450,225	14	5
France	3,056,154	12	4	635,927	13	5	256,081	19	7	892,009	13	0
Portugal, Azores and Madeira	520,616	18	8	2,251,584	3	0	68,197	17	1	2,319,782	0	1
Spain and the Canaries	1,293,924	0	4	1,036,623	17	8	318,038	7	8	1,354,662	5	4
Gibraltar	19,668	7	0	879,382	3	7	121,340	18	3	1,000,723	1	10
Italy	1,475,304	6	10	4,528,154	10	4	820,651	1	0	5,348,805	11	4
Malta	63,550	2	10	257,537	8	8	20,485	2	6	278,022	11	2
Ionian Islands	187,185	11	4	71,592	13	2	13,383	8	7	84,976	1	9
Turkey and Continental Greece	759,797	19	1	2,113,928	9	2	95,777	3	2	2,209,705	12	4
Morea and Greek Islands	29,273	6	9	28,563	12	0	1,743	11	10	30,307	3	10
Isles Guernsey, Jersey, Alderney, and Man	202,940	14	7	445,410	2	4	126,435	1	2	571,845	3	6
	17,180,433	15	11	25,467,207	9	8	8,550,520	14	5	34,017,728	4	1
Africa—Egypt, ports on the Mediterranean	275,547	19	7	236,189	15	3	2,068	9	9	238,258	5	0
Tripoli, Barbary, and Morocco	45,986	5	9	759	10	0	4,950	16	11	5,710	6	11
Western coast of Africa	299,105	0	5	352,182	17	9	155,275	19	7	507,458	17	4
Cape of Good Hope	183,481	14	2	351,107	13	3	28,940	6	1	380,047	19	4
Eastern coast of Africa	2,328	17	0	......			......			......		
Cape Verde Islands	......			123	17	6	75	3	8	199	1	2
St Helena	44,512	3	8	28,439	6	3	3,030	9	10	31,469	16	1
Mauritius	724,285	8	2	268,963	16	4	11,984	17	9	280,948	14	1
Asia—East Indies and China	7,920,182	3	9	6,521,532	19	7	426,068	0	7	6,947,600	11	2
New South Wales, Van Diemen's Land, & Swan River	191,841	3	2	427,378	18	8	149,735	11	9	577,114	10	5
New Zealand and South Sea Islands	6,442	10	0	4,056	12	6	815	8	3	4,872	0	9
America—British Northern Colonies	1,532,582	19	0	2,858,514	19	9	271,975	9	3	3,130,490	9	0
British West Indies	8,448,839	8	7	3,729,521	14	3	258,764	6	4	3,988,286	0	7
Foreign West Indies	615,594	7	2	2,186,482	5	7	48,762	14	11	2,235,245	0	6
United States	8,970,342	8	3	12,007,208	8	11	588,965	9	0	12,596,173	17	11
Mexico	160,751	12	3	1,112,916	12	11	138,852	4	10	1,251,768	17	9
Guatemala	8,065	4	6	......			......			......		
Colombia	25,243	14	1	476,768	0	0	22,964	17	4	499,732	17	4
States of Rio de la Plata	476,272	14	10	582,086	6	4	8,224	8	10	590,310	15	2
Chili	21,030	16	11	1,057,621	17	2	10,842	2	8	1,068,463	19	10
Peru	42,377	9	3	624,639	11	10	21,392	9	3	646,032	1	1
Brazil	2,278,059	18	4	2,392,662	8	4	39,002	8	7	2,431,664	16	11
The Whale Fisheries	273,800	19	9	....			1,914	0	0	1,914	0	0
Total.......L.	49,727,108	14	6	60,686,364	12	10	10,745,126	9	7	71,431,491	2	5

III.—*Value of the Produce and Manufactures of the United Kingdom, exported from Great Britain and Ireland to Foreign Parts, according to the Real or Declared Value thereof, specifying the Amount sent from each.*

Species of Exports.	Years ending the 5th of January.								
	1831.			1832.			1833.		
Great Britain.	*L.*	*s.*	*d.*	*L.*	*s.*	*d.*	*L.*	*s.*	*d.*
Alum	3,008	7	6	5,855	5	11	4,771	15	9
Apparel, slops and Negro clothing	384,213	13	6	368,545	3	9	376,091	16	5
Arms and ammunition	241,623	0	10	562,729	1	2	274,950	17	0
Bacon and hams	31,833	18	1	20,834	6	10	17,970	1	6
Beef and pork, salted	85,859	15	9	83,428	3	9	66,180	5	6
Beer and ale	206,876	16	1	157,350	0	4	198,715	7	0
Books, printed	93,851	3	7	100,770	9	3	92,809	3	8
Brass and copper manufactures	863,313	6	8	802,879	1	5	916,226	4	9
Bread and biscuit	9,654	0	2	10,072	10	0	12,877	2	4
Butter and cheese	123,792	8	9	130,603	5	2	185,346	17	9
Cabinet and upholstery wares	55,567	19	2	41,316	11	4	43,907	10	2
Coals and culm	182,862	10	9	198,242	14	11	226,772	15	3
Cordage	78,441	10	10	75,821	14	4	95,030	2	8
Corn, grain, meal, and flour	35,842	4	11	37,026	16	9	27,407	9	2
Cotton manufactures	15,203,713	7	2	13,207,947	6	3	12,622,880	2	10
Cotton yarn	4,132,258	17	7	3,974,989	17	0	4,721,796	3	6
Cows and oxen	2,348	10	0	1,726	0	0	510	6	0
Earthenware of all sorts	439,566	19	2	458,965	11	11	489,980	17	7
Fish of all sorts	245,750	11	3	184,031	18	0	213,607	10	0
Glass of all sorts	396,662	6	1	423,828	19	4	396,407	5	0
Haberdashery and millinery	384,701	2	7	414,716	17	3	332,429	9	6
Hardwares and cutlery	1,410,936	4	5	1,620,236	11	6	1,433,297	17	5
Hats, beaver and felt	208,497	19	5	169,076	6	5	144,111	3	5
Hats of all other sorts	15,672	5	9	15,148	7	8	15,189	14	0
Hops	6,614	4	8	11,284	5	9	71,067	19	0
Horses	49,243	10	0	29,212	0	0	57,886	0	0
Iron and steel, wrought and unwrought	1,076,186	11	3	1,119,967	3	1	1,189,250	10	2
Lard	4,326	15	0	3,390	15	0	5,529	3	0
Lead and shot	106,768	15	5	96,215	17	0	144,598	10	10
Leather, wrought and unwrought	243,142	16	6	234,491	6	10	235,505	1	0
Leather, saddlery and harness	78,071	18	10	60,950	8	9	54,229	6	11
Linen manufactures	1,926,256	15	1	2,301,803	7	3	1,655,478	16	8
Machinery and mill-work	208,736	17	2	105,505	15	3	92,714	11	1
Mathematical and optical instruments	21,446	12	11	17,103	7	8	16,430	18	5
Mules	7,248	0	0	2,715	10	0	1,056	0	0
Musical instruments	51,784	11	4	38,372	5	9	36,601	13	10
Oil, train, of Greenland fishery	45,063	3	8	21,170	11	3	33,394	4	1
Painters' colours	99,985	3	0	101,986	12	6	115,910	8	0
Plate, plated ware, jewellery, and watches	190,207	15	9	187,930	15	0	173,617	13	1
Potatoes	5,451	17	4	6,106	8	0	7,707	10	0
Salt	181,209	9	2	162,706	3	9	147,176	12	0
Saltpetre, British refined	8,682	9	0	20,683	10	6	24,482	0	10
Seeds of all sorts	4,510	13	0	5,257	18	4	4,996	0	5
Silk manufactures	519,919	9	4	578,260	10	0	529,808	3	10
Soap and candles	220,315	9	2	210,170	8	7	288,674	0	0
Spirits	5,841	13	6	5,218	18	0	7,193	11	6
Stationery of all sorts	167,679	15	11	177,698	0	2	176,497	9	7
Sugar, refined	1,287,887	14	10	1,237,774	6	6	1,038,519	16	0
Tin, unwrought	106,134	7	2	77,718	7	2	111,797	7	10
Tin and pewter wares, and tin plates	249,619	12	2	230,004	10	10	243,191	5	10
Tobacco (manufactured) and snuff	21,734	10	2	16,258	12	9	15,133	9	6
Tongues	1,345	11	0	1,500	8	0	1,550	13	0
Umbrellas and parasols	32,508	15	9	47,512	18	0	40,490	8	2
Whalebone	41,893	5	0	8,287	10	0	16,975	15	0
Wool, sheep's	144,712	11	3	173,103	19	6	219,650	1	0
Wool of other sorts	33,460	2	6	66,835	4	0	24,088	0	0
Woollen manufactures	4,847,398	9	6	5,385,811	5	4	5,475,298	12	2
All other articles	859,063	19	0	843,542	17	0	880,255	0	6
Total real or declared value of the produce and manufactures of the United Kingdom, exported from Great Britain to foreign parts	37,694,302	5	4	36,652,694	17	9	36,046,027	11	5
Ireland.									
Total real or declared value of the produce and manufactures of the United Kingdom, exported from Ireland to foreign parts	560,200	4	11	510,952	16	1	398,497	7	2
United Kingdom.									
Total real or declared value of the produce and manufactures of the United Kingdom, exported from the same to foreign parts	38,251,502	10	3	37,163,647	13	10	36,444,524	18	7

IV.—*Account of the Quantities of the Principal Articles of Foreign and Colonial Merchandize imported and retained for Home Consumption, and also the Quantity exported, in the year* 1829 (*fractional quantities omitted*).

	Quantities Imported.	Retained for Home Consumption.	Quantities Exported.
Ashes, pearl and pot……cwts.	162,258	143,657	19,780
Barilla……ditto	165,338	236,563	……
Bark, oak, and cork tree……ditto	1,009,816	1,004,070	……
Brimstone, rough……ditto	302,038	313,766	……
Bristles……lbs.	1,715,488	1,695,083	……
Butter……cwts.	148,139	147,951	……
Cassia lignea……lbs.	817,968	62,252	795,242
Cheese……cwts.	168,900	166,484	……
Cinnamon……lbs.	544,225	29,720	386,108
Cloves……ditto	36,071	48,638	57,904
Cochineal……ditto	288,456	127,954	153,738
Cocoa-nuts……ditto	3,209,933	393,847	1,674,613
Coffee……ditto	39,071,215	19,466,028	23,023,410
Copper, unwrought……cwts.	10,267	14	13,743
Cork, unmanufactured……ditto	46,494	45,636	……
Corn:—			
Wheat……qrs.	1,544,969	1,267,914	52,190
Barley……ditto	281,713	202,405	10,297
Oats……ditto	541,858	192,889	58,635
Rye……ditto	65,910	65,331	7,861
Peas and beans……ditto	82,139	96,513	2,345
Wheat-meal and flour……cwts.	461,895	337,065	70,652
Cortex Peruvianus or Jesuits' bark……lbs.	405,552	103,695	296,382
Cotton, piece goods of India, not printed……pieces	1,403,397	value L.44,883	614,085
Cottons, printed……sq. yds.	131,420	2,873	171,969
Currants……cwts.	119,927	114,076	……
Dye and hard woods:—			
Fustic……tons	7,364	6,006	……
Logwood……ditto	13,893	8,851	6,226
Mahogany……ditto	19,335	16,546	……
Elephants' teeth……cwts.	4,345	3,605	……
Figs……ditto	21,938	19,702	……
Flax and tow, and codilla of hemp, &c……ditto	922,039	909,709	……
Furs:—			
Bear……number	12,583	884	14,227
Beaver……ditto	76,427	68,665	……
Fitch……ditto	278,740	278,846	……
Marten……ditto	151,937	121,741	49,712
Mink……ditto	77,361	34,109	……
Musquash……ditto	1,070,016	491,978	281,347
Nutria……ditto	618,187	629,170	……
Gitter……ditto	14,862	857	14,751
Onger……cwts.	11,007	5,947	11,209
Gum:—			
Arabic……ditto	8,232	17,249	2,049
Lac-dye……lbs.	594,494	462,988	26,763
Shell-lac……ditto	703,886	316,070	446,598
Hats, straw……number	160,195	234,254	……
Hemp, undressed……cwts.	374,932	422,121	……
Hides, untanned……ditto	286,416	231,874	……
Indigo……lbs.	6,748,281	2,113,830	4,286,605
Iron in bars……tons	15,720	13,067	3,024
Lead, pig……ditto	1,508	35	1,700
Leather gloves……pairs	865,157	837,208	……
Lemons and oranges:—			
Packages not exceeding 5000 cubic inches……	53,215	48,921	……
Ditto above 5000, and not exceeding 7300……	130,946	130,348	……
Ditto above 7300, and not exceeding 14,000……	67,336	65,669	……
Linens,—Cambrics, &c……pieces	40,778	41,224	……
Linens, plain and diaper:—			
Entered by the ell……ells	372,697	……	451,533
Entered by the piece……pieces	31,638	……	30,175
Entered by the square yard……sq. yds.	138,458	692	124,200

Account of the Quantities of the Principal Articles of Foreign and Colonial Merchandise, &c. continued.

	Quantities Imported.	Retained for Home Consumption.	Quantities Exported.
Linens, plain and diaper—entered at value........... L.	4,031	6,674	1,144
Liquorice juice..cwts.	4,440	5,795	......
Mace...lbs.	6,841	14,254	20,106
Madder..cwts.	70,017	69,658	......
Madder root..ditto	33,541	39,804	......
Molasses...ditto	394,432	386,142	......
Nutmegs...lbs.	38,868	113,273	47,913
Oil:—			
Castor...lbs.	396,104	293,028	......
Olive...gallons	1,153,834	1,334,758	......
Palm..cwts.	179,945	175,393	.. ...
Train—Blubber...tuns.	5,754	5,754	......
Spermaceti..ditto	5,571	5,694	......
Not blubber or spermaceti.......................ditto	11,974	9,047	......
Opium...lbs.	48,634	23,970	41,919
Pepper..ditto	2,015,184	1,933,641	2,962,063
Pimento..ditto	3,599,268	339,013	2,732,493
Prunes..cwts.	6,283	6,245	......
Quicksilver...lbs.	635,905	162,816	575,552
Raisins..cwts.	145,750	121,737	......
Rhubarb..lbs.	146,881	33,673	91,738
Rice..cwts.	222,547	116,854	95,584
Rice in the husk,.......................................bushels	293,354	222,472	......
Safflower..cwts.	4,623	4,370	......
Sago...ditto	486	4,026	......
Saltpetre...ditto	176,489	155,095	34,537
Sarsaparilla...lbs.	228,164	104,679	......
Seeds:—			
Clover...cwts.	40,529	88,662	......
Flax and Linseed.......................................bushels	2,052,258	1,899,936	......
Rape...ditto	378,304	375,162	......
Tares...ditto	87,101	101,160	......
Senna..lbs.	187,492	122,601	......
Shumac...cwts.	80,191	78,874	......
Silk:—			
Raw and waste...lbs.	3,594,754	2,601,516	221,412
Thrown..ditto	211,179	168,985	26,715
Manufactures of Europe............................ditto	132,313	121,584	6,909
Manufactures of India, viz.			
Bandanas, Romals, &c..............................pieces	99,393	67,465	79,886
Crape in pieces...ditto	53	Before July 5. lbs. 7,675 After July 5. L.5,926	602
Crape scarfs, shawls, &c...........................number	70,299		13,981
Taffaties, damasks, &c..............................pieces	9,052		4,064
Skins:—			
Calf and kid, untanned.............................cwts.	43,764	43,046	......
Deer, undressed...number	123,276	36,314	101,387
Goat, undressed...ditto	306,579	182,062	113,724
Kid, undressed...ditto	106,319	107,513	......
Kid, dressed...ditto	591,094	591,091	......
Lamb, undressed..ditto	1,888,487	1,887,891	......
Seal, undressed..ditto	289,541	262,446	......
Smalts...lbs.	376,675	353,468	......
Spelter..cwts.	84,603	12,430	79,279
Spirits:—			
Rum...proof gallons	6,938,426	3,375,866	1,644,663
Brandy..ditto	1,994,649	1,300,746	661,097
Geneva..ditto	177,847	37,146	148,176
Sugar, unrefined..cwts.	4,856,393	3,539,821	297,912
Tallow...ditto	1,177,908	1,024,993	......
Tar..lasts	5,812	6,492	......
Tea:..lbs.	30,544,404	29,495,205	251,971
Timber:—			
Battens and batten ends.................great hundreds	11,149	11,065	......

Account of the Quantities of the Principal Articles of Foreign and Colonial Merchandise, &c. concluded.

	Quantities Imported.	Retained for Home Consumption.	Quantities Exported.
Timber:—Deals and deal ends..........great hundreds	51,587	51,890	......
Lathwood..fathoms	10,386	10,282	......
Masts, yards, &c. under 12 inches diameter...number	13,475	13,676	......
Ditto, 12 inches and above..........................ditto	4,803	5,591	......
Oak plank, two inches thick or upwards..........loads	1,433	1,551	......
Staves..................................great hundreds	95,953	89,009	......
Teak...loads	16,924	16,835	......
Timber, eight inches square or upwards..........ditto	549,259	541,565	......
Wainscot logs, ditto....................................ditto	4,221	3,407	......
Tin..cwts.	2,674	2	2,581
Tobacco, unmanufactured.................................lbs.	22,399,335	18,819,021	7,369,749
Tobacco, manufactured, and snuff......................ditto	169,634	66,743	27,813
Turpentine, not worth more than 12s. per cwt......cwts.	262,832	277,509	......
Valonia..ditto	111,391	110,773	......
Wax, bees'...ditto	11,699	6,568	......
Whale-fins...ditto	13,305	12,876	......
Wool, cotton...lbs.	222,767,767	204,097,037	30,289,115
Wool, sheeps'..ditto	21,525,542	22,614,550	406,566
Wine:—			
Cape..gallons	967,363	579,744	20,162
French..ditto	498,320	365,336	109,292
Portugal..ditto	2,405,342	2,682,084	246,670
Spanish...ditto	2,841,030	1,964,162	442,881
Madeira...ditto	320,581	229,392	168,446
Canary...ditto	199,026	101,699	115,640
Rhenish...ditto	85,858	76,396	9,153
Other sorts..ditto	300,677	218,839	85,366
Yarn, linen, raw...cwts.	29,646	29,645	......
Zaffre...lbs.	158,026	157,085	......

Decline in he real value of the xports.

The increase in the official, and the decline in the real or declared value of the exports, since 1815, has given rise to a great deal of irrelevant discussion. It has been looked upon as a proof that our commerce is daily becoming less prosperous, whereas, in point of fact, a precisely opposite conclusion should be drawn from it. We have already stated, that the rates according to which the official values of the exports are determined, were fixed as far back as 1696; so that they have long ceased to be of importance as affording any criterion of the actual value, their only use being to show the fluctuations in the *quantities* exported. To remedy this defect, a plan was formed during the early part of Mr Pitt's administration, for keeping an account of the *real* value of the exports, as ascertained by the declarations of the exporters. Those who contend that our trade is getting into a bad condition, argue that the great increase in the official value of the exports since 1815 shows that the *quantity* of the articles exported has been proportionally augmented, whilst the fall in their real value shows that we are selling this larger quantity for a smaller price, a result which, they affirm, is most injurious. But the circumstance of a manufacturer or a merchant selling a large or a small quantity of produce at the same price, affords no criterion by which to judge as to the advantage or disadvantage of the sale; for if, in consequence of improvements in the arts or otherwise, a particular article may now be produced for half the expense that its production cost ten or twenty years ago, it is obvious that double the quantity of it may be afforded at the same price without injury to the producers. Now this is the case with some of the most important articles which are exported from England. Cottons and cotton-twist form a full half or more of our entire exports; and since 1814 there has been an extraordinary fall in the price of these articles, occasioned partly by cotton wool having fallen from about 1s. 6d. per lb. to about 7d. per lb., but more by improvements in the manufacture. To such an extent have these causes operated, that yarn No. 40, which in 1812 cost 2s. 6d., in 1830 cost 1s. 2½d.; in 1812 No. 60 cost 3s. 6d., in 1830 it cost 1s. 10½d.; in 1812 No. 80 cost 4s. 4d., in 1830 it cost 2s. 6¾d., and so on; and in the weaving department the reduction has been similar. Hence, whilst the official value of the exports of cotton goods and twist has increased from about L.18,000,000 in 1814, to about L.37,000,000 in 1830, their declared value has sunk from about L.20,000,000 at the former period to about L.16,000,000 at the latter. Surely, however, this is, if any thing can be, a proof of increasing prosperity; it shows that we can now export and sell with a profit (for unless such were the case, does any one imagine the exportation would continue?) nearly double the quantity of cotton goods and yarn which we exported in 1814 for about the same price. In as far, therefore, as an abundant and cheap supply of cottons may be supposed to increase the comforts of society, it is plain that they must be about double, not in this country only, but in all those countries to which we export. (M'Culloch's *Commercial Dictionary*, art. *Cotton.*)

Shipping.

The subjoined tables give a complete view of the shipping belonging to the different ports of the British empire, and of the navigation with foreign countries, in 1829 and 1830, since which time there has been no sensible variation.

I.—*Number of Ships and Vessels belonging to the different Ports or Places of the British Empire in* 1829, *stated in succession, agreeably to the Amount of Tonnage belonging to each.*

	Ships.	Tons.
England.		
London	2,663	572,835
Newcastle	987	202,379
Liverpool	805	161,780
Sunderland	624	107,628
Whitehaven	496	72,967
Hull	579	72,248
Bristol	316	49,535
Yarmouth	585	44,134
Whitby	258	41,576
Scarborough	169	28,070
Plymouth	302	24,838
Dartmouth	349	24,114
Beaumaris	389	22,076
Poole	168	17,860
Exeter	196	17,166
Lynn	118	14,659
Cardigan	281	14,643
Gloucester	247	13,026
Rochester	255	10,816
Bideford	116	10,182
Lancaster	107	9,410
Ipswich	138	8,532
Portsmouth	184	8,485
Southampton	178	8,120
Milford	116	8,104
Boston	152	8,059
Swansea	122	7,772
Faversham	217	7,392
Maldon	190	7,373
Stockton	74	7,296
Weymouth	85	7,175
Colchester	235	6,745
Falmouth	78	6,614
Aberystwith	120	6,423
Bridlington	40	6,290
Cowes	151	6,015
Chepstow	72	5,805
St Ives	87	5,570
Dover	120	5,525
Harwich	96	5,513
Fowey	81	5,470
Penzance	92	4,981
Chester	74	4,816
Berwick	57	4,784
Ramsgate	70	4,397
Ilfracombe	64	4,095
Wells	66	3,962
Newport	50	3,824
Rye	68	3,704
Goole	50	3,625
Padstow	68	3,587
Blackney and Clay	50	3,380
Lyme	39	3,335
Llanelly	69	3,264
Bridgewater	46	2,921
Carlisle	40	2,886
Chichester	62	2,805
Cardiff	38	2,742
Arundel	25	2,711
Aldborough	49	2,698
Woodbridge	38	2,659
Southwold	37	2,638
Wisbech	43	2,487
Shoreham	42	2,272
Barnstaple	40	2,087
Truro	25	1,727
Grimsby	39	1,390
Newhaven	21	1,205
Minehead	20	957
Scilly	22	792
Deal	19	557
Gweek	8	557
Total	13,977	1,758,065
Scotland.		
Aberdeen	350	46,201
Glasgow	235	41,121
Greenock	371	36,241
Dundee	299	31,986
Leith	263	26,362
Grangemouth	204	24,327
Montrose	173	16,179
Kirkaldy	192	14,802
Irvine	135	13,379
Dumfries	183	12,192
Bo'ness	123	9,108
Inverness	136	7,338
Port Glasgow	46	6,807
Banff	133	5,818
Lerwick	94	3,314
Kirkwall	68	3,312
Stornoway	74	3,093
Campbeltown	68	2,779
Thurso	39	2,441
Stranraer	42	1,497
	3,228	308,297
Ireland.		
Belfast	247	24,989
Dublin	289	23,904
Cork	256	17,093
Newry	161	8,281
Waterford	26	6,942
Wexford	135	6,701
Londonderry	32	4,306
Baltimore	86	2,478
Drogheda	30	2,387
Limerick	39	1,874
Sligo	20	1,219
Galway	19	864
Coleraine	10	409
Dundalk	6	339
Westport	7	208
	1,413	101,994
Isle of Jersey	200	18,217
Isle of Guernsey	75	7,672
Isle of Man	217	5,714
Total of the United Kingdom and British Islands	19,110	2,199,959
Plantations	4,343	317,041
Grand Total	23,453	2,517,000

Number of men belonging to ships of United Kingdom and British Islands	134,516
Number of men belonging to ships of Plantations	20,292
Total of men belonging, in 1829, to the mercantile navy of the United Kingdom and Plantations,	154,808

Mercantile Navy in 1830.

	Vessels.	Tons.	Men.
Great Britain and Plantations,	23,721	2,531,819	154,812

II.—*General Statement of the Shipping employed in the Trade of the United Kingdom in the Year* 1830, *exhibiting the Number and Tonnage of Vessels entered Inwards and cleared Outwards (including their repeated Voyages), with the Number of their Crews; separating British from Foreign Ships, and distinguishing the Trade with each Country.* (Parl. Paper, No. 350, Sess. 1831.)

Countries, &c.	Inwards.						Outwards.					
	British.			Foreign.			British.			Foreign.		
	Ships.	Tons.	Men.	Ships.	Tons.	Men.	Ships.	Tons.	Men.	Ships.	Tons.	Men.
Russia	1,661	321,426	14,698	90	26,905	1,280	1,231	240,638	11,253	88	22,858	1,036
Sweden	82	32,116	583	127	23,158	1,175	55	8,020	412	67	9,624	526
Norway	66	6,459	395	556	84,585	4,570	53	5,148	326	582	93,176	4,780
Denmark	111	12,210	608	655	51,420	3,175	540	85,981	4,133	926	98,694	5,377
Prussia	666	102,758	4,920	720	139,646	6,132	341	50,931	2,539	380	73,133	3,251
Germany	986	150,997	7,516	616	54,869	3,018	876	133,847	6,724	612	52,118	2,824
United Netherlands	1,156	120,301	7,030	863	92,811	5,096	887	87,559	5,301	783	82,557	4,657
France	1,367	110,766	10,029	933	47,940	6,369	1,330	111,779	9,968	642	33,955	3,847
Portugal, Proper	395	43,336	2,542	78	8,394	705	339	36,930	2,313	99	14,724	894
——— the Azores	161	12,906	836	2	185	18	105	8,332	571	4	489	28
——— Madeira	8	1,339	73	...	...	...	7	1,327	90	1	194	11
Spain and the Balearic Islands	428	46,508	2,645	61	5,639	450	353	37,412	2,230	58	6,751	485
——— Canaries	42	4,793	258	...	...	...	46	5,590	324	2	641	40
Gibraltar	30	4,196	239	...	...	...	83	10,677	606	8	968	64
Italy and the Italian Islands	353	51,512	2,848	13	2,253	157	418	58,307	3,347	14	2,407	159
Malta	17	2,162	118	1	225	10	38	9,306	512	1	160	8
Ionian Islands	32	4,304	240	...	...	...	38	5,513	292	...	...	...
Turkey and Continental Greece	95	13,610	780	...	...	...	95	13,424	783	...	...	...
Morea and Greek Islands	7	1,055	55	...	...	...	11	1,607	98	...	...	...
Egypt (Ports on the Mediterranean)	14	3,853	188	...	...	...	22	4,281	236	1	1,613	110
Tripoli, Barbary, and Morocco	11	1,127	63	...	...	...	3	331	19	...	...	...
Coast of Africa, from Morocco to the Cape of Good Hope	126	34,763	1,852	...	...	...	137	38,661	2,192	...	...	...
Cape of Good Hope	23	4,276	230	...	...	...	38	7,737	463	...	...	...
Cape Verde Islands	...	...	...	...	...	...	2	307	19	1	85	11
St Helena and Ascension	1	142	13	...	...	...	3	615	33	...	...	...
Isle of Bourbon	...	...	...	...	...	...	...	...	...	2	407	28
Mauritius	55	17,189	893	...	...	...	33	8,036	481	...	...	...
East India Company's Territories and Ceylon	148	65,498	4,525	...	...	...	141	59,605	4,043	...	...	...
China	22	27,782	2,700	...	...	...	16	21,033	2,169	2	789	41
Sumatra and Java	3	1,189	59	1	370	20	2	577	53	1	459	22
Philippine Islands	6	2,486	121	...	...	...	1	237	16	2	393	32
Other islands of the Indian Seas	...	...	...	...	...	...	1	369	31	...	...	...
New South Wales and Van Diemen's Land	26	8,668	502	...	...	...	65	22,587	1,633	...	...	...
Swan River	...	...	...	...	...	...	2	764	42	...	...	...
New Guinea	...	...	...	...	...	...	1	405	30	...	...	...
New Zealand and South Sea Islands	2	431	26	...	...	...	3	728	71	...	...	...
British North American Colonies	1,709	452,397	21,338	...	...	...	1,714	450,987	22,045	...	...	...
British West Indies	911	253,872	13,782	...	...	...	868	240,664	13,647	...	..	...
Hayti	21	3,719	198	...	...	...	46	7,642	472	...	...	...
Cuba and other Foreign West Indies	25	4,637	238	12	3,111	139	67	12,584	741	16	4,636	214
United States of America	197	65,130	2,948	609	214,166	9,189	281	91,551	4,344	611	211,714	9,439
Mexico	35	6,236	351	...	...	...	51	8,574	503	2	483	22
Colombia	17	3,268	186	...	...	...	16	3,108	178	...	...	...
Brazil	168	38,322	1,968	1	270	9	254	57,682	3,044	...	...	...
States of the Rio de la Plata	51	9,784	531	1	320	21	36	6,294	373	3	569	41
Chili	7	1,242	78	...	...	...	14	2,510	152	...	...	...
Peru	11	2,085	116	...	...	...	10	1,899	118	...	...	...
The Whale Fisheries	97	31,897	3,835	...	...	...	123	40,166	5,044	..	...	...
The Isles of Guernsey, Jersey, Alderney, and Man	2,199	117,298	8,949	20	2,561	141	1,897	95,547	7,829	...	...	...
Foreign Parts, not otherwise described	...	...	...	...	...	...	34	4,338	202	250	44,771	1,822
Total, all parts of the world	13,548	2,180,042	122,103	5,359	758,828	41,670	12,747	2,102,147	122,025	5,158	758,368	39,796

Steam-Boats belonging to Great Britain in 1829, and to Ireland in 1828.

	Vessels.	Tons.
England	241	20,611
Scotland	75	5,953
Ireland	26	4,791

IX.—*Establishments for Religion and Education.*

Rank of the clergy.

The church of England has two archbishops and twenty-four bishops, all peers of the realm, and all indebted for their appointment to the crown. The bishop of the Isle of Man, formerly appointed by the Duke of Atholl, is now also appointed by the crown, but has no seat in the House of Lords. The province of York comprises four bishoprics, viz. Durham, Carlisle, Chester, and the Isle of Man; all the rest, to the number of twenty-one, are in the province of Canterbury. The clerical dignitary next to the bishop is the archdeacon, whose duty, though very different in different dioceses, may be termed that of a representative of the bishop in several of his less important functions. The number of archdeacons in England is about sixty. The name of Dean (*Decanus*) was probably derived from his originally superintending ten canons or prebendaries. Each bishop has a chapter or council appointed to assist him, and each chapter has a dean as its president; but there are in the church of England many deaneries of other descriptions. Rector is, in general, the title of a clergyman holding a living, of which the tithes are entire; vicar is understood of a living where the great tithes have passed into secular hands. The very general name of curate signifies sometimes (as *curé* in France) a clergyman in possession of a living, but more frequently one exercising the spiritual office in a parish under the rector or vicar. The latter are temporary curates, their appointment being a matter of arrangement with the rector or vicar; the former, being more permanent, are called perpetual curates, and are appointed by the impropriator of the tithe in a parish which has neither rector nor vicar. The name of priest is, in general, confined to the clergy of the church of Rome; in the church of England the corresponding term is a clerk in orders. A parson (*persona ecclesiæ*) denotes a clergyman in possession of a parochial church. Deacon is, in England, not a layman, as in Calvinist countries, but a clergyman of limited qualifications, entitled to preach, baptize, marry, and bury, but not to give the sacrament. Readers are not regular clergymen, but laymen of good character, licensed by the bishop to read prayers in churches or chapels where there is no clergyman. (See Adolphus *on the British Empire*, vol. i.)

A clerical education in England is of much less length than in Calvinist countries; in Scotland, Holland, Switzerland, or the north of Germany, after going through a course of classics and philosophy, a second course is required for theology solely; but in England the former is sufficient. The degree of bachelor of arts requires an examination and a university residence of three or four years; but to qualify for the acceptance of a curacy, a certificate of attending a single course of lectures in divinity is all that is necessary.

Livings.

The number of church livings in England and Wales is very great, being fully 10,500. From this multiplicity of benefices, and from the general smallness of the incomes, have arisen two great irregularities, pluralities and non-residence, both forbidden by the ancient statutes of the church, but both long sanctioned by usage. Many clergymen hold livings without doing duty at any of them; others do duty in one or in two which are adjacent to each other, and have a curate for the more distant; whilst curates frequently do duty at two and sometimes at three distinct places of worship. To prevent, or at least to lessen, the abuse of non-residence, an act of parliament was passed in 1813, directing that every non-resident incumbent should nominate a curate at a salary of not less than L.80 a year, unless the entire living should be less. The effect of this act was to reduce the number of non-resident clergymen by 800 fully; they had previously been about 4700; but in 1815 the official return to parliament of the incumbents in England and Wales was as follows:

Non-resident from the following causes:

Sinecures	52
Vacancies	164
Sequestrations	40
Recent Institutions	87
Dilapidated Churches	32
Held by Bishops	22
Law-suits, absence on the Continent, &c.	122
Livings from which no report	279
	798
Incumbents non-resident from other causes	3,856
Incumbents resident	5,847
	10,501

Tithes.

The rental of England and Wales was, by a late return, discriminated as follows in regard to tithes:

Tithe-free *in toto*	L.7,904,379
Tithe-free in part	856,185
Free on payment of a *modus*	498,823
Subject to tithe	20,217,467
Total	L.29,476,854

A part, and by no means an inconsiderable one, of the tithes of England, is held by laymen; but as the church has other sources of income, its total revenue is computed at nearly L.3,000,000; but the absorption of large sums by several of the prelates, as the Bishops of Durham, Winchester, and London, and the accumulation of the best livings amongst a few individuals of influence, reduce the annual average income of the curates, or most numerous class, to little more than L.100 a year.

Tithes necessarily fluctuate with the state of agriculture, and, during the distress of 1815, the deficiency in this respect became alarming. It was then that the clergy felt what they should have felt long before, that tithe was an unsuitable and impolitic source of revenue. Application was made to parliament, and the subject was for some time under serious discussion; but the rise of corn in 1816 and 1817 prevented any other measure than an act founded on a committee report of 18th June 1816, authorizing the possessors of tithes, laymen as well as clergymen, to grant leases of them for a term not exceeding fourteen years. The dissatisfaction with tithes has now, however, become so very general that we have no doubt a commutation of some sort or other must shortly take place.

A return to parliament, in June 1817, has specified the incomes of those benefices where there is no parsonage-house, or at least none that forms a suitable residence.

	Livings.
From L.10 to L.100	615
L.100 to L.150	442
L.150 and upwards	793
	1850

Churche

A prior and more comprehensive return had stated the number of churches and chapels for the established faith at 2533; and as these were inadequate (the members of the established church being about five millions, or half the population of England and Wales), an act was passed in 1818, and even pecuniary aid given by government, for the erection of a number of additional churches. The previous attempts to raise the requisite funds by the issue of briefs and voluntary subscriptions had exhibited a miserable specimen of misapplied labour, the expenses of atistics.

the collection, and of the patent and stamps, absorbing more than half the money received from the subscribing parties.[1]

erical
rms.

A prebend is a provision in land or money given to a church *in præbendum*, that is, for the support of a clergyman whose title may be either prebendary or canon. Advowson (*advocatio*) is the right of presentation to a living, and was first vested in those laymen who were founders of or benefactors to livings. A living is held *in commendam* when, to prevent its becoming void, it is committed (*commendatur*) until it can be conveniently provided with a pastor. The *modus* (*modus decimandi*) is a composition for tithes; it may be either perpetual or during the lives of the contracting parties. The lay impropriators of tithe, so frequent in England, date from the dissolution of the monasteries in the reign of Henry VIII.; patrons were then allowed to retain the tithes and glebe in their own hands, without appointing a clergyman; in cases of such appointment, the clergyman was called *vicarius* or representative of the patron.

ssenters.

The dissenters in England are, first, the Presbyterians, who nearly coincide with the church of England as to doctrine, but differ in church-government, allowing no hierarchy in individuals; next the Independents, who go further, and disclaim hierarchy in synods and other collective assemblies; thirdly, the well-known sect of Quakers, who date from the middle of the seventeenth century; and, lastly, the more numerous Methodists, who date from 1729. Of the Anabaptists, the chief characteristic is their not receiving baptism till they become adults. The Catholics in England are not numerous, but comprise a large proportion of wealthy families.

ducation.

In regard to the mode of education in England, there is much both to commend and to censure. Scotland has for a century past been in possession of a larger proportion of parish schools; but the utility of these is much lessened by an established routine of teaching Latin to almost all youths, whatever be their intended line of life. In England this absurdity is less prevalent, because most of the schools are private undertakings, the managers of which are necessarily guided by considerations of utility. The youth destined for a life of business are thus saved a serious waste of time; their education, if imperfect, is not supererogatory; but, on examining the higher seminaries of England, we find much ground for disappointment, and many marks of a blind adherence to ancient usage. Two universities are evidently inadequate for the education of the nobility, the gentry, and the clergy of so populous a country. Their course of study, also, is quite unsuitable to the future occupations of many of the students. They were originally designed for the education of churchmen; and, to this day, Latin, Greek, and mathematics form the chief objects of instruction. Under a government which has so long borne the representative form, there are no classes for the study of political science and legislation. In the country of Locke there are no classes devoted to the study of the philosophy of the mind. In short, there are scarcely any of those public lectures which, in the rest of Europe, constitute the grand characteristic of a university, and distinguish it from schools; all, or nearly all, is done by private tuition. Again, in point of constitution, whilst in other countries a university forms, in general, one large association, in England each college is a distinct body, having its head, its fellows, and its students, who, as far as education is concerned, have very little connection with the rest of the university. In one point, however, these venerable seminaries redeem their faults, and assert the dignity of their character; we mean in their public examinations. These, since the early part of the present century, have been put on an admirable footing, both at Oxford and Cambridge; distinguishing the relative degrees of proficiency with great accuracy, and converting into a full and impartial trial that which in other universities is almost always a mere matter of form.

Statistics.

Education of the poor.

No country rivals England in the magnificence of her academical buildings. Whilst in France, Germany, or Holland, an university possesses only a single pile of building, Oxford and Cambridge can boast for every college a large, commodious, and generally an elegant structure. The endowments appropriated to them are very various, both in their origin and destination, but these arise chiefly from land, and, having increased with the rise of rents, are in many cases very ample. The destination of these funds is regulated by the bequest of the donors and the established usage of the colleges; part going to the students under the name of exhibitions or scholarships; part to the head and fellows; and a further part consisting in livings, which devolve in succession on the fellows, and lead to their removal from the university. A hall is an inferior college; an academical establishment not incorporated or endowed, but possessed of exhibitions or other provisions for students. Oxford has nineteen colleges and five halls; Cambridge has twelve colleges and four halls.

Within these few years two institutions of a novel kind, the London University and King's College, have been founded in the metropolis, in the view of obviating the defects complained of at Oxford and Cambridge, and of cheapening and diffusing the advantages of an academical education; but their success has not corresponded with the expectations of their projectors. Their constitution appears ill fitted to attain the objects in view; and it is very questionable, unless they be materially modified, whether they will ever be of any material service. The education which they afford is neither very good nor very cheap.

Boys in England are taught the classics, either in the lesser schools established at every town of consequence throughout the kingdom, or at the great public schools. Of the latter, the principal are Eton, Westminster, Winchester, and Harrow; also the Charter-house, St Paul's, and Merchant Tailors' School. These seminaries, at present so expensive, and attended by youths of the first family, had their origin in a fund or provision set apart for scholars of humbler birth. This has served as the basis of a stately superstructure, each school having attracted, by the advantage of situation or the repute of the teachers, a much greater number of pupils in independent circumstances. But in each a proportion of the scholars are still on the foundation. At Eton there are seventy thus provided for; and the same number at Winchester.[2] This subject will be resumed, and treated in detail, under the articles NATIONAL EDUCATION, SCHOOLS, and UNIVERSITIES.

X.—*Establishments for purposes of Charity.—Poor-Rates.*

The public charities of England are very numerous; the bequests of benevolent founders in this country exceeding those of the zealous Catholics of France or Spain, as well as those of the once affluent Protestants of Holland. Our limits admit of the notice of only a few of the foundations in the metropolis and its neighbourhood.

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[1] See *Return of Briefs delivered to Parliament*, 19th May 1819.

[2] *Reports of the Education Committee*, 1817 and 1818.

Amongst the principal *Hospitals* are,

- Bethlem Hospital.
- St Luke's, Old Street.
- St Bartholomew's, West Smithfield.
- Guy's, in Southwark.
- The Lock Hospital, Hyde-Park-Corner.
- The London Hospital, Whitechapel Road.
- The Magdalen Hospital, St George's Road.
- The Middlesex Hospital, Berner's Street.
- The Foundling Hospital.

Amongst the *Dispensaries* and medical charities are,

- The General Dispensary, Aldersgate Street.
- City Dispensary in the Poultry.
- Finsbury Dispensary.
- Various Vaccine Dispensaries.
- The Fever Hospital, instituted in 1801.

A *College*, in the sense of a charity, is an alms-house on an enlarged scale, under the direction of a master and other incorporate officers. There are only three in the neighbourhood of London, namely, Bromley, Morden, and Dulwich Colleges.

Alms Houses.—These are very numerous, viz. the Haberdashers', Mercers', Skinners', East India Company's, &c.

School Charities.—These institutions are also very numerous. Amongst the most remarkable are,

- Christ's Hospital, or the Blue Coat School.
- Marine Society.
- School for the Indigent Blind.
- Deaf and Dumb Asylum.
- Debtors' Children.
- Ladies' Charity School.
- Masonic Charity.
- Raines' Charities.

Miscellaneous Charities.—Under this head are comprehended several extensive and well-known associations.

- The African Institution.
- The British and Foreign Bible Society.
- Society for Bettering the Condition of the Poor.
- Society for Promoting Christian Knowledge.
- The Missionary Society.
- The Literary Fund.

A compulsory provision for the support of the poor has existed in England for a lengthened period. Its introduction dates from the reign of Henry VIII., and it was perfected in that of Elizabeth; the famous statute of the 43d Eliz. cap. 2, having embodied all the principles, with many of the regulations, still to be found in the system. The law has, however, been repeatedly modified, and very great alterations have taken place in its administration. These changes will be fully detailed in our article on the POOR-LAWS; and in it also the reader will find an examination of the important and difficult question as to the policy of a compulsory provision for the support of the unemployed poor. Here we have only to state what has been the amount of the rates levied on account of the poor, from what sources they have been derived, and how they have been distributed.

Account of Monies levied for Poor's Rates and County Rates in England and Wales; of the Payments thereout for other purposes than the Relief of the Poor, at all the several periods for which Returns have been required by Parliament; also the Average Price of Wheat at every such period, and the Amount of Population.

Years.	Total Sum levied for Poor's Rates and County Rates.	Payments thereout for other purposes than the Relief of the Poor.	Expended in Law Removals and similar Incidents.	Expended for the Relief of the Poor.	Total Expenditure.	Average Price of Wheat per Quarter.		Population.
						By the Winchester Bushel of Eight Galls.	By the Imperial Bushel of Eight Gallons.	
(Average.)	L.	L.	L.	L.	L.	s. d.	s. d.	
1748–49–50	730,135	40,164	......	689,971	730,135	27 11	......	6,467,000
1775–6	1,720,316	137,072	35,072	1,530,800	1,703,528	45 0	......	7,690,000
(Average.) 1783–4–5	2,167,749	163,511	91,998	2,004,239	2,259,748	46 6½	......	8,260,000
(Average.) 1801–2–3	5,348,205	1,034,105	190,072	4,077,891	5,302,068	64 8	......	9,000,000
1812–13	8,646,841	1,860,347	324,957	6,656,106	8,841,410	125 5	......	10,284,000
1813–14	8,388,974	1,880,817	332,663	6,294,581	8,508,061	108 9	......	......
1814–15	7,457,676	1,762,406	324,596	5,418,846	7,505,848	73 11	......	......
1815–16	6,937,425	1,214,071	......	5,724,839	6,938,910	64 4	......	......
1816–17	8,128,418	1,210,720	......	6,910,925	8,121,645	75 10	......	......
1817–18	9,320,440	1,432,332	......	7,870,801	9,303,133	94 9	......	......
1818–19	8,932,185	1,408,905	......	7,516,704	8,925,609	84 1	......	......
1819–20	8,719,655	1,342,658	......	7,330,254	8,672,912	73 0	......	......
1820–21	8,411,893	1,375,868	......	6,959,251	8,335,119	65 7	......	11,978,000
1821–22	7,761,441	1,336,533	......	6,358,704	7,695,237	54 5	......	
1822–23	6,898,153	1,148,230	......	5,772,962	6,921,192	43 3	......	......
1823–24	6,836,505	1,137,598	......	5,736,900	6,874,498	51 9	......	......
1824–25	6,972,323	1,212,199	......	5,786,989	6,999,188	62 0	......	......
1825–26	6,965,051	1,246,145	......	5,928,505	7,174,650	66 6	......	......
1826–27	7,784,351	1,362,377	......	6,441,089	7,803,466	......	58 9	......
1827–28	7,715,055	1,372,433	......	6,298,003	7,670,436	......	56 9	......
1828–29	7,642,171	1,280,328	......	6,332,411	7,612,739	......	60 5	......
1829–30	......	......	......	6,829,042	......	......	66 3	......
1830–31	8,279,218	1,540,198	......	6,798,888	8,339,087	......	64 3	13,894,000
1831–32	8,622,920	1,646,493	......	7,036,969	8,683,461	......	66 4	

The following account for 1825–26 shows the sources whence the poor-rates are derived, and the amount furnished by each.

Account of Monies levied by Assessment for Poor's Rate and County Rate in each County of England and Wales, in the year ending 25th March 1826; distinguishing the amount, and showing the proportion of amount levied in each County on Land, on Dwelling-Houses, on Mills and Factories, and on Manerial Profits and Incidentals.

Counties.	Land.		Dwelling Houses.		Mills, Factories, &c.		Manerial Profits, &c.		Total Levied.
	L.	Parts of 1000.	L.	Parts of 1000.	L.	Parts of 1000.	L.	Parts of 1000.	L.
Bedford	77,920	917	6,298	74	568	7	183	2	84,969
Berks	89,596	787	21,014	185	2,446	21	839	7	113,895
Bucks	123,470	858	17,495	121	2,702	19	248	2	143,915
Cambridge	85,612	846	14,427	143	1,049	10	143	1	101,231
Chester	88,606	762	20,592	177	5,315	46	1,752	15	116,265
Cornwall	85,979	787	14,016	128	1,858	17	7,408	68	109,261
Cumberland	40,765	741	12,378	225	714	13	1,129	21	54,986
Derby	71,376	814	12,735	145	2,128	24	1,455	17	87,694
Devon	180,873	766	47,898	202	3,925	17	3,396	14	236,092
Dorset	74,811	799	17,170	183	750	8	914	10	93,645
Durham	63,297	666	16,668	175	3,924	38	11,442	120	95,031
Essex	243,112	827	42,761	145	6,829	23	1,369	5	294,071
Gloucester	100,117	644	49,017	315	4,962	32	1,456	9	155,552
Hereford	58,623	895	6,736	103	86	1	35	1	65,480
Hertford	74,927	740	23,110	228	2,756	27	512	5	101,305
Huntingdon	38,912	863	5,504	122	570	13	97	2	45,083
Kent	253,375	681	103,584	279	11,660	31	3,327	9	371,946
Lancaster	168,422	482	118,261	338	50,461	144	12,525	36	349,669
Leicester	93,882	834	17,634	156	782	7	310	3	112,608
Lincoln	174,766	862	23,306	115	3,887	19	887	4	202,846
Middlesex	57,221	95	509,365	844	36,353	60	787	1	603,726
Monmouth	25,662	805	4,206	132	791	25	1,214	38	31,873
Norfolk	240,526	797	49,085	163	8,097	27	3,924	13	301,632
Northampton	131,644	904	12,372	85	536	4	1,022	7	145,574
Northumberland	50,834	653	15,233	196	8,774	113	2,981	38	77,822
Nottingham	52,625	658	24,124	301	2,971	37	291	4	80,011
Oxford	109,306	823	21,863	165	1,149	9	469	3	132,787
Rutland	10,960	922	847	71	75	6	7	1	11,889
Salop	72,763	802	14,515	160	1,227	13	2,247	25	90,752
Somerset	141,247	798	30,306	171	2,380	14	3,042	17	176,975
Southampton	165,602	767	46,174	214	3,374	16	666	3	215,816
Stafford	85,670	637	34,963	261	6,655	49	7,129	53	134,417
Suffolk	221,332	842	36,525	139	4,398	17	712	2	262,967
Surrey	80,357	321	144,064	576	22,983	92	2,645	11	250,049
Sussex	214,304	818	42,752	163	4,610	17	466	2	262,132
Warwick	94,842	600	49,393	313	10,674	68	3,082	19	157,991
Westmoreland	24,186	876	2,831	102	496	18	103	4	27,616
Wilts	157,231	843	24,662	132	3,234	18	1,321	7	186,448
Worcester	62,888	749	15,892	189	3,111	37	2,092	25	83,983
York, East Riding	71,530	652	32,414	295	2,338	21	3,478	32	109,760
York, North Riding	83,523	892	8,205	88	1,208	13	669	7	93,605
York, West Riding	180,597	627	78,472	272	23,269	81	5,782	20	288,120
England	4,523,288	679	1,788,865	269	255,775	38	93,559	14	6,661,487
Wales	272,194	893	25,363	83	3,790	13	3,323	10	304,670
Total of England and Wales	4,795,482	688	1,814,228	261	259,565	37	96,882	14	6,966,157

yment wages t of or-rates.

It is obvious, from the preceding tables, that, allowing for the increase of population, the increase of the rates has not been nearly so great as is commonly supposed. In point of fact, too, more than half the rates really form part of the wages of labour. The pernicious practice of ekeing out wages by means of contributions from the rates began in 1795; and as it forms at this moment one of the principal evils in the state of the English poor, we may be excused, perhaps, for subjoining the following statements illustrative of its tendency.

"The price of corn, which had, upon an average of the three preceding years, averaged 54s., rose in 1795 to 74s. As wages continued stationary at their former elevation, the distress of the poor was very great; and many able-bodied labourers, who had rarely before applied for parish assistance, became claimants for relief. But instead of meeting this emergency as it ought to have been met, by temporary expedients, and by grants of relief proportioned to the exigency of every given case, one uniform system was adopted. The magistrates of Berks, and some other southern counties, issued tables, showing the wages which, as they affirmed, every labouring man ought to receive, according to the variations in the number of his family, and the price of bread; and they accompanied these tables with an order, directing the parish officers to make up the deficit to the labourer, in the event of the wages paid him by his employers falling short of the tabular allowance. An act was at the same time passed to allow the justices to administer relief out of the workhouse, and also to relieve such poor persons as had property of their own. As might have been expected, this system did not cease with the temporary circumstances which gave it birth, but has ever since been acted upon. It is now almost universally established in the southern half of England, and has been productive of an extent of mischief that could hardly have been conceived possible.

"It is needless to dwell on the folly of attempting to make the wages of labour vary directly and immediately with every change in the price of bread. Every one must see, that if this system were *bona fide* acted upon, if the poor were always supplied with the power of purchasing an equal quantity of corn, whether it happened to be abundant and cheap, or scarce and dear, they could have no motive to lessen their consumption in seasons when the supply is deficient, so that the whole pressure of the scarcity would, in such cases, be removed from them and thrown entirely upon the other, and chiefly the middle classes. But, not to insist on this point, let us look at the practical operation of this system as it affects the labourer and his employers. The allowance scales now issued from time to time by the magistrates are usually framed on the principle that every labourer should have a gallon loaf of standard wheaten bread weekly for every member of his family and one over; that is, four loaves for three persons, five for four, six for five, and so on. Suppose, now, that the gallon loaf costs 1s. 6d., and that the average rate of wages in any particular district is 8s. a week, A, an industrious unmarried labourer, will get 8s.; but B has a wife and four children, hence he claims seven gallon loaves, or 10s. 6d. a week; and as wages are only 8s., he gets 2s. 6d. a week from the parish. C, again, has a wife and six children; he consequently requires nine gallon loaves, or 13s. 6d. a week, and gets of course a pension, over and above his wages, of 5s. 6d. D is so idle and disorderly that no one will employ him, but he has a wife and five children, and is in consequence entitled to eight gallon loaves for their support, so that he must have a pension of 12s. a week to support him in his dissolute mode of life.

"It is clear that this system, by making the parish allowance to labourers increase with every increase in the number of their children, acts as a bounty on marriage, and that, by increasing the supply of labourers beyond the demand, it necessarily depresses the rate of wages. And it is further clear, that by giving the same allowance to the idle and disorderly as to the industrious and well-behaved workman, it operates as a premium on idleness and profligacy, and takes away some of the most powerful motives to industry and good conduct. These, however, are not the only effects of this system. Under its operation a labourer dares not venture to earn beyond a certain amount; for if he did, his allowance from the parish would either be withheld altogether, or proportionally reduced. In consequence, working by the piece is now comparatively unknown in the southern counties of England; and the whole labouring population are reduced to the condition of paupers, deprived of the means and almost of the desire to emerge from the state of helotism in which they are sunk.

"It must be obvious to every one, that if we would avert the plague of universal poverty from the land, a vigorous effort must be made to counteract this system; and we have experience to teach us how this may be done. All, in fact, that is necessary, is to revert to the regulations established previously to 1795, to abolish every vestige of the allowance system, and to enact that henceforth no able-bodied labourer shall have a legal claim for relief, unless he consent to accept it in a workhouse. This condition would go far to prevent relief from being claimed by any except the really necessitous; for there is nothing of which the idle and disorderly are so much afraid, as of the strict discipline, scanty fare, and hard labour that ought to be enforced in every workhouse. It is not, however, meant to recommend that relief should in all cases be refused except to the inmates of such establishments. In the great majority of instances, that temporary assistance which the able-bodied poor only require may be more advantageously afforded at their own houses. But to prevent its being abused, it is indispensable that authority to refuse it, except under condition of residence in a workhouse, and of unconditional submission to all its regulations, should be vested in the administrators of the law. The maimed and impotent poor may, in all cases, be more cheaply and better provided for in their own houses than in workhouses.

"Were the change now proposed effected, most of the inconveniences attached to the poor-laws would be removed, and their salutary and sustaining influence would alone remain." (M'Culloch's *Principles of Political Economy*, 2d edit. pp. 418–421.)

XI.—*Establishments for the purposes of War and Defence.*

These consist, of course, principally of the army and navy. But as detailed accounts, derived from the very best sources, are given, under the articles Army and Navy in this work, of all the most important particulars relating to the history and present state of each of these grand departments of the public force, it would be quite superfluous to enter into any details with respect to them in this place. The subjoined accounts of revenue and expenditure during the three years ended with 1831, contain statements of the number of troops and seamen, and of the expense incurred on account of each branch of the service, in each of these years. They seem, therefore, to include every thing to which it is necessary to direct the reader's attention in this place.

Exclusively of the army and navy, great numbers of individuals in all parts of the country are enrolled as special constables, who may be called upon by the magistrates and other civil authorities to assist in suppressing disorders, and in preserving the public peace. In London and in other great towns strong bodies of police are also employed, constituting, as it were, a half military and half civil force.

[illegible] *Revenue and Expenditure.*

The various taxes, the produce of which forms the public revenue of the kingdom, will be described in the article Taxation in this work, where also their real incidence and practical operation will be pointed out. The subjoined tables give an account of the income and expenditure of the empire during each of the three years ending with 1831.

Account of the Public Income of the United Kingdom during each of the three years ending with the 5th of January 1832, specifying the different Taxes, and the produce of each.

HEADS OF INCOME.	YEARS.																	
	1830.						1831.						1832.					
Customs and Excise.	*L.*	*s.*	*d.*	*L.*	*s.*	*d.*	*L.*	*s.*	*d.*	*L.*	*s.*	*d.*	*L.*	*s.*	*d.*	*L.*	*s.*	*d.*
Spirits Foreign	1,519,572	8	7				1,480,507	3	2				1,432,179	8	0			
Spirits Rum	1,434,782	13	1				1,599,445	6	11				1,629,881	9	5			
Spirits British	4,783,951	2	1				5,185,574	4	9½				5,195,125	5	6½			
Malt	3,814,305	1	5¼				3,436,272	14	2				4,359,333	16	8½			
Beer*	3,055,453	15	11½				2,345,122	10	8½				6,888	19	1			
Hops	242,658	0	10½				118,912	5	3½				148,594	19	2½			
Wine	1,473,607	11	4				1,524,177	18	3				1,537,484	2	4			
Sugar and Molasses	5,089,315	0	3				4,927,025	7	6				4,807,472	5	8¼			
Tea	3,321,722	2	6				3,387,097	18	9½				3,344,918	12	9½			
Coffee	498,951	8	1				579,363	10	7				583,751	5	6			
Tobacco and Snuff	2,849,706	7	8				2,924,264	13	11				2,960,325	7	4			
				28,684,025	11	10¼				27,507,763	14	1				26,005,956	11	7¼
Butter	147,839	3	4				102,752	3	8				121,256	4	11			
Cheese	87,122	14	4				54,870	19	5				68,256	16	0			
Currants and Raisins	388,102	2	6				420,217	0	3				503,440	9	1			
Corn	898,793	15	2				790,109	17	8				544,792	4	3			
Cotton Wool,* and Sheep's, imported	317,074	10	5				482,274	11	11				476,682	17	7			
Silks	205,615	9	0				209,047	7	3				213,847	14	6			
Printed Goods*	552,270	12	4½				570,330	15	0¼				58,968	4	6½			
Hides and Skins*	452,768	15	7				255.278	3	10				52,134	17	0¾			
Paper	684,563	10	11¾				690,610	1	4¼				680,140	5	4½			
Soap†	1,152,245	11	1½				1,251,021	12	11¾				1,139,313	3	5½			
Candles and Tallow*	652,971	16	11½				662,944	18	8½				615,554	12	3			
Coals, sea-borne*	983,919	9	2½				1,021,862	5	11				125,745	15	11¾			
Glass	670,494	12	9¾				567,632	18	11				548,050	5	6¼			
Bricks, Tiles,* and Slates*	398,145	14	8¼				383,985	5	7½				366,418	11	6¼			
Timber	1,394,407	19	11¼				1,319,233	9	11				1,278,905	14	10¾			
Auctions	251,562	19	6¾				234,854	2	11				218,085	4	7¾			
Excise Licenses	845,390	18	3¼				848,469	14	11½				919,175	4	9¼			
Miscellaneous Duties of Customs and Excise	1,892,668	2	4				1,971,223	8	3¼				1,743,795	6	1½			
				11,975,957	18	6¾				11,836,718	18	7				9,674,653	12	5¾
Total of Customs and Excise				40,059,983	10	5				39,344,482	12	8				35,680,609	4	1
Stamps.																		
Deeds and other Instruments	1,663,145	14	6½				1,621,427	1	8½				1,512,107	3	1¼			
Probates and Legacies	2,035,719	0	4				2,084,432	15	3				2,001,932	4	7½			
Insurance Marine†	226,897	6	6½				219,565	6	1				248,156	11	8¼			
Insurance Fire	764,939	0	11¼				760,931	3	11½				764,755	11	11			
Bills of Exchange, Bankers' Notes, &c.	593,485	1	1½				568,546	1	8½				666,704	14	9½			
Newspapers and Advertisements†	433,385	5	10½				613,848	2	2¾				655,724	10	3			
Stage Coaches	426,472	1	3¾				418,598	5	9½				422,580	14	9¾			
Post Horses	252,772	2	8				220,357	12	10				231,863	3	4			
Receipts	225,996	2	6				223,660	6	2¾				218,847	6	10½			
Other Stamp Duties	663,164	5	9½				516,716	18	8½				416,066	15	0½			
				7,285,976	1	7½				7,248,083	14	6				7,133,638	16	5¼
Assessed and Land Taxes.																		
Land Taxes	1,200,159	10	11¼				1,184,790	12	5½				1,161,312	7	1½			
Houses	1,324,327	18	9¾				1,361,625	0	5¼				1,357,041	13	11¾			
Windows	1,163,760	17	8				2,185,283	7	10¾				1,178,344	2	3½			
Servants	286,552	7	0				295,087	5	6				295,111	18	6			
Horses	405,678	1	9				425,125	17	0				417,841	2	0			
Carriages	374,677	14	0				397,613	10	0				392,947	4	0			
Dogs	183,060	8	4				186,102	2	0				181,0[illegible]	1	0			
Other Assessed Taxes	268,175	2	9				259,242	11	7				239,117	19	3			
				5,206,392	1	3				5,294,870	6	10½				5,222,718	8	1¾
Post Office				2,184,667	2	4				2,212,206	5	6¼				2,227,364	4	11¼
Crown Lands				465,481	4	5½				363,742	0	4				373,770	10	2½
Other Ordinary Revenues and other Resources				622,302	0	0½				376,805	0	6				347,214	6	5½
Grand Total				55,824,802	0	1½				54,840,190	0	4¾				50,990,315	10	3¼

N. B.—The duties marked * are now repealed; those marked † are reduced.

There are no means by which it is possible to assign to each portion of the empire what may be considered its proper share of the total expenditure. But the following table shows how much each contributes to the revenue:—

Return of the Revenue collected in 1831, *in England, Wales, Scotland, and Ireland, respectively; distinguishing the Customs, Excise, Stamps, and Assessed Taxes.*

Places.	Customs.			Excise.			Stamps.			Land and Assessed Taxes.			Post Office.			Total.		
	L.	*s.*	*d.*	*L.*	*s.*	*d.*	*L.*	*s.*	*d.*	*L.*	*s.*	*d.*	*L.*	*s.*	*d.*	*L.*	*s.*	*d.*
England	16,515,911	0	0	14,147,252	6	5	6,410,573	6	10	4,804,829	5	4	1,031,715	0	0	42,910,280	18	7
Wales	26,139	0	0	176,046	4	6	......[1]			105,530	0	0	40,995	0	0	348,710	4	6
Scotland	1,478,231	0	0	2,576,965	4	1	534,985	15	0	318,578	0	7	204,593	6	9	5,113,353	6	5
Ireland	1,463,624	0	0	2,193,079	4	7	482,040	19	8	...			253,356	16	5	4,392,101	0	8
Total......L.	19,483,905	0	0	19,093,342	19	7	7,427,600	1	6	5,228,937	5	11	1,530,660	3	2	52,764,445	10	2

Account of the Public Expenditure of the United Kingdom during each of the three years ending with the 5th of January 1832, *specifying each separate item, with the number of Troops, Seamen, &c.*

HEADS OF EXPENDITURE.	YEARS.																	
	1830.						1831.						1832.					
Revenue Charges of Collection.	L	*s.*	*d.*	*L.*	*s.*	*d.*	*L.*	*s.*	*d.*	*L.*	*s.*	*d.*	*L.*	*s.*	*d.*	*L.*	*s.*	*d.*
Customs { Civil Departments	1,100,050	8	10¾				1,027,870	17	1½				1,002,251	6	9¼			
Customs { Preventive Service	268,478	10	3¾				260,043	1	4½				313,674	13	7¾			
Total	1,368,528	19	2½				1,287,913	18	6				1,315,926	0	5			
Excise	1,240,948	12	0				1,225,429	10	9½				1,144,150	5	4¼			
Stamps	193,279	13	9				190,157	7	1¾				185,109	19	1½			
Assessed and Land Taxes	287,183	2	2				281,939	12	1				281,304	2	4			
Other Ordinary Revenues (except the Post Office)	28,162	10	6½				28,782	2	10				29,355	16	2½			
Total Revenue				3,118,102	17	8				3,014,224	11	4¼				2,955,846	3	5¼
Public Debt.																		
Interest of Permanent Debt	25,318,866	10	7½				24,091,750	7	10				24,027,666	2	6¼			
Actual Payment of Terminable Annuities*	1,854,695	8	4				1,843,106	11	7				1,844,498	4	1			
Actual Payment for Life Annuities and Annuities for Terms of Years*	826,402	13	10				1,453,269	2	5				1,501,991	5	6			
Interest of Exchequer Bills	878,494	1	3¾				813,300	16	5				655,329	11	3			
Management	275,143	7	1¾				275,179	3	4				273,296	8	9¾			
Total Debt				29,153,602	1	3				28,476,606	1	7				28,302,781	12	2
Civil Government.																		
Civil List; Privy Purse; Tradesmen's Bills; Salaries of the Household	409,700	0	0				401,628	16	10¾				411,800	0	0			
The Allowances to the Junior Branches of the Royal Family, and to H. R. H. Leopold George Frederick Prince of Coburg	247,974	4	6¼				245,923	1	6¼				212,375	0	0			
The Lord Lieutenant of Ireland's Establishment	67,935	1	8				32,749	9	3¾				16,379	14	1			
The Salaries and other Expenses of the Houses of Parliament (including Printing)	141,599	18	5				144,374	6	5				238,037	19	11			
Civil departments in Great Britain, exclusive of those in the Army, Navy, and Ordnance Estimates	328,706	0	1¼				320,045	1	8½				339,376	9	8½			
Pensions on the Consolidated Fund and Gross Revenue	204,870	7	9				264,247	3	2¼				348,275	2	3½			
Ditto on Civil List	196,114	4	11				170,000	0	0				75,000	0	0			
Total Civil Government				1,596,899	17	4½				1,578,967	19	0½				1,641,244	6	0
Carry forward				33,868,604	16	3½				33,069,798	12	0				32,899,872	1	7¼

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[1] This item of Welsh revenue cannot be discriminated.

HEADS OF EXPENDITURE.	YEARS.																	
	1830.						1831.						1832.					
	L.	s.	d.	L.	s.	d.	L.	s.	d.	L.	s.	d.	L.	s.	d.	L.	s.	d.
Brought forward...				33,868,604	16	3½				33,069,798	12	0				32,899,872	1	7¼
Justice.																		
Courts of Justice in England, Scotland, and Ireland	426,828	16	2				407,801	9	9½				415,953	7	6¾			
Police, and Criminal Prosecutions	203,639	11	3				222,450	9	4				210,523	4	11			
Correction. Convicts at Home and Abroad	145,925	18	3				140,305	16	1				5,129,587	5	1			
Convicts New S. Wales...	167,500	0	0				167,500	0	0				3,167,500	0	0			
Other Expenses	60,704	12	8				53,620	6	11¾				63,184	0	0			
Total Justice......				1,004,598	13	4				993,678	2	2¾				986,747	17	6¾
Diplomatic.																		
Salaries and Retired Allowances of Foreign Ministers	224,950	0	0				220,930	15	9¾				141,437	15	3			
Ditto ditto Consuls	192,470	0	0				117,575	0	0				112,195	0	0			
Civil Contingencies, Diplomatic	59,118	5	2				37,097	7	1				45,193	3	8			
Total Diplomatic......				403,538	5	2				375,625	2	10¾				298,825	18	11
Forces.																		
Army. Effective Number of Men	(85,721.)						(84,172.)						(78,498.)					
Charge	4,829,282	12	4½				4,492,688	5	7½				4,808,362	16	2			
Non-Effective Number of Men	(96,595.)						(96,081.)						(94,024.)					
Charge	2,939,896	0	0				2,939,606	9	6				2,924,604	17	4			
Total Army......	7,769,178	12	4½				7,432,294	15	1½				7,732,967	13	6			
Ordnance. Effective Number of Men	(8,879.)						(8,878.)						(12,791.)					
Charge	1,363,282	0	0				1,332,354	0	0				1,062,913	0	0			
Non-Effective Number of Men	(12,494.)						(12,364.)						(13,052.)					
Charge	365,626	0	0				357,090	0	0				355,904	0	0			
Total Ordnance......	1,728,908	0	0				1,689,444	0	0				1,418,817	0	0			
Navy. Effective Number of Men	(32,458.)						(31,444.)						(33,749.)					
Charge	4,299,645	11	11				4,063,308	7	8¼				4,243,846	7	3			
Non-Effective Number of Men	(30,467.)						(29,922.)						(32,021.)					
Charge	1,579,149	0	0				1,531,646	17	11¾				1,626,704	14	5			
Total Navy.......	5,878,794	11	11				5,594,955	5	8				5,870,551	0	8			
Total Forces......				15,376,881	4	3¼				14,716,694	0	9½				15,022,335	15	2
Bounties for promoting Fisheries, Linen Manufactures, &c. paid out of the Gross Revenue				236,898	3	0¾				207,966	10	1½				173,955	18	9¼
Public Works				606,396	8	4				474,242	0	1				825,210	8	3
Payments out of the Revenue of Crown Lands, for Improvements and various Public Services				427,015	2	5½				252,601	5	7¼				254,433	11	9¾
Post-Office Charges of Collection and other Payments				696,801	16	11¾				718,359	8	6½				673,317	5	3¼
Quarantine and Warehousing Establishments				191,852	18	2½				214,037	14	6¾				203,734	0	6½
Spanish Claims, as granted by Parliament				200,000	0	0												
Miscellaneous Services, not classed under the aforegoing heads, consisting of Grants of Parliament, Payments out of the Consolidated Fund and of Civil List				1,336,287	16	7				1,988,530	7	8½				1,236,875	18	5
Grand Total......				54,348,875	9	8½				53,011,533	4	5½				52,575,308	16	3¾
* Terminable and Life Annuities paid as above				2,681,098	2	2				3,296,375	14	0				3,346,489	9	7
Corresponding Perpetuities, as estimated by Mr Finlaison....				1,811,529	15	9				2,143,685	13	6				2,104,507	18	2
Difference......				869,568	6	5				1,152,689	0	6				1,241,981	11	5

XIII.—*National Debt.*

The national debt consists, as every one knows, of sums borrowed to make up deficiencies of revenue. It originated during the wars carried on by William III. against France. Its contraction was then not a matter of choice, but of necessity; for, owing to the numerous adherents the exiled family of Stuart had in the country, it would have been impossible to have imposed such an amount of taxes as would have sufficed to defray the expenses of the war, without inflaming the popular discontent to such a degree as would most probably have been subversive of the new government. At first it was usual to fund the amount of stock equal to the sums borrowed; but since the reign of George II. a different practice has obtained; and it has been judged advisable to fund generally in a stock bearing a low rate of interest, by proportionally increasing its amount. Thus suppose interest were five per cent. and that government wished to borrow in three per cent. stock; in such a case they would give L.166⅔ of stock for every L.100 money paid into the exchequer. By affording, in consequence of the increase of the stock, greater scope for speculation, this practice is supposed to have enabled government to borrow on rather lower terms at the time; but, by disabling them from reducing the interest on such loans at the close of a war, when the market rate of interest uniformly falls, it has proved most signally injurious. It is not going too far to say that this blunder costs the public at this moment L.7,000,000 a year.

	Principal.	Interest.
Debt at the accession of Queen Anne in 1702	L.16,394,702	L.1,310,942
Debt at the accession of George I. in 1714	54,145,363	3,351,358
Debt at the accession of George II. in 1727	52,092,238	2,217,551
Debt in 1763	138,865,430	4,852,051
Debt at the commencement of the American war in 1775	128,583,635	4,471,571
Debt at the conclusion of the American war in 1784	249,851,628	9,451,772
Debt at the commencement of the French war in 1793	239,350,148	9,208,495
Debt 5th January 1817, when the English and Irish exchequers were consolidated	848,282,477	33,854,466

Since 1817 a deduction has been made of about sixty-four millions from the principal of the debt, and about 5⅓ millions from the interest on its account. This diminution has been principally effected by taking advantage of the fall in the rate of interest since the peace, and offering to pay off the holders of the different stocks unless they consented to accept of a reduced payment; and had it not been for the highly objectionable practice already adverted to, of funding large capitals at a low rate of interest, the saving in this way would have been incomparably larger. We subjoin an account of the funded and unfunded debt of Great Britain and Ireland as at 5th January 1833.

	Capital of Unredeemed Debt.		
GREAT BRITAIN.			
Debt due to the South Sea Company, at 3 per cent	L.3,662,784	8	6½
Old South Sea annuities	3,497,870	2	7
New South Sea annuities	2,460,830	2	10
South Sea annuities, 1751	523,100	0	0
Debt due to the Bank of England	14,686,800	0	0
Bank annuities created in 1726	874,949	19	0
Consolidated annuities	347,458,931	7	0¼
Reduced annuities	123,029,913	5	3
Total bearing interest at 3 per cent	L.496,195,179	5	2¾
Annuities at 3½ per cent. anno 1818	12,350,801	16	1
Reduced annuities, ditto	63,453,824	2	1
New 3½ per cent. annuities	137,613,820	7	2
L.4 per cent. annuities created in 1826	10,796,340	0	0
New 5 per cent. annuities	462,736	13	4
Great Britain	L.720,872,702	3	10¾
IRELAND.			
Irish consolidated annuities at 3 per cent	2,803,780	18	4
Irish reduced annuities ditto	162,062	6	2
L.3. 10s. per cent. debentures and stock	14,605,670	3	11
Reduced 3½ per cent. annuities	1,234,509	4	3
New 3½ per cent. annuities	11,784,394	14	0
Debt due to the Bank of Ireland at 4 per cent	1,615,384	12	4
New 5 per cent. annuities	6,661	1	0
Debt due to the Bank of Ireland at 5 per cent	1,015,384	12	4
Ireland	L.33,227,847	6	4
Total united kingdom	754,100,549	10	2¾
Exchequer bills outstanding 5th January 1833	27,278,000	0	0
Total funded and unfunded debt 5th January 1833	L.781,378,549	10	2¾

Annual Charge on Account of Public Debt.

		In Great Britain.			In Ireland.			Total Annual Charge.		
		£	s.	d.	£	s.	d.	£	s.	d.
Due to the public creditor.	Annual interest on unredeemed capital	22,810,491	8	7½	1,171,553	0	11¾	......		
	Long annuities, expire 1860	1,192,943	4	10	73	19	3	......		
	Annuities per 4 Geo. IV. c. 22, expire 1867,	585,740	0	0	......			......		
	Annuities per 10 Geo. IV. c. 24, expire at various period	870,998	2	0	......			......		
	Annuities to the trustees of the Waterloo Subscription Fund, per 59 Geo. III. c. 34, expire 5th of July 1833	7,900	0	0	......			......		
	Payable at the National Debt Office. Life Annuities, per 48 Geo. III. c. 148, and 10 Geo. IV. c. 24.	717,529	5	0	......			......		
	Payable at the National Debt Office. Tontines and other Life Annuities, per various acts, English	22,371	13	3	......			......		
	Payable at the National Debt Office. Tontines and other Life Annuities, per various acts, Irish	34,230	8	7	6,823	7	3	......		
	Interest of funded debt	26,242,204	2	3½	1,178,450	7	5¾	27,420,654	9	9¼
	Management of debt	......			......			271,533	1	10¼
Annual charge on account of public funded debt,		......			......			27,692,187	11	7½
Interest on exchequer bills (1832)		......			......			659,165	6	6
Total annual charge on account of funded and unfunded debt		......			......			28,351,352	18	1½[1]

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A sinking fund for the extinction of the public debt was established by Sir Robert Walpole as early as 1716; but it was virtually subverted in 1733. It was again instituted by Mr Pitt in 1786; and, singular as it may now appear, it was for a lengthened period supposed, that by means of the *legerdemain* operation of compound interest, the public debt might be reduced by borrowing money to pay it off. Dr Hamilton of Aberdeen has the merit of having dissipated this extraordinary delusion, the grossest, certainly, by which any civilized nation ever suffered itself to be imposed upon. He showed that the excess of revenue over expenditure is the only real sinking fund, —the only means by which any portion of the public debt had ever been, or ever could be, paid off; and that all sinking funds operating at compound interest, or otherwise, excepting in as far as they happened to be founded on this principle, were mere quackery and delusion. In fact, upon examining into the matter, it was found that the public debt would have been decidedly less had the sinking fund never been heard of. After such an exposition, the existence of the sinking fund was impossible; and having undergone various modifications, it was finally abolished by the 10th Geo. IV. cap. 27, which enacts, that the sum thenceforth annually applicable to the reduction of the public debt shall consist of the *actual surplus revenue beyond the expenditure.* In 1832 this surplus amounted to L.614,758. 18s. 8d.

XIV.—*Population.*

The population of England and Wales at periods antecedent to 1801, can only be determined by computations founded on the returns obtained under poll and hearth taxes, and on the registers of births and deaths. Unfortunately, however, none of these affords data from which the amount of population can be accurately deduced. During the latter part of last century the uncertainty in which this subject was involved afforded materials for a keen controversy, which was carried on by Dr Price on the one hand, and by Mr Howlett, vicar of Dunmow in Essex, and Mr Hales, on the other. The former contended that population had been declining in England from the Revolution downwards, and that it did not in 1777 exceed 4,763,000. Mr Howlett, however, showed conclusively that no reliance could be placed on either Dr Price's facts or arguments; and that there could be no reasonable doubt that the population had materially increased in the interval between 1700 and 1780. The returns obtained under the population acts put an end to this controversy, and proved the general accuracy of Mr Howlett's conclusions. The population, as deduced from them, after allowing for their defects and inaccuracies, is as follows:—

Years.	Population of England and Wales.	Years.	Population of England and Wales.
1700	5,475,000	1760	6,736,000
1710	5,240,000	1770	7,428,000
1720	5,565,000	1780	7,953,000
1730	5,796,000	1790	8,675,000
1740	6,064,000	1801	8,872,000
1750	6,467,000		

The population for 1801 was determined by actual enumeration; and since then censuses have been taken in 1811, 1821, and 1831, the results of which are embodied in the following comprehensive table.

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[1] Exclusive of L.34,521. 7s. 10d. the annual charge on capitals and long annuities, standing in the names of the National Debt Commissioners, on account of stock unclaimed ten years or upwards, and of unclaimed dividends; and also on account of donations and bequests.

Population of England and Wales.

Counties.	1801.	Increase per cent.	1811.	Increase per cent.	1821.	Increase per cent.	1831.	
ENGLAND.								
Bedford	63,393	11	70,213	19	83,716	14	95,383	
Berks	109,215	8	118,277	11	131,977	10	145,289	
Buckingham	107,444	9	117,650	14	134,068	9	146,529	
Cambridge	89,346	13	101,109	20	121,909	18	143,955	
Chester	191,751	18	227,031	19	270,098	24	334,410	
Cornwall	188,269	15	216,667	19	257,447	17	302,440	
Cumberland	117,230	14	133,744	17	156,124	10	169,681	
Derby	161,142	15	185,487	15	313,333	11	237,170	
Devon	343,001	12	383,308	15	439,040	13	494,168	
Dorset	115,319	8	124,693	16	144,499	10	159,252	
Durham	160,361	11	177,625	17	207,673	22	253,827	
Essex	226,437	11	252,473	15	289,424	10	317,233	
Gloucester	250,809	12	285,514	18	835,843	15	386,904	
Hereford	89,191	5	94,073	10	103,243	7	110,976	
Hertford	97,577	14	111,654	16	129,714	10	143,341	
Huntingdon	37,568	12	42,208	15	48,771	9	53,149	
Kent	307,624	21	373,095	14	426,016	12	479,155	
Lancaster	672,731	23	828,309	27	1,052,859	27	1,336,854	
Leicester	130,081	16	150,419	16	174,571	13	197,003	
Lincoln	208,557	14	237,891	19	283,058	12	317,244	
Middlesex	818,129	17	953,276	20	1,144,531	19	1,358,541	
Monmouth	45,582	36	62,127	15	71,833	36	98,130	
Norfolk	273,371	7	291,999	18	344,368	13	390,054	
Northampton	131,757	7	141,353	15	162,483	10	179,276	
Northumberland	157,101	9	172,161	15	198,965	12	222,912	
Nottingham	140,350	16	162,900	15	186,873	20	225,320	
Oxford	109,620	9	119,191	15	136,971	11	151,726	
Rutland	16,356	...	16,380	13	18,487	5	19,385	
Salop	167,639	16	194,298	6	206,153	8	222,503	
Somerset	273,750	12	303,180	17	355,314	13	403,908	
Southampton	219,656	12	245,080	15½	283,298	11	314,313	
Stafford	239,153	21	295,153	17	345,895	19	410,485	
Suffolk	210,431	11	234,211	15	270,542	9	296,304	
Surrey	269,043	20	323,851	23	398,658	22	486,326	
Sussex	159,311	19	190,083	22	233,019	17	272,328	
Warwick	208,190	10	228,735	20	274,392	23	336,988	
Westmoreland	41,617	10	45,922	12	51,359	7	55,041	
Wilts	185,107	5	193,828	15	222,157	8	239,181	
Worcester	139,333	15	160,546	15	184,424	15	211,356	
York (East Riding)	110,992	16	134,437	14	154,010	10	168,646	1,371,296
City of York and Ainstey	24,393	12	27,304	12	30,451	17	35,362	
York (North Riding)	158,225	7	169,391	11	187,452	2	190,873	
York (West Riding)	565,282	16	655,042	22	801,274	22	976,415	
	8,331,434	14½	9,538,827	17½	11,261,437	16	13,089,338	
WALES.								
Anglesey	33,806	10	37,045	21	45,063	7	48,325	
Brecon	31,633	19	37,735	16	43,603	10	47,763	
Cardigan	42,956	17	50,260	15	57,784	10	64,780	
Carmarthen	67,317	15	77,217	17	90,239	12	100,655	
Carnarvon	41,521	19	49,336	17	57,958	15	65,753	
Denbigh	60,352	6	64,240	19	76,511	8	83,167	
Flint	39,622	17	46,518	15	53,784	11	60,012	
Glamorgan	71,525	18	85,067	19	101,737	24	126,612	
Merioneth	27,506	4	30,924	11	34,382	3	35,609	
Montgomery	47,978	8	51,931	15	59,899	9	66,485	
Pembroke	56,280	7	60,615	22	74,009	9	81,424	
Radnor	19,050	9	20,900	7	22,459	9	24,651	
	541,546	13	611,788	17	717,438	12	805,236	
GREAT BRITAIN.								
England	8,334,434	14⅔	9,551,888	17⅞	11,261,437	16	13,089,338	
Wales	541,546	13	611,788	17	717,438	12	805,236	
Scotland	1,599,068	14	1,805,688	16	2,093,456	13	2,365,807	
Army, Navy, &c.	470,598	...	640,500	...	319,300	...	277,017	
	10,942,646	15¼	12,609,864	14	14,391,631	15	16,537,398	

Statistics.

Houses; occupations; sexes.

The following table contains an account of the houses inhabited, building, and uninhabited, the number of families, the distribution of families according to their occupations, with the number of males and the number of females, in England and Wales in the year 1821. It is necessary, however, to observe that the classification of employments is not in any degree to be depended upon; but as it has been frequently referred to, we think it right to lay it before the reader. A much more scientific and elaborate classification of employments was made under the census of 1831; but the results have not hitherto been published.

Summary of Houses, Families, Occupations, and Persons, in 1821.

COUNTIES.	HOUSES.				OCCUPATIONS.			PERSONS.		
	Inhabited.	By how many Families occupied.	Building.	Uninhabited.	Families chiefly employed in Agriculture.	Families chiefly employed in Trade, Manufactures, or Handicraft.	All other Families not comprised in the two preceding Classes.	Males.	Females.	Total of Persons.
ENGLAND.										
Bedford	15,412	17,373	105	202	10,754	4,827	1,792	40,385	43,331	83,716
Berks	24,705	27,709	154	622	14,769	8,773	4,158	65,546	66,431	131,977
Bucks	24,876	28,867	148	549	16,640	8,318	3,909	64,867	69,201	134,068
Cambridge	20,869	25,603	217	247	15,536	6,964	3,103	60,301	61,608	121,909
Chester	47,094	52,024	414	1,212	18,120	27,105	6,799	132,952	137,146	270,098
Cornwall	43,873	51,202	535	1,820	19,302	15,543	16,357	124,817	132,630	257,447
Cumberland	27,246	31,804	155	908	11,297	13,146	7,361	75,600	80,524	156,124
Derby	40,054	42,404	305	1,072	14,582	20,505	7,317	105,873	107,460	213,333
Devon	71,486	90,714	756	3,082	37,037	33,985	19,692	208,229	230,811	439,040
Dorset	25,926	30,312	278	766	14,821	10,811	4,680	68,934	75,565	144,499
Durham	32,793	45,940	257	966	9,427	20,212	16,301	99,100	108,573	207,673
Essex	49,978	59,629	298	1,164	33,206	17,160	9,263	144,909	144,515	289,424
Gloucester	60,881	72,156	705	2,555	23,170	35,907	13,079	160,451	175,392	335,843
Hereford	20,061	21,917	132	804	13,558	5,633	2,726	51,552	51,691	103,243
Hertford	23,178	26,170	172	509	13,485	7,935	4,750	64,121	65,593	129,714
Huntingdon	8,879	10,397	46	168	6,435	2,937	1,025	24,020	24,751	48,771
Kent	70,507	85,399	511	3,186	30,869	30,180	24,890	209,833	216,183	426,016
Lancaster	176,449	203,173	1,735	5,759	22,723	152,271	28,179	512,476	540,383	1,052,859
Leicester	34,775	36,806	225	1,141	13,028	20,297	3,481	86,390	88,181	174,571
Lincoln	53,813	58,760	302	979	34,900	15,845	8,015	141,570	141,488	283,058
Middlesex	152,969	261,871	2,879	7,327	9,393	161,356	91,122	533,573	610,958	1,144,531
Monmouth	13,211	14,122	166	520	6,020	6,147	1,955	27,278	34,555	71,833
Norfolk	62,274	74,497	525	1,269	36,368	26,201	11,928	166,892	177,476	344,368
Northampton	32,503	35,552	179	527	18,974	11,695	4,883	79,575	82,908	162,483
Northumberland	31,526	43,128	190	1,166	11,567	20,565	10,996	95,354	103,611	198,965
Nottingham	35,022	38,603	288	859	13,664	21,832	3,107	91,491	95,382	186,873
Oxford	25,594	28,841	245	531	15,965	8,971	3,905	68,817	68,154	136,971
Rutland	3,589	3,936	25	61	2,410	1,034	492	9,223	9,264	18,487
Salop	38,663	41,636	179	1,012	18,414	17,485	5,737	102,056	104,097	206,153
Somerset	61,852	73,537	850	1,974	31,448	27,132	14,957	170,199	185,115	355,314
Southampton	49,516	57,942	287	1,943	24,303	19,810	13,829	138,373	144,925	283,298
Stafford	63,319	68,780	429	2,326	18,285	42,435	8,060	171,668	169,372	341,040
Suffolk	42,773	55,064	270	656	30,795	17,418	6,851	132,410	138,132	270,542
Surrey	64,790	88,806	1,096	2,741	14,944	46,811	27,051	189,871	208,787	398,658
Sussex	36,283	43,565	576	1,272	21,920	15,463	6,182	116,705	116,314	233,019
Warwick	55,082	60,123	403	2,408	16,779	39,189	4,155	133,827	140,565	274,392
Westmoreland	9,243	10,438	113	301	5,096	3,801	1,541	25,513	25,846	51,359
Wilts	41,702	47,684	294	1,129	24,972	16,982	5,730	108,213	113,944	222,157
Worcester	34,738	39,006	232	980	14,926	18,566	5,514	90,259	94,165	184,424
York (East Riding)	34,390	40,499	190	1,277	15,480	16,637	8,382	92,761	97,688	190,449
York (North Riding)	35,765	38,731	148	835	16,737	11,570	10,424	90,153	93,228	183,381
York (West Riding)	154,314	161,466	1,275	7,230	31,613	108,841	21,012	397,542	401,815	799,357
Total	1,951,973	2,346,717	18,289	66,055	773,732	1,118,295	454,690	5,483,679	5,777,758	11,261,437
Wales	136,183	146,706	985	3,652	74,225	41,680	30,801	350,487	366,951	717,438
Total of England and Wales	2,088,156	2,493,423	19,274	69,707	847,957	1,159,975	485,491	5,834,166	6,144,709	11,978,875

Rate of mortality, &c.

Notwithstanding the defective state of the registers of marriages, births, and deaths, the results deduced from them are such as to establish beyond all question the fact of an extraordinary improvement having taken place in the healthiness of the mass of the people. Although about 919,000 were added to the population of England and Wales in the interval between 1780 and 1800, the annual average number of burials did not differ materially during that period.[1] It appears from the returns, that in 1780 the rate of mortality in England and Wales was one in forty; meaning by this, that one fortieth part of the whole population died annually. In 1790 the rate of mortality was reduced to one in forty-five. During the five years ending with 1800, it was one in forty-eight; during the five years ending with 1810, one in fifty-one; and during the five years ending with 1820, it had sunk to one in fifty-seven. During the five years ending with 1830, it seems to have slightly increased; having been, at an average of that period, one in fifty-four. See the subjoined table.

This extraordinary decrease of mortality is no doubt owing to a variety of causes; such as, the greater prevalence of habits of sobriety and cleanliness; the better lodging, feeding, and clothing of the labouring classes; improvements in medical science, &c. But to whatever it may be owing, it affords unquestionable evidence of the signally improved condition of the population.

The increase of longevity has been particularly conspicuous in London and other great towns. During the first half of last century, the mortality in the metropolis is believed to have been as high as one in twenty-four; and it required, down to the American war, large supplies of recruits from the country to keep up its numbers. But from 1770 the rate of mortality has been gradually diminishing. In 1790 the births for the first time exceeded the burials; and since then the city would have gone on increasing, though it had not been indebted to the country for a single immigrant. In Manchester, Bristol, &c. the improvement has been equally striking.

The proportion of births and marriages to the population has continued pretty nearly stationary since 1790. We subjoin a table of the annual proportion of baptisms, burials, and marriages, to the population of England; calculated upon an average of the totals of such baptisms, burials, and marriages in the five years preceding the several enumerations of 1801, 1811, 1821, and 1831, and distinguishing the several counties.

COUNTIES.	1796—1800.			1806—1810.			1816—1820.			1826—1831.		
	Baptisms.	Burials.	Marriages.	Baptisms.	Burials.	Marriages.	Baptisms.	Burials.	Marriages.	Baptisms.	Burials.	Marriages.
Bedford	35	50	113	34	51	131	35	56	124	37	57	129
Berks	33	51	148	33	53	144	33	55	140	33	52	149
Bucks	37	50	129	33	51	129	35	55	139	36	55	144
Cambridge	33	45	118	31	44	130	31	56	117	32	46	124
Chester	39	51	130	39	51	132	35	52	127	43	57	142
Cornwall	33	58	120	32	62	142	33	70	146	34	65	147
Cumberland	38	53	145	35	53	132	34	55	152	36	56	168
Derby	35	52	138	34	61	139	36	61	146	36	56	134
Devon	36	49	109	33	52	113	34	60	132	35	60	134
Dorset	41	62	142	35	56	139	36	64	144	35	58	138
Durham	38	42	116	34	50	133	34	54	134	35	54	148
Essex	35	44	125	34	46	130	36	60	146	37	54	154
Gloucester	37	55	127	36	65	120	36	62	111	35	62	116
Hereford	40	65	183	36	61	144	36	60	171	37	56	149
Hertford	38	54	161	34	58	168	35	58	171	36	59	127
Huntingdon	33	46	104	35	50	134	35	63	127	36	47	131
Kent	30	41	116	29	38	115	31	51	130	34	49	141
Lancaster	34	47	114	31	51	115	37	55	116	38	57	117
Leicester	35	49	130	38	59	134	36	59	127	38	56	127
Lincoln	32	49	117	31	50	125	31	60	134	31	51	135
Middlesex	39	37	95	40	46	94	41	51	101	40	45	102
Monmouth	56	72	168	50	70	145	53	72	151	59	83	131
Norfolk	32	47	126	31	50	134	32	59	130	33	54	142
Northampton	42	50	130	38	55	132	37	57	129	37	53	135
Northumberland	47	57	138	43	55	141	41	65	149	40	63	141
Nottingham	32	51	116	33	53	119	33	55	124	31	51	120
Oxford	35	53	139	34	56	141	33	57	148	32	52	120
Rutland	33	50	131	34	55	161	35	62	142	34	53	138
Salop	34	54	142	35	60	142	36	55	148	35	54	140
Somerset	39	55	139	35	55	128	35	61	140	36	60	147
Southampton	34	46	104	30	46	102	32	61	128	35	56	131
Stafford	34	49	124	31	53	118	32	52	123	32	51	125
Suffolk	34	56	129	33	55	132	34	66	134	37	60	137
Surrey	37	42	134	37	46	129	39	51	139	38	50	129
Sussex	31	55	126	29	53	129	33	69	142	33	58	140
Warwick	35	52	116	35	45	119	36	48	118	36	60	119
Westmoreland	35	50	142	32	55	137	33	52	149	33	57	152
Wilts	41	60	142	36	58	138	36	64	134	35	57	145
Worcester	34	46	137	32	52	129	34	53	140	31	52	127
York (East Riding)	39	55	129	30	49	108	34	55	122	35	50	116
York (North Riding)	36	53	142	31	51	124	35	61	147	35	56	146
York (West Riding)	34	49	124	33	54	123	36	61	124	38	57	136
Summary of England, not including Wales	36	48	123	34	51	122	35	57	127	37	54	129

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[1] Preliminary Remarks to Census of 1821. p. 26.

XV.—*Crimes in England and Wales.*

Crimes of violence have greatly decreased in England during the last half century. Highway robbery, once so prevalent, is now almost unknown; and though murders are occasionally perpetrated, they are not numerous compared with the amount of population. Latterly, however, the crime of arson has made a great and alarming progress; and, from the facility with which it may be committed, the difficulty of detection, and the destruction of property and life it is almost sure to occasion, no means should be left untried which may tend to arrest its progress. There would seem, from the accounts laid before parliament, to be of late years a very great increase in the offences against property. We believe, however, that much of this increase is apparent only, resulting from the establishment of a police force in most great towns, and from the consequent commitment and punishment of numerous culprits who were formerly allowed to escape. The law of England as to capital punishments has recently been much modified; and various opinions are entertained as to what will be the effect of the change. It has, however, been too recently effected, to allow of any inferences being drawn as to its practical operation. The subjoined tables give a very complete view of the state of crime in England and Wales during the seven years ending with 1832.

I.—*Number of Persons Committed, Convicted, Sentenced, Acquitted, &c. in England and Wales.*

In the Years	1826.	1827.	1828.	1829.	1830.	1831.	1832.	Total Number in the Seven Years.
	Number of Persons.	Number of Persons.	Number of Persons.	Number of Persons.	Number of Persons.	Number of Persons.	Number of Persons.	
COMMITTED FOR TRIAL.								
Viz. Males........................	13,472	15,154	13,832	15,556	15,135	16,600	17,486	107,235
„ Females.....................	2,692	2,770	2,732	3,119	2,971	3,047	3,343	20,675
Total.........	16,164	17,924	16,564	18,675	18,107	19,647	20,829	127,910
CONVICTED AND SENTENCED.								
To death..........................	1,203	1,529	1,165	1,385	1,397	1,601	1,449	9,729
Transportation for life..........	133	198	317	396	405	334	546	2,330
———— 35 years....	...	...	...	1	...	...	...	1
———— 28 years....	...	1	1	...	2	1	1	6
———— 21 years....	...	1	...	2	...	1	...	4
———— 14 years....	185	293	508	691	659	638	764	3,736
———— 10 years....	...	...	1	...	...	1	1	3
———— 9 years......	...	...	...	...	1	...	...	1
———— 7 years......	1,945	2,232	2,046	2,285	2,169	2,340	2,603	15,620
Imprisonment, and severally to be whipped, fined, kept to hard labour, &c.... 5 years........	...	1	...	...	...	...	...	1
4 years........	...	...	1	...	...	...	...	1
3 years........	11	11	11	7	1	5	3	49
2 years and above 1 year....	297	296	243	235	209	226	230	1,736
1 year and above 6 months	1,204	1,433	1,117	1,277	1,220	1,311	1,304	8,866
6 months and under......	5,819	6,251	5,991	6,646	6,458	7,012	7,644	45,821
Whipping, and fine..............	310	321	322	336	284	360	402	2,334
Total convicted.................	11,107	12,567	11,723	13,261	12,805	13,830	14,947	90,240
acquitted..................	3,271	3,407	3,169	3,614	3,470	3,723	3,716	24,370
no bills found, and not prosecuted..........	1,786	1,950	1,672	1,800	1,832	2,094	2,166	13,300
Total.........	16,164	17,942	16,564	18,675	18,107	19,647	20,829	127,910
Of whom were executed.......	57	73	58	74	46	52	54	414

II.—*Specification of the Crimes of which Persons were convicted in England and Wales in* 1826–1832, *and of the Numbers annually convicted of such Crimes.*

Nature of the Crimes of which Persons were Convicted in the years	1826.	1827.	1828.	1829.	1830.	1831.	1832.
	Number of Persons.	Number of Persons.	Number of Persons.	Number of Persons.	Number of Persons.	Number of Persons.	Number of Persons.
Arson, and other wilful burning	3	3	2	8	15	26	35
Bigamy	35	23	38	31	27	26	27
Burglary	311	368	171	108	104	99	118
Breaking into a dwelling-house, and larceny	125	240	353	561	535	517	583
Breaking into a building, shop, &c. (not communicating with dwelling-house), and larceny	...	...	151	164	208	163	203
Cattle stealing	21	31	28	25	25	20	42
—— feloniously killing, and maiming	...	1	2	2	2	7	8
Child stealing	1	5	3	3	4	4	2
Coining	7	14	6	...	...	7	1
Coin, counterfeit, putting off, uttering, and having, &c.	210	223	205	256	243	257	349
Embezzlement (by servants)	91	101	135	130	122	127	154
Forgery of and uttering forged instruments, other than Bank of England notes	8	20	32	24	17	29	50
Forgery of and uttering forged Bank of England notes	15	26	10	13	2	5	5
Forged Bank of England notes, having in possession, &c.	4	...	...	1	...	...	2
Fraudulent offences	157	206	215	282	290	266	280
Game laws, offences against	128	212	306	174	108	83	163
Horse stealing	121	147	135	147	131	125	155
Larceny	8,089	8,858	8,199	9,444	8,969	9,059	10,130
——— in a dwelling-house, &c.	222	223	69	81	100	113	127
——— from the person	658	722	682	724	759	906	1,151
Letters, containing bank notes, &c. secreting and stealing	...	3	1	...	2	4	2
——— sending threatening	2	...	1	2	1	24	4
Manslaughter	62	83	72	56	82	79	66
Murder	13	12	20	13	16	14	20
——— shooting at, stabbing, wounding, and administering poison, with intent to murder, &c.	14	35	20	65	28	44	52
——— concealing the birth of their infants	7	5	5	23	23	22	29
Perjury	6	6	7	4	9	6	6
Piracy	...	...	...	...	4	...	...
Rape, &c.	4	11	5	7	9	9	16
—— assault with intent to commit	83	64	78	69	41	68	80
Riot and felony	48	...	2	...	...	105	44
Robbery of the person, on the highway and other places	144	201	158	147	166	297	223
Sacrilege	4	8	7	11	8	15	13
Sheep stealing, and killing with intent to steal	127	156	122	155	213	162	219
Sodomy	1	1	2	1	5	2	2
——— assault with intent to commit, and other unnatural offences	20	23	27	14	28	14	36
Stolen goods, receiving	157	235	229	277	277	271	347
Transports being at large, &c.	12	12	7	8	8	10	4
Treason, high	...	...	...	...	...	...	1
Felony, transferring a stamp, to defraud	...	...	...	...	...	1	...
——— trafficking in slaves	...	...	...	...	3	...	...
——— armed to assist smugglers, &c.	1	16	11	...	2	...	...
——— breaking thrashing machines, &c.	...	...	...	...	33	665	17
Felony, and misdemeanour (not otherwise described)	196	273	207	231	186	189	181
Total number of persons convicted in each year	11,107	12,567	11,723	13,261	12,805	13,830	14,947

III.—*Specification of the Crimes for which Persons were Executed in England and Wales in the years* 1826–1832, *and of the Numbers annually executed for such Crimes.*

Crimes for which Persons were Executed, who were Sentenced to Death, in the Years	1826.	1827.	1828.	1829.	1830.	1831.	1832.	Total Number in the Seven Years.
	Number of Persons.	Number of Persons.	Number of Persons.	Number of Persons.	Number of Persons.	Number of Persons.	Number of Persons.	
Arson, and other wilful burning....	1	...	...	3	6	16	16	42
Burglary	10	10	3	4	2	4	1	34
Breaking into a dwelling-house, and larceny......................	...	...	11	10	6	1	4	32
Coining....................................	1	4	2	...	...	...	...	7
Forgery of and uttering forged instruments, other than Bank of England notes	1	2	2	6	...	...	...	11
Forgery of and uttering forged Bank of England notes.........	...	2	2	1	...	...	...	5
Horse stealing.........................	7	10	6	6	...	...	...	29
Larceny in a dwelling-house, &c...	5	4	1	1	2	1	...	14
Letters containing bank notes, secreting and stealing	...	1	...	...	...	...	1	2
Murder....................................	10	11	17	13	14	12	15	92
——— shooting at, stabbing, wounding, and administering poison, with intent to murder, &c.	1	6	5	10	1	3	2	28
Piracy......................................	...	...	...	...	2	...	...	2
Rape, &c..................................	2	2	3	3	3	4	7	24
Riot and felony..........................	...	...	...	...	...	2	4	6
Robbery of the person, on the highway and other places.....	15	17	5	12	5	7	4	65
Sheep stealing..........................	3	3	1	5	1	1	...	14
Sodomy....................................	1	1	...	...	4	1	...	7
Total number of persons executed in each year..............	57	73	58	74	46	52	54	414

END OF VOLUME EIGHTH.

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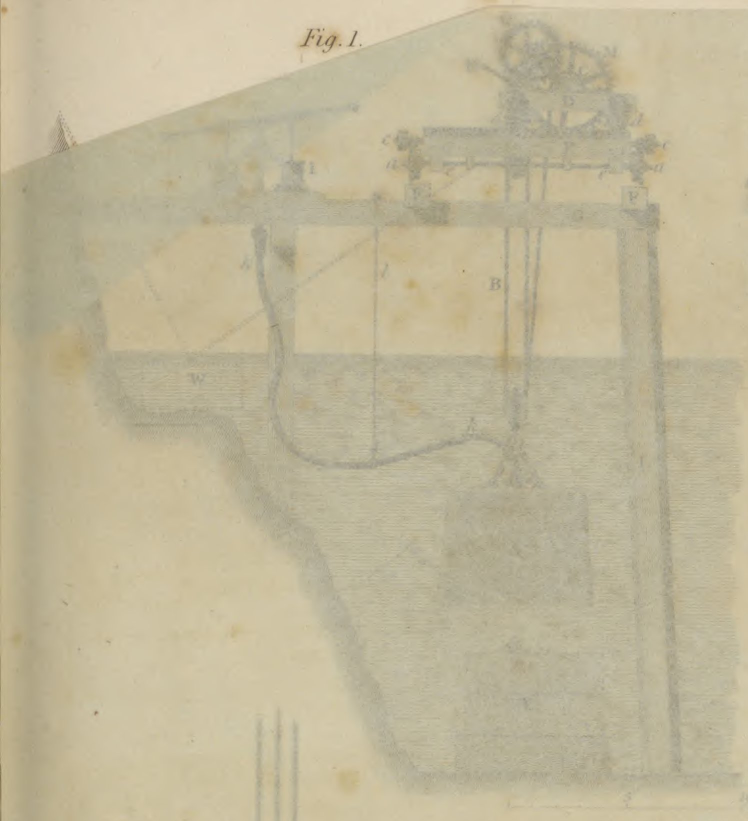

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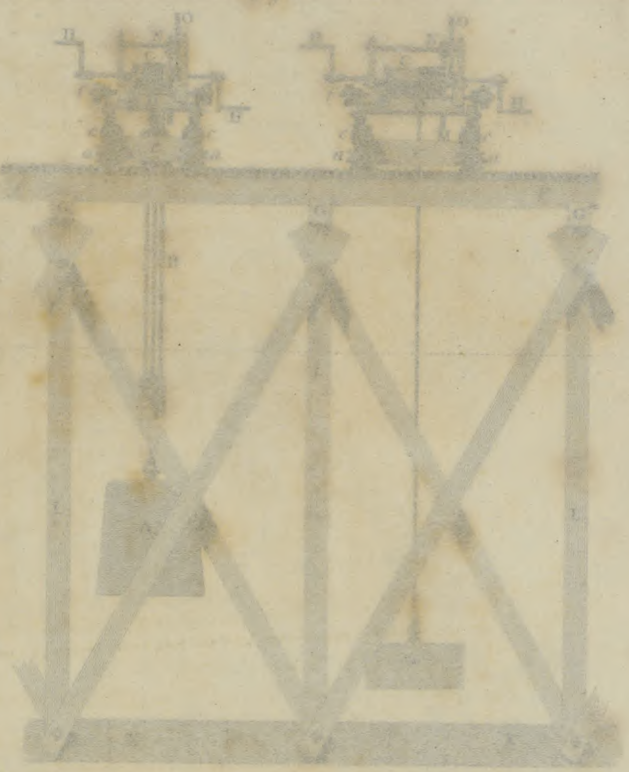

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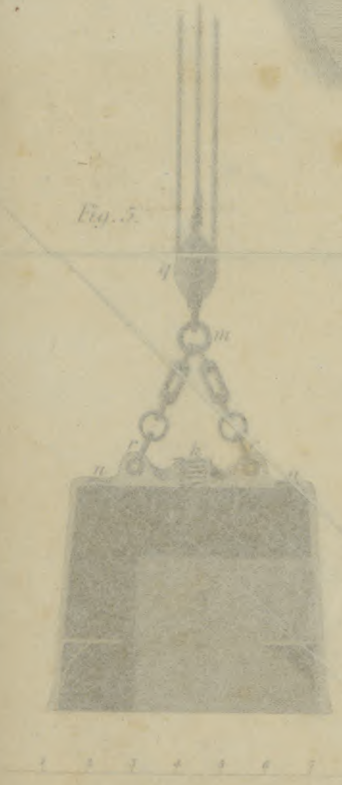

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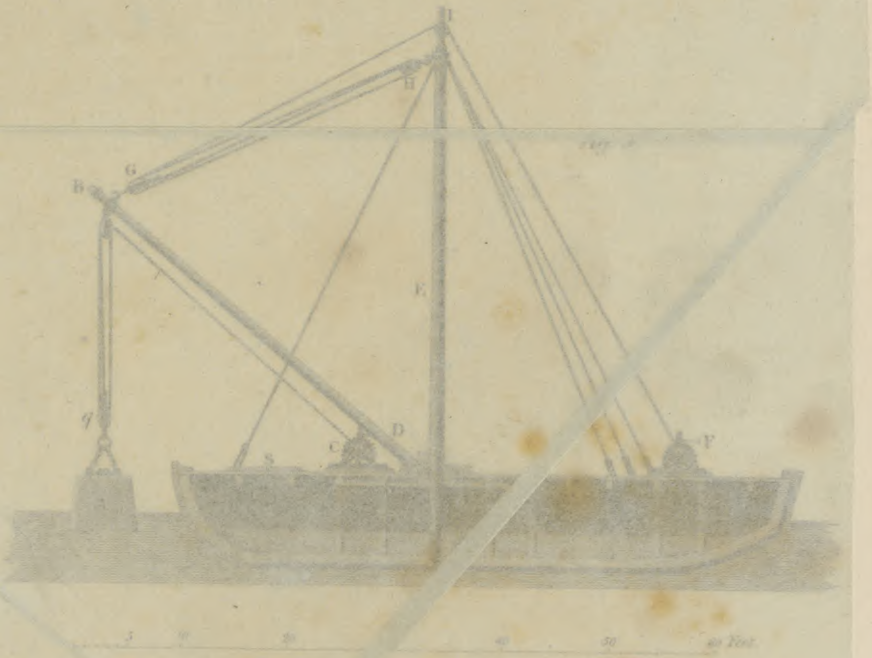

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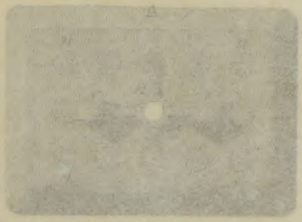

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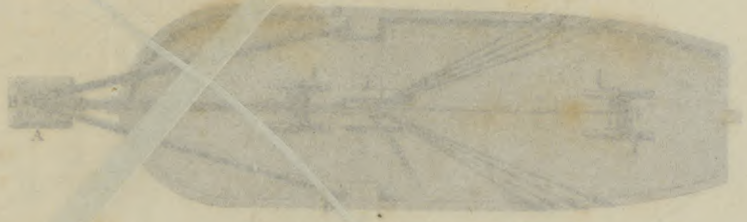

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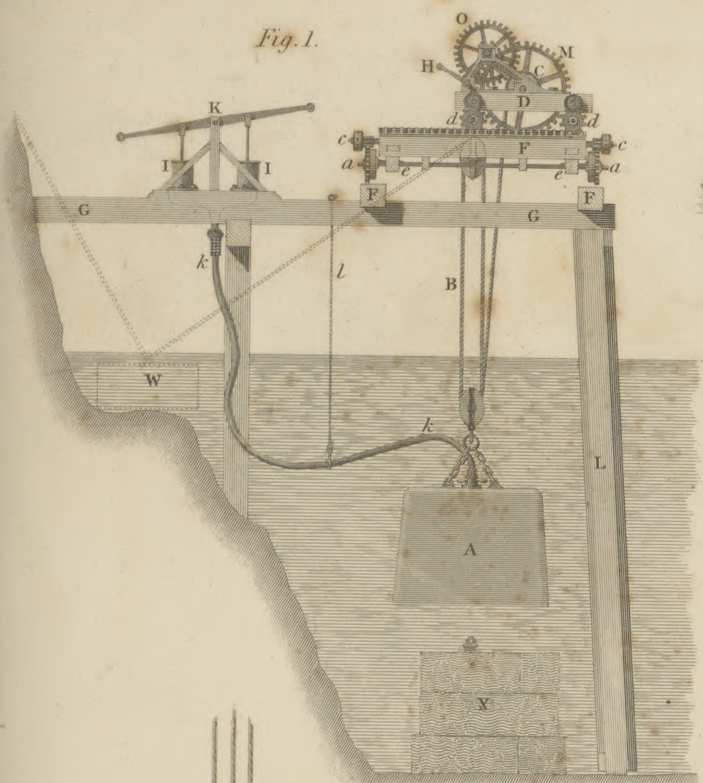

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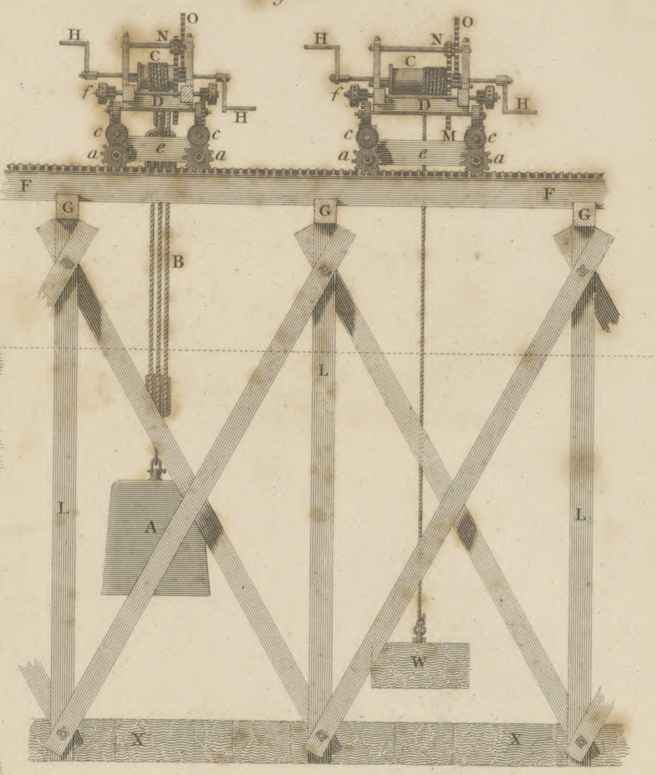

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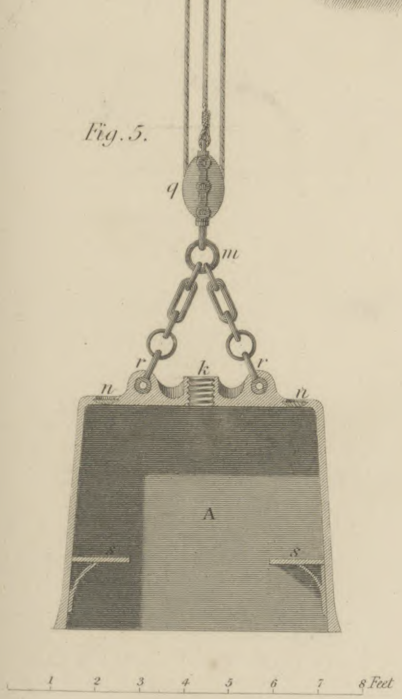

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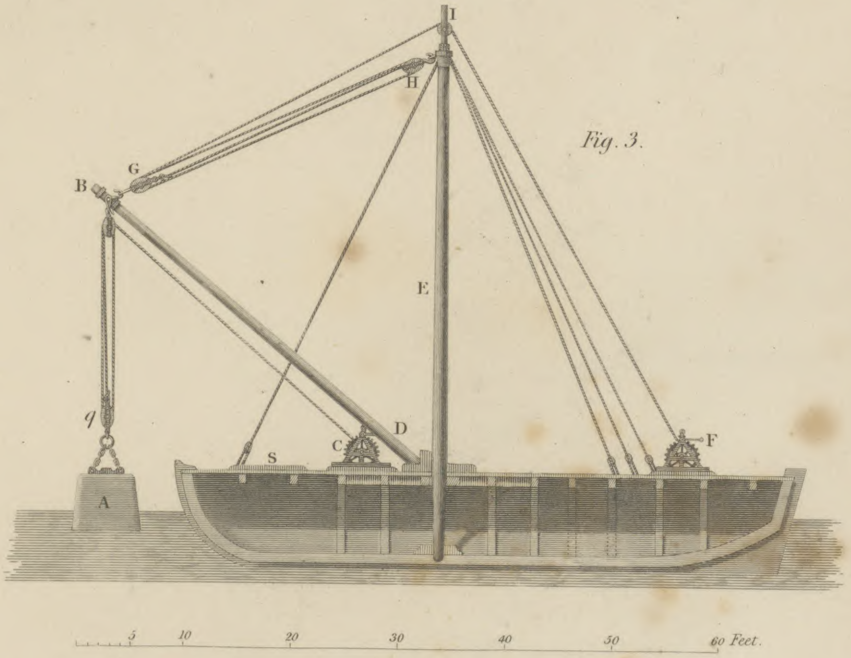

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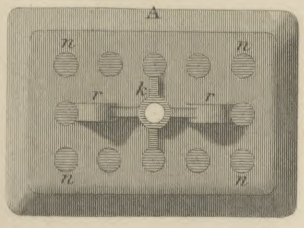

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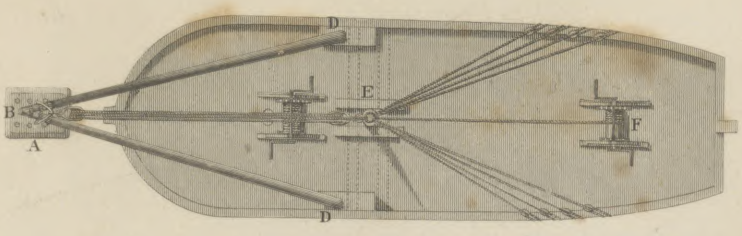

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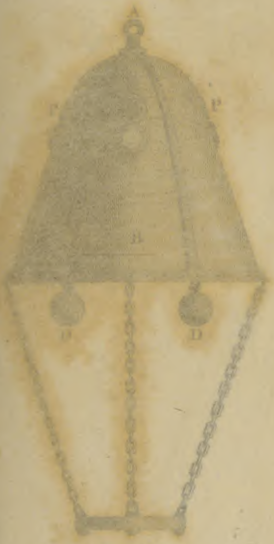
DIVING. PLATE CLXXXIX.

KLINGERT'S DIVING APPARATUS.

Fig. 6.

TRIEWALD'S DIVING BELL.



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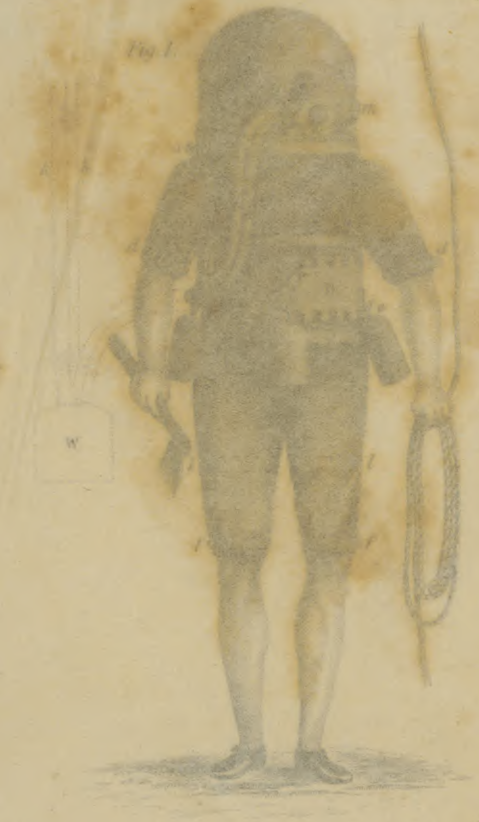


ROWE'S DIVING CHEST. Fig. 4.

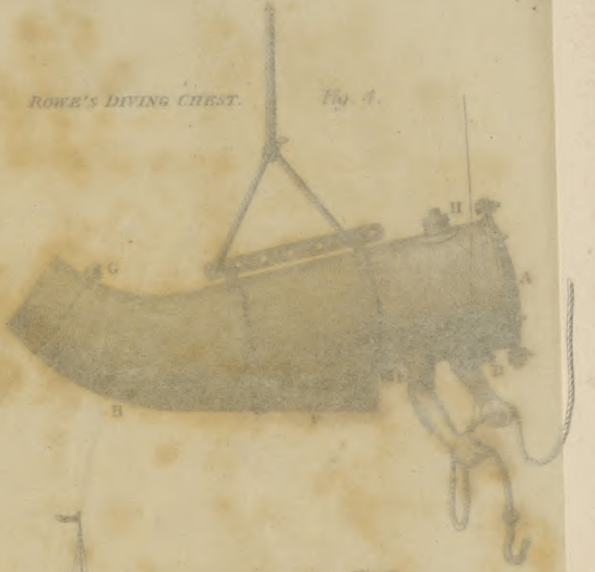
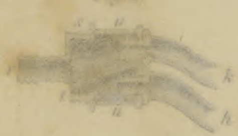


Fig. 2.



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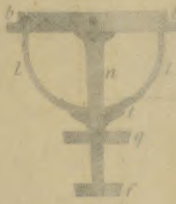
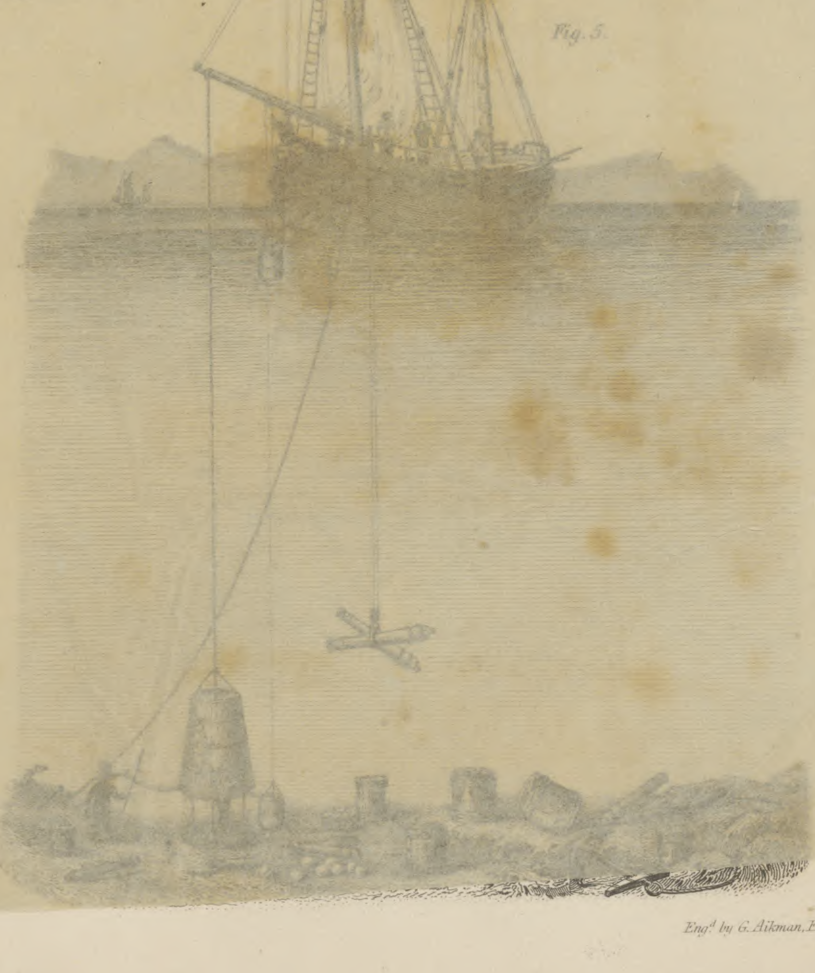
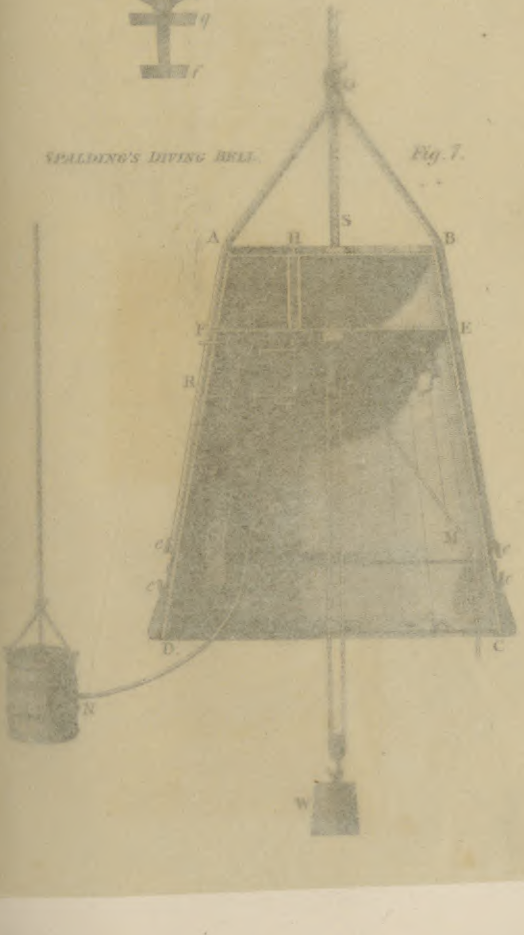


HALLEY'S DIVING BELL.

Fig. 5.



SPALDING'S DIVING BELL. Fig. 7.



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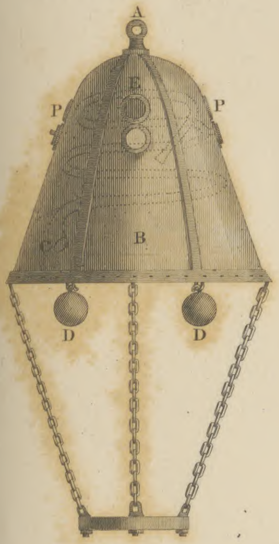
DIVING.

PLATE CLXXXIX.

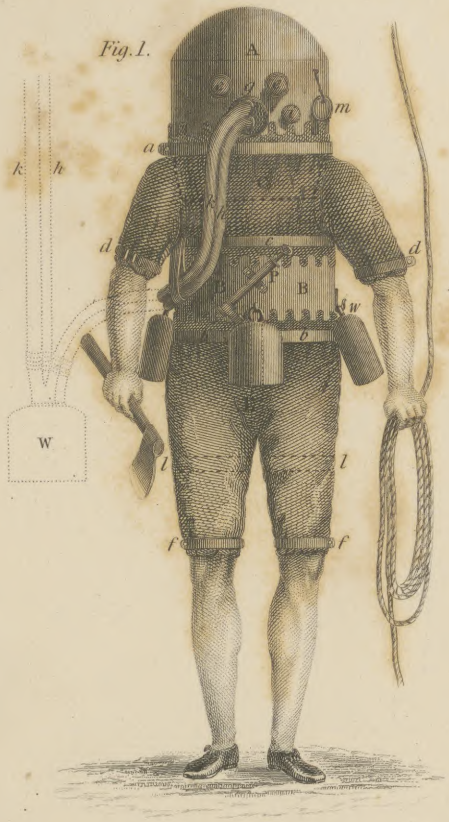
Fig. 6.

TRIEWALD'S DIVING BELL.



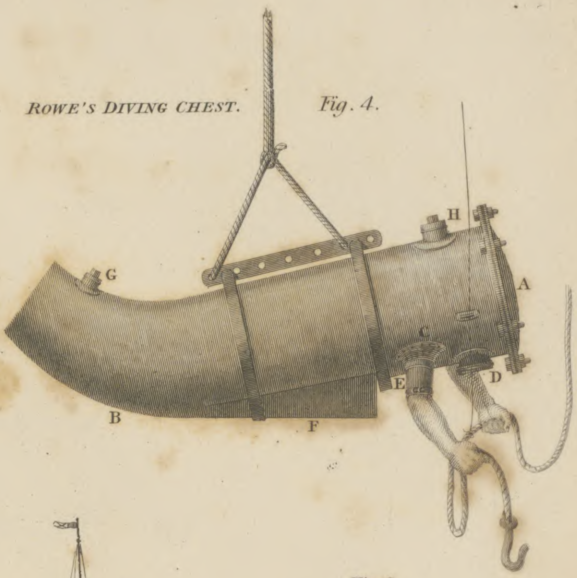
KLINGERT'S DIVING APPARATUS.

Fig. 1.



ROWE'S DIVING CHEST.

Fig. 4.



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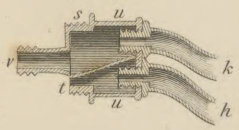

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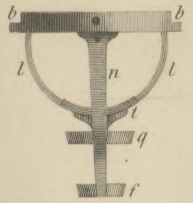
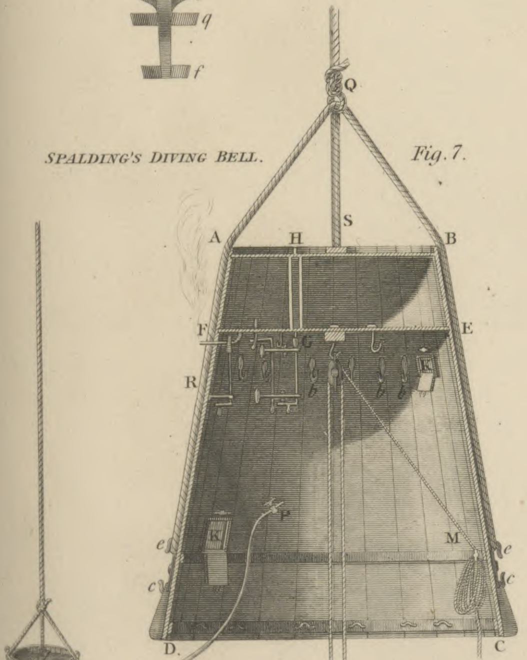


SPALDING'S DIVING BELL.

Fig. 7.



HALLEY'S DIVING BELL.

Fig. 5.

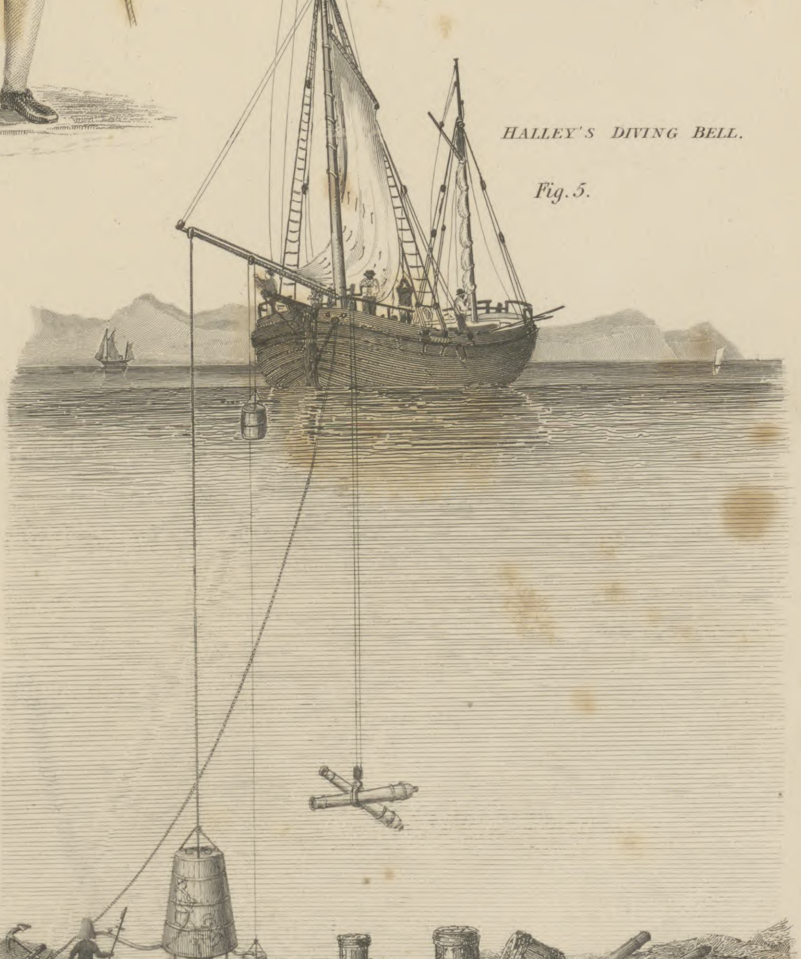


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Fig. 1.

Fig. 2.

Fig. 3.

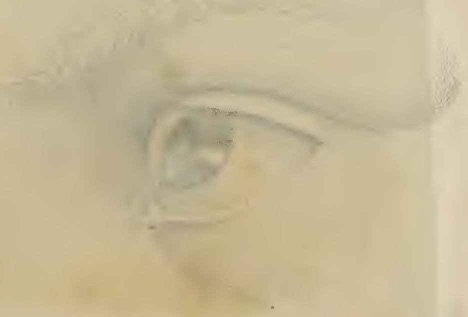


Fig. 4.

Fig. 5.

Fig. 6.

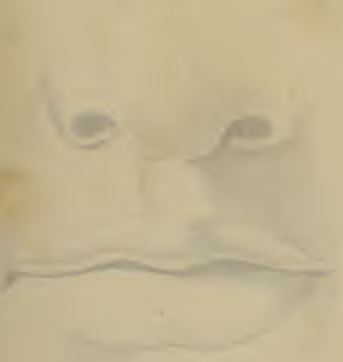
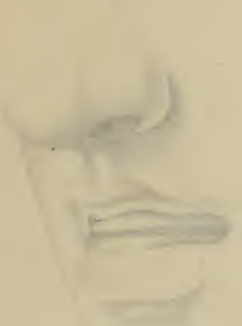


Fig. 7.

Fig. 8.



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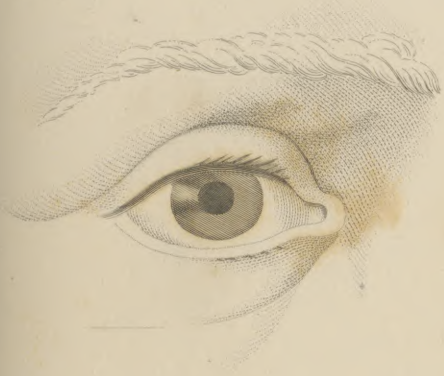

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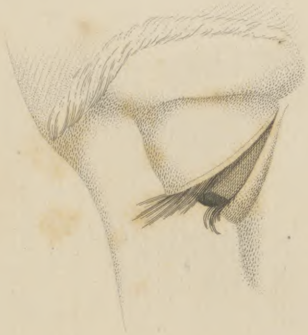

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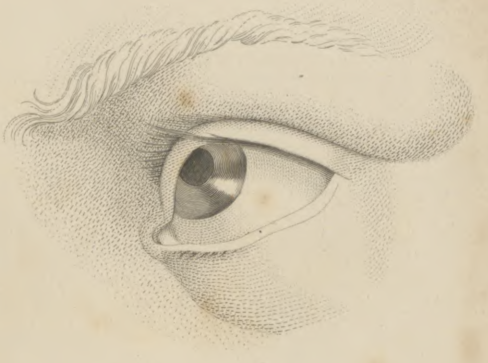

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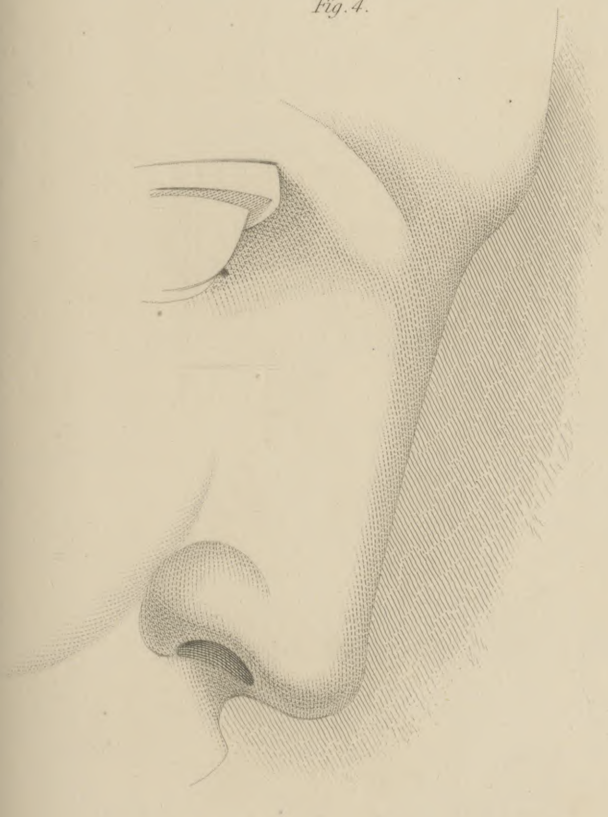

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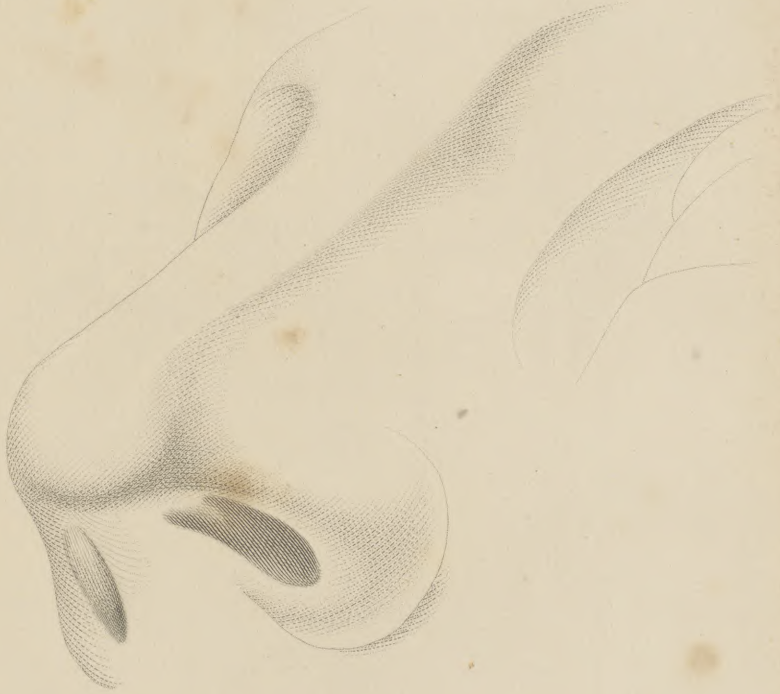

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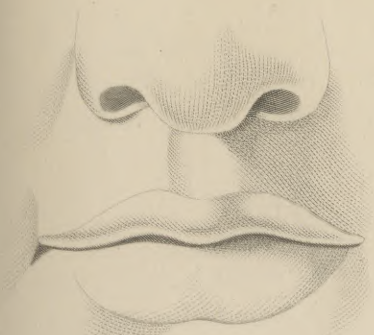

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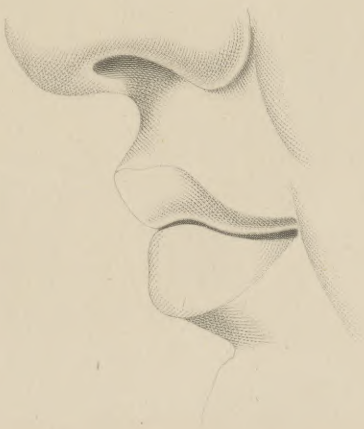

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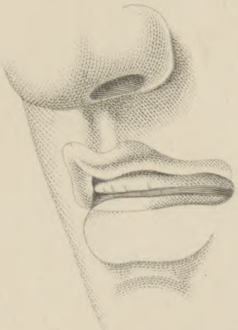

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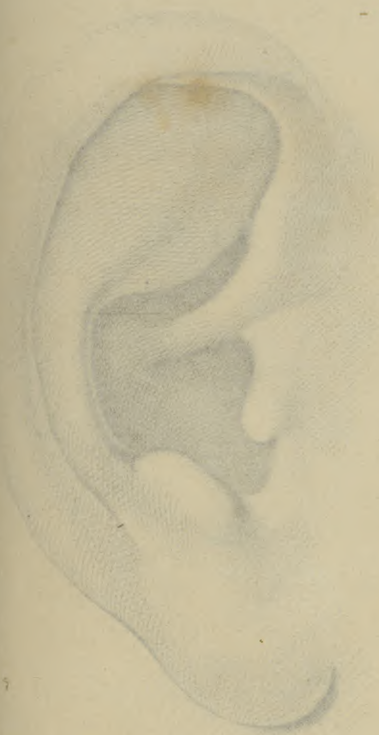

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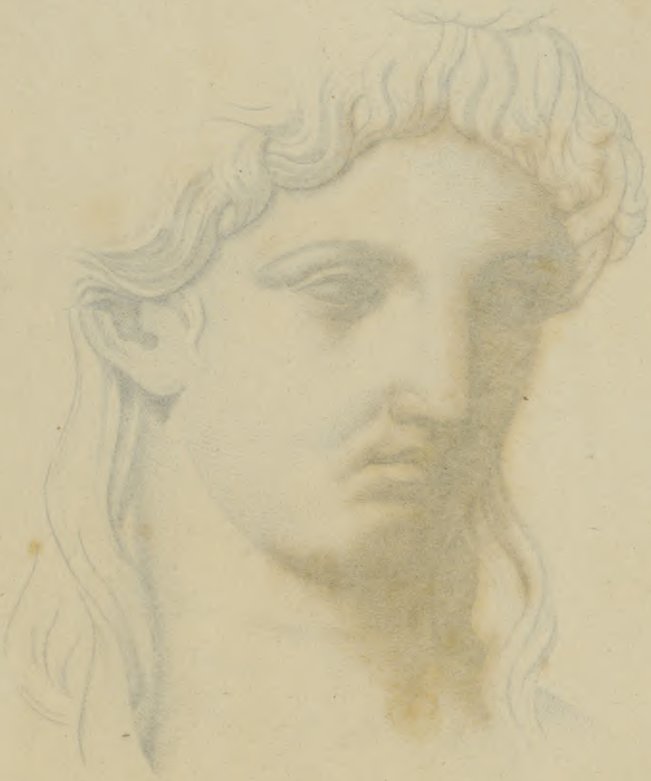

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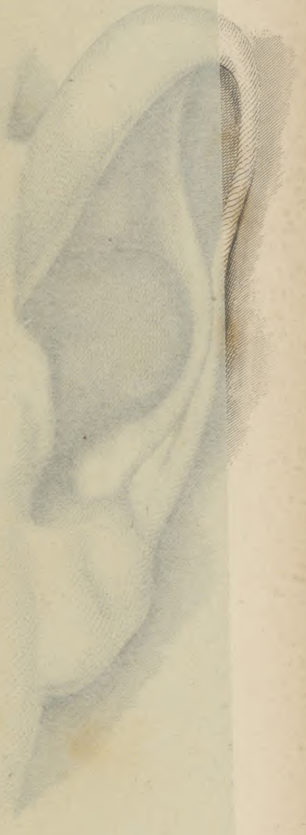

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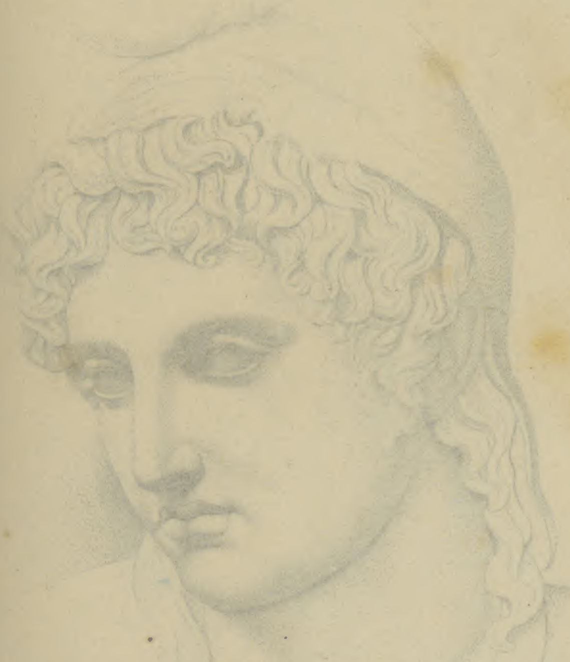

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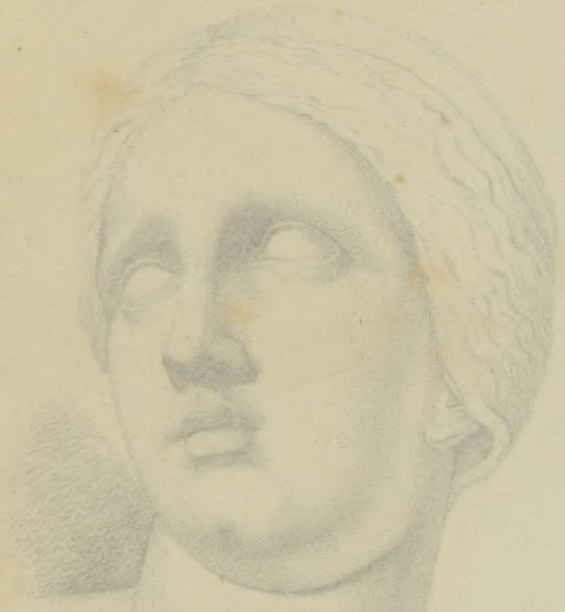

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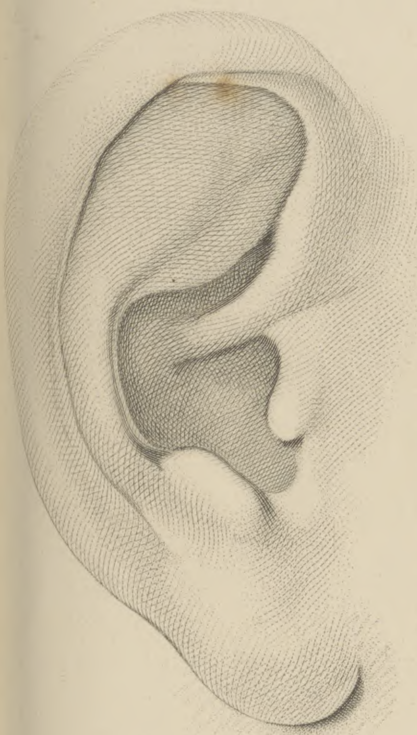

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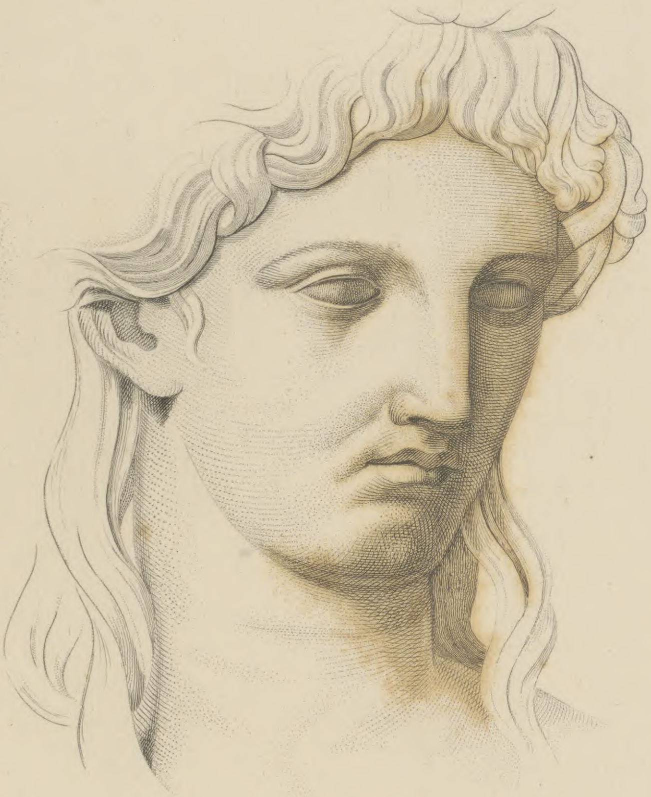

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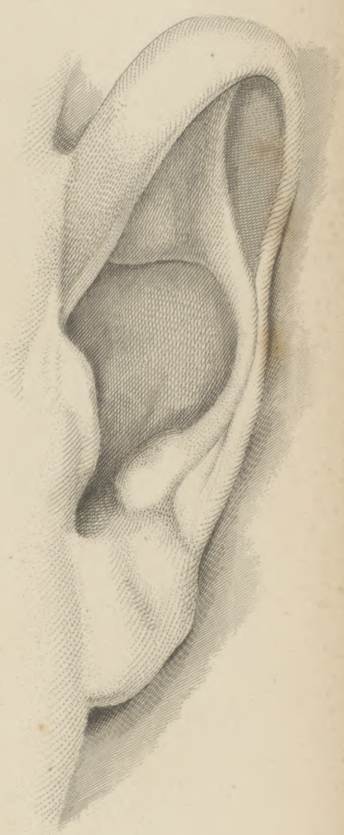

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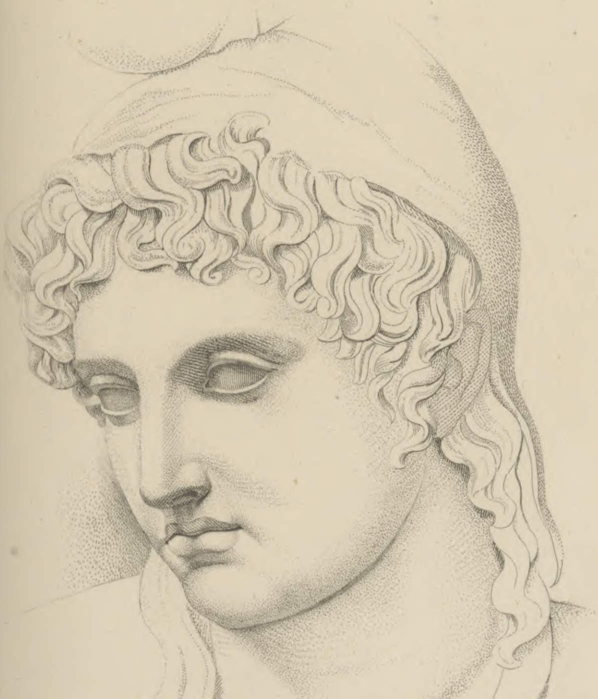

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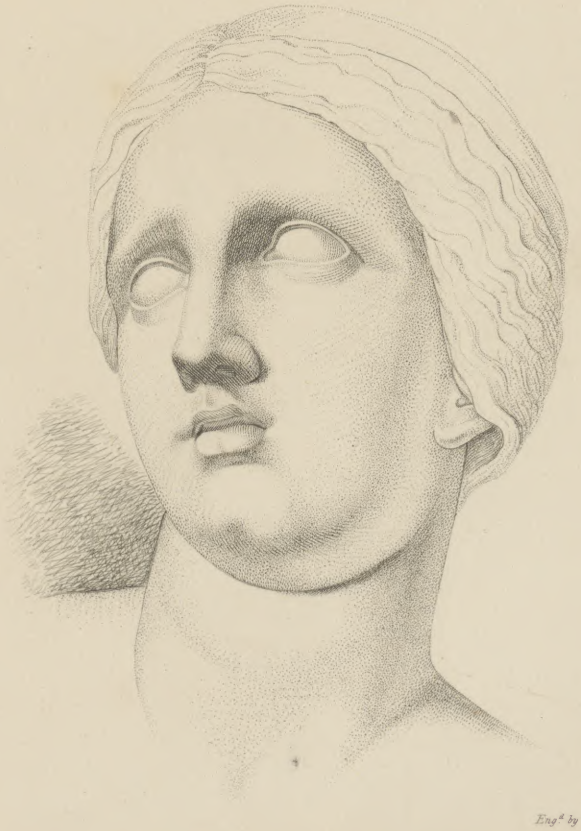

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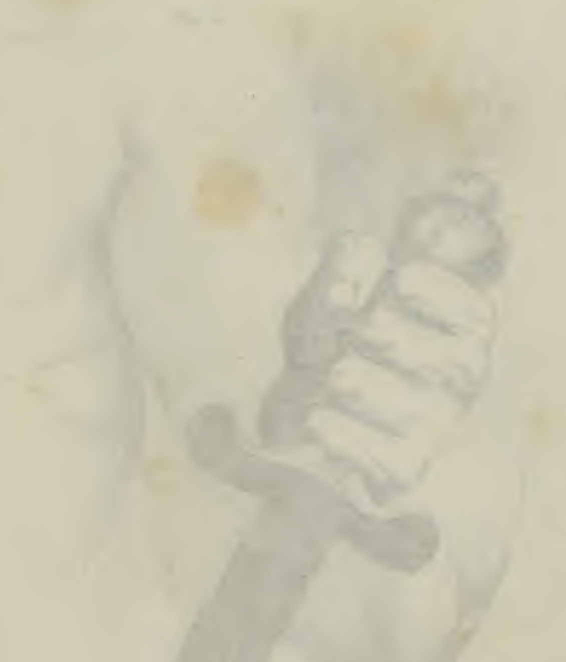

Eng^d by G. Aikman Edin^r

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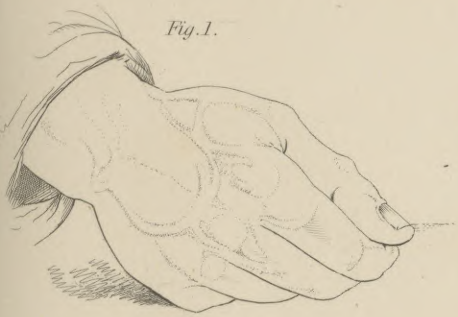

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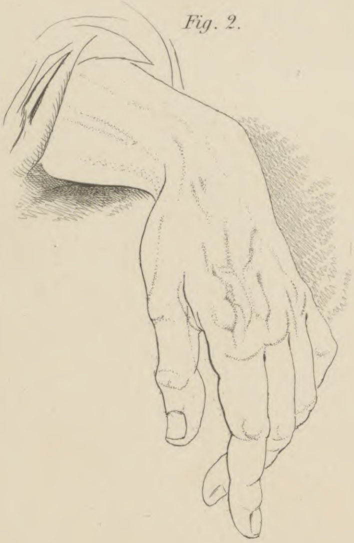

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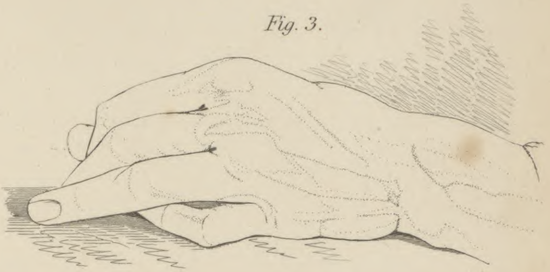

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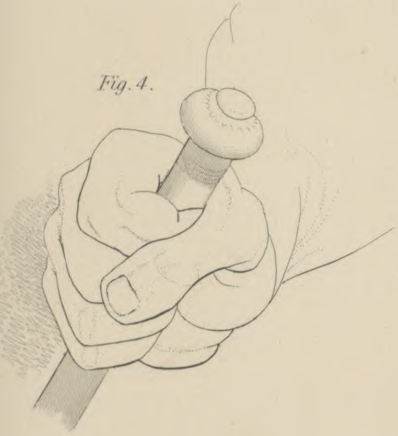

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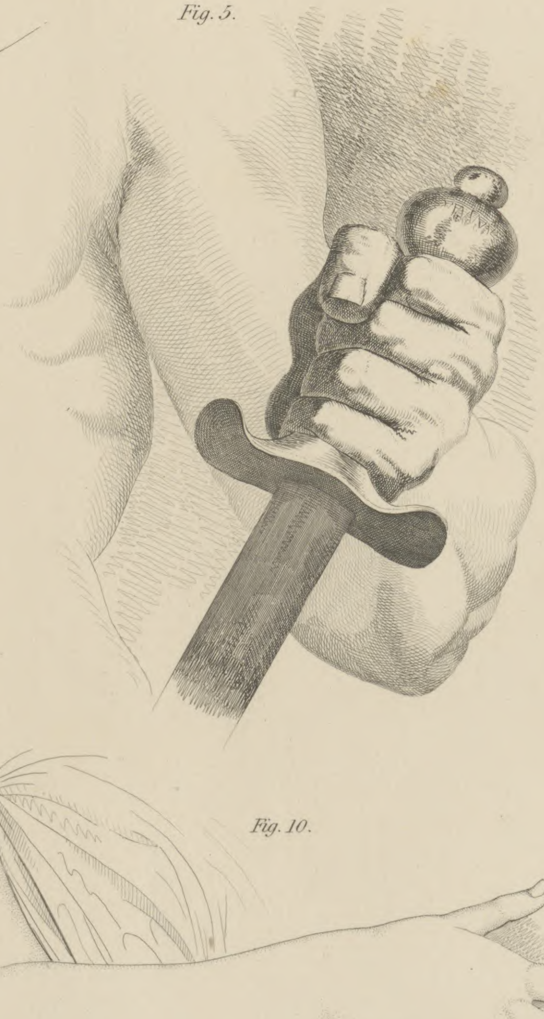

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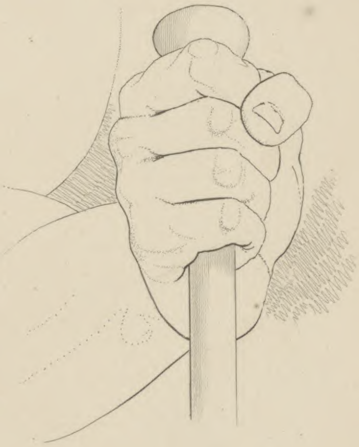

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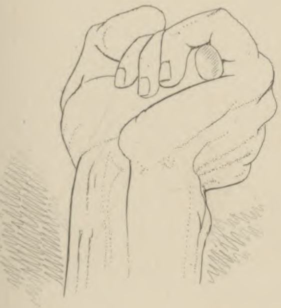

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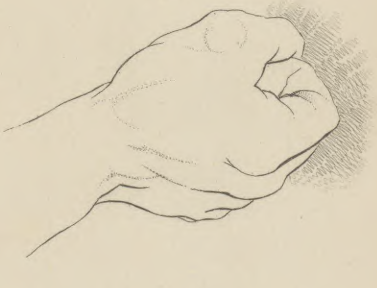

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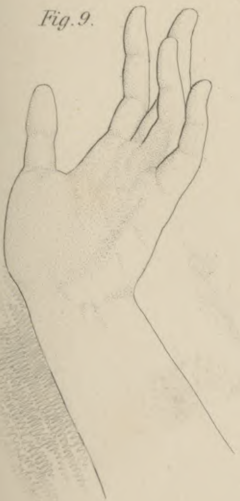

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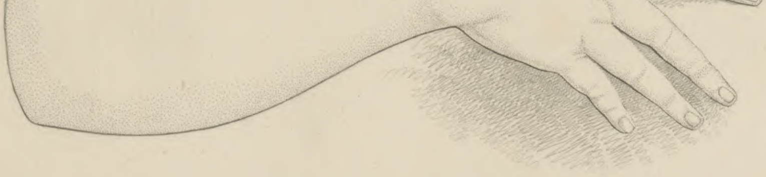

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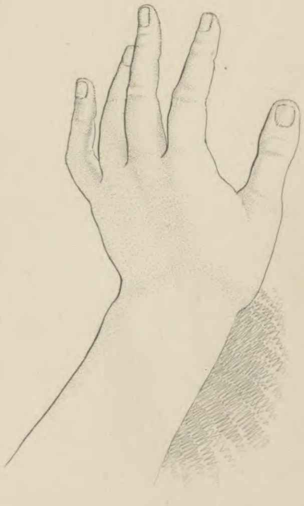

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DRAWING. PLATE CXCIII.

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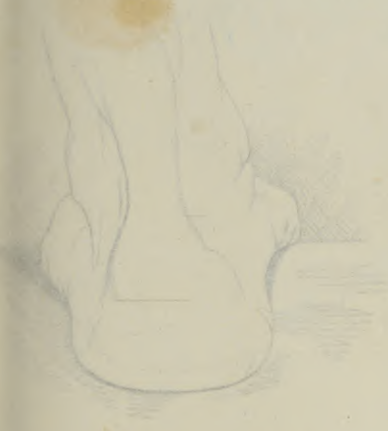

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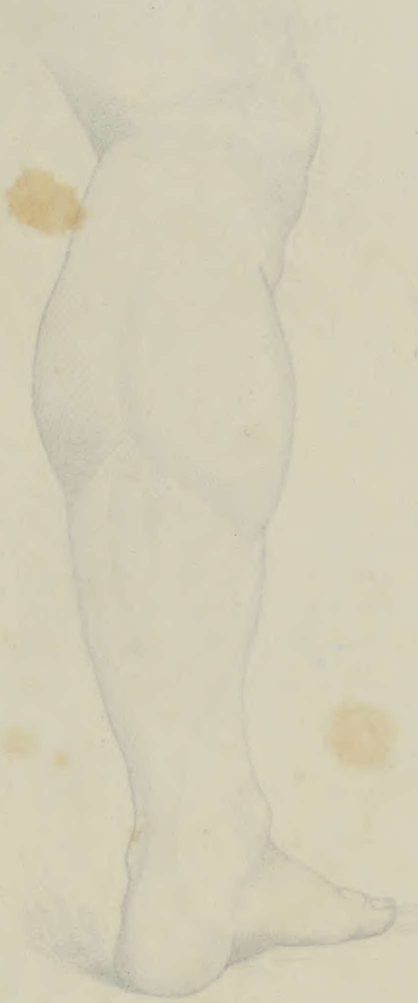

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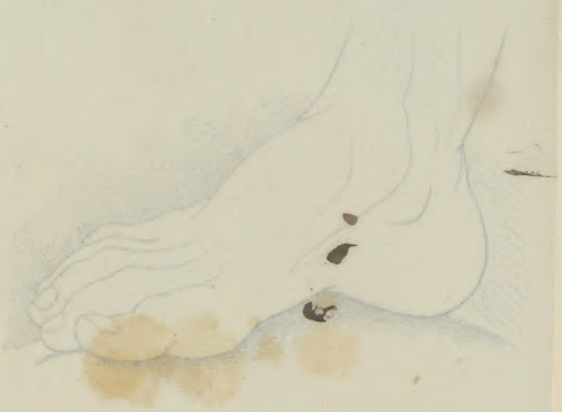

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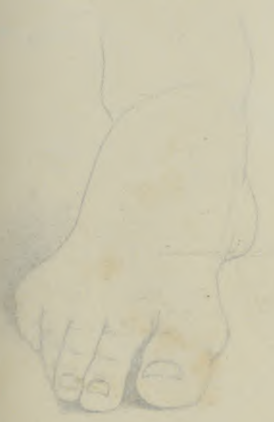

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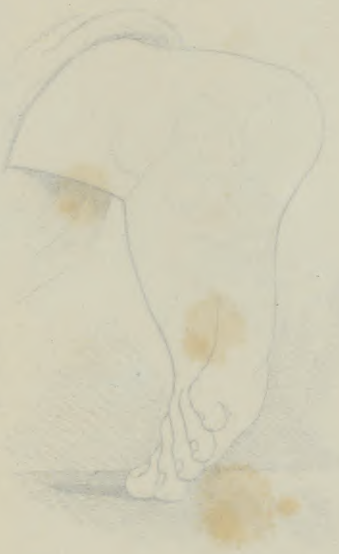

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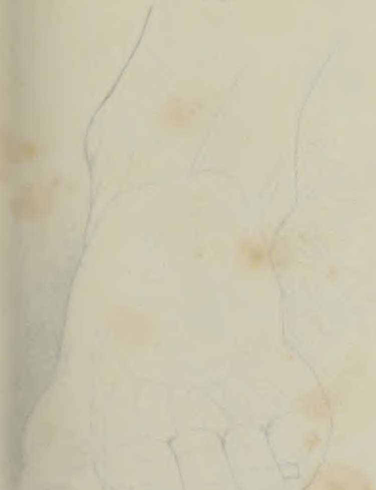
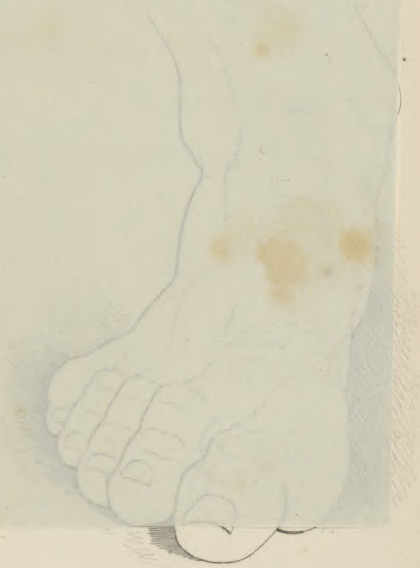


Fig. 7.

Fig. 8.



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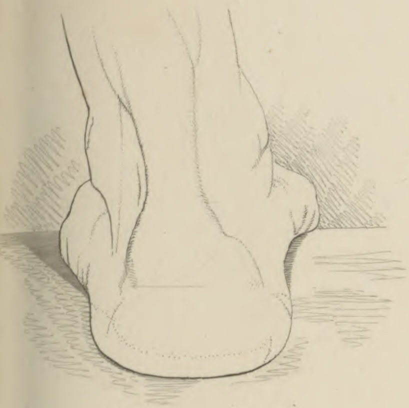

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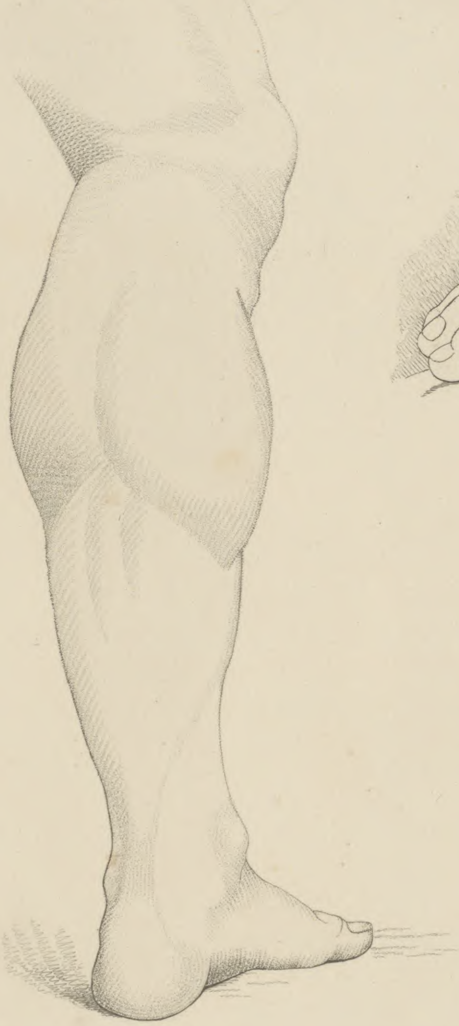

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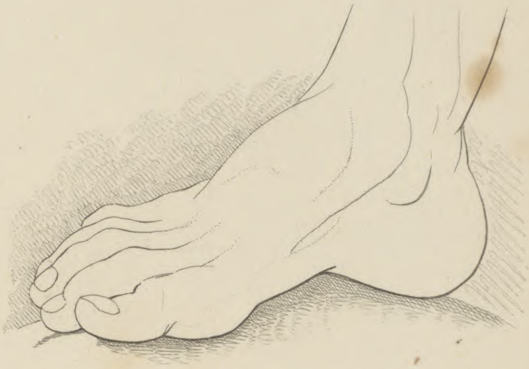

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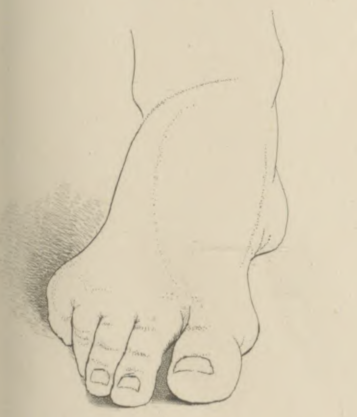

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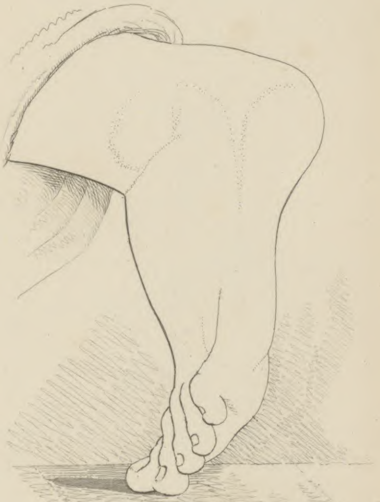

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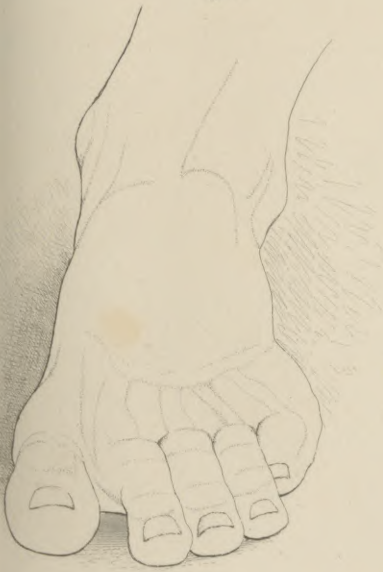

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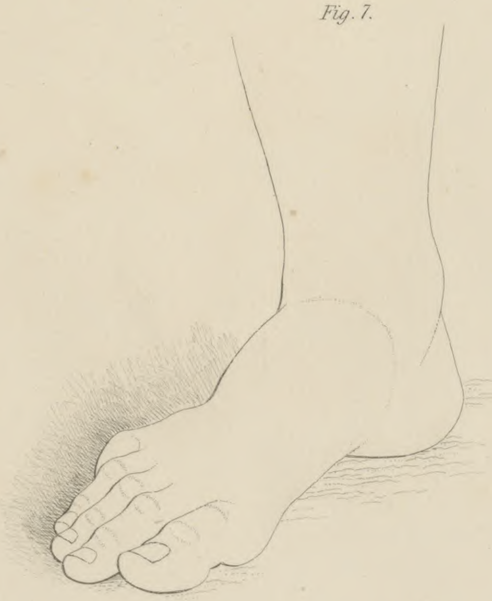

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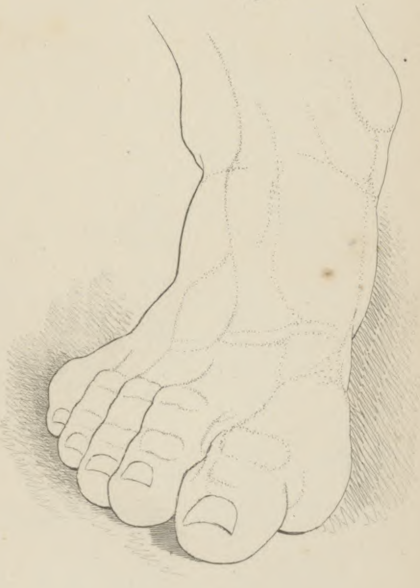

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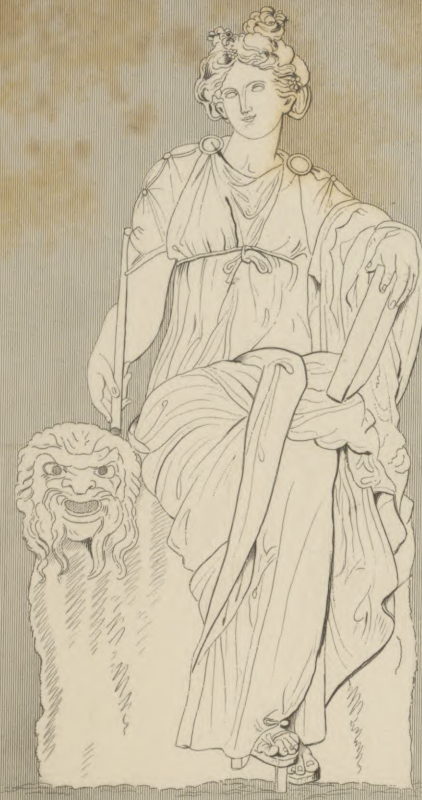
THALIA



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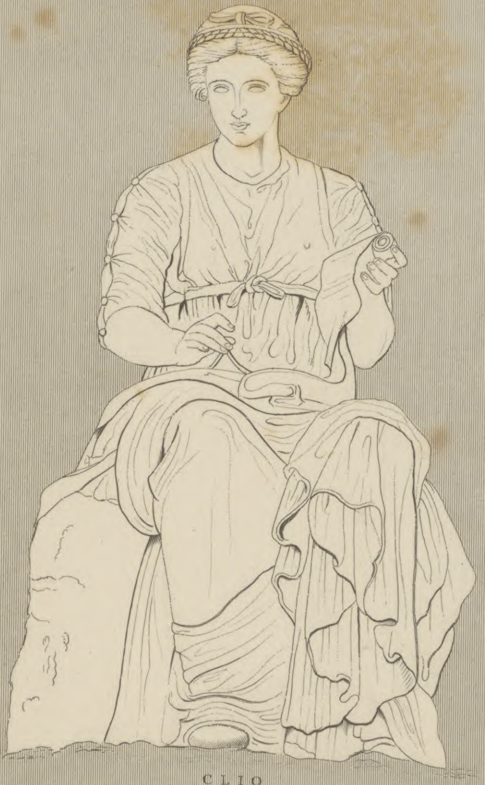
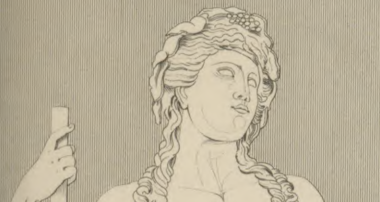
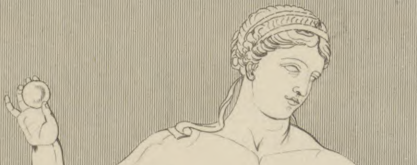


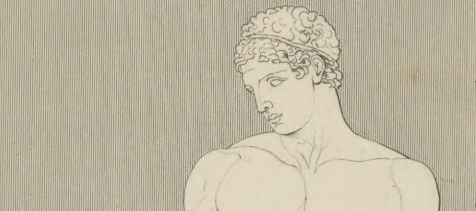
CLIO



BACCHUS



VENUS OF ARLES



DISCOBOLUS

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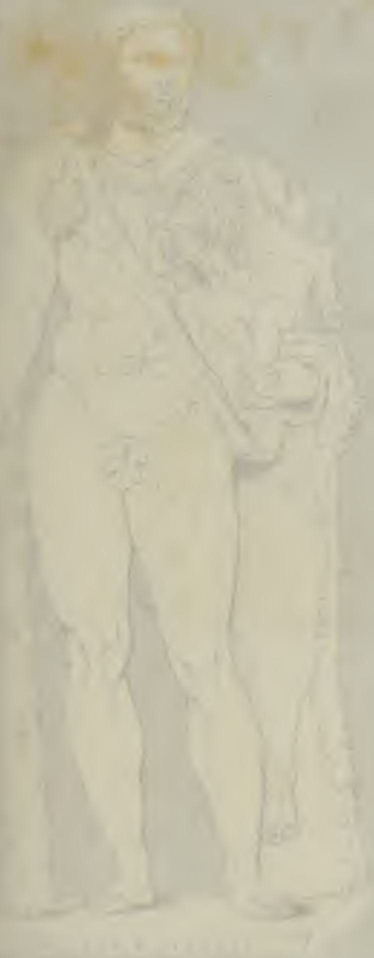
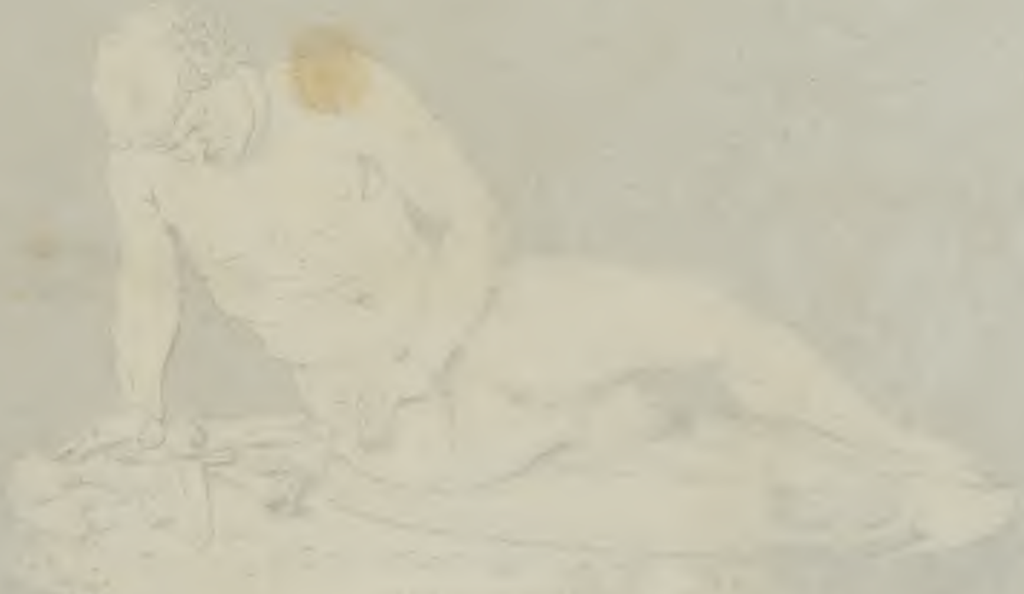
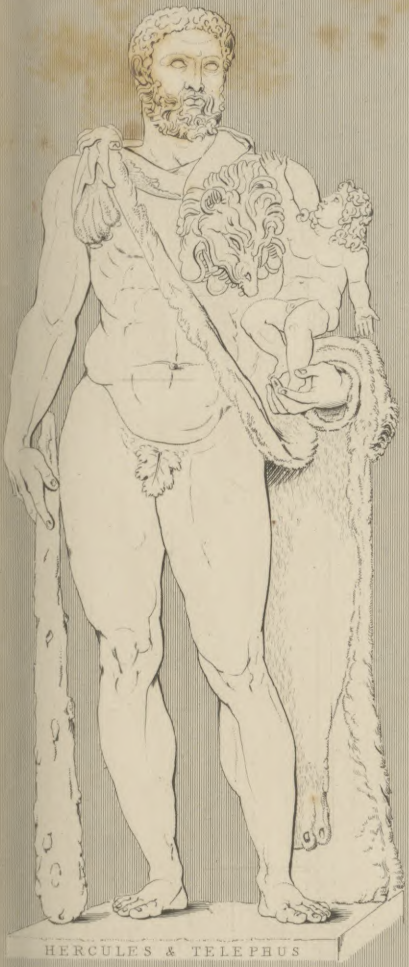
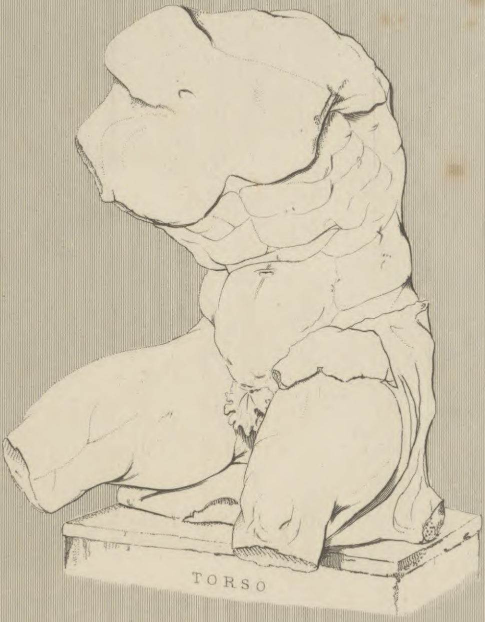


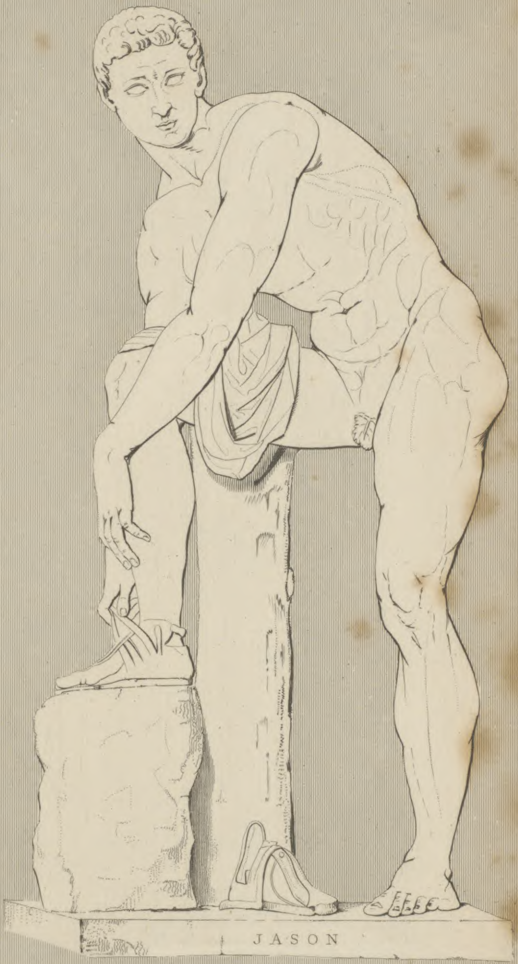




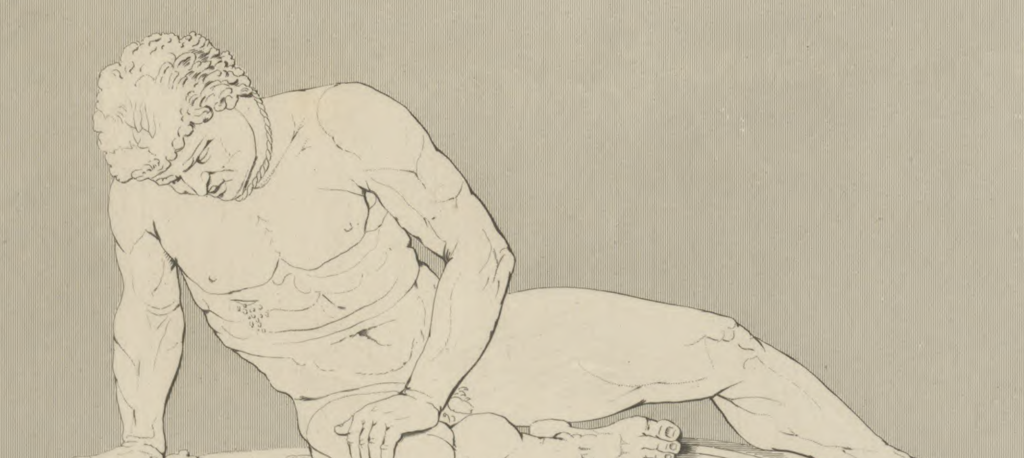
HERCULES & TELEPHUS



TORSO

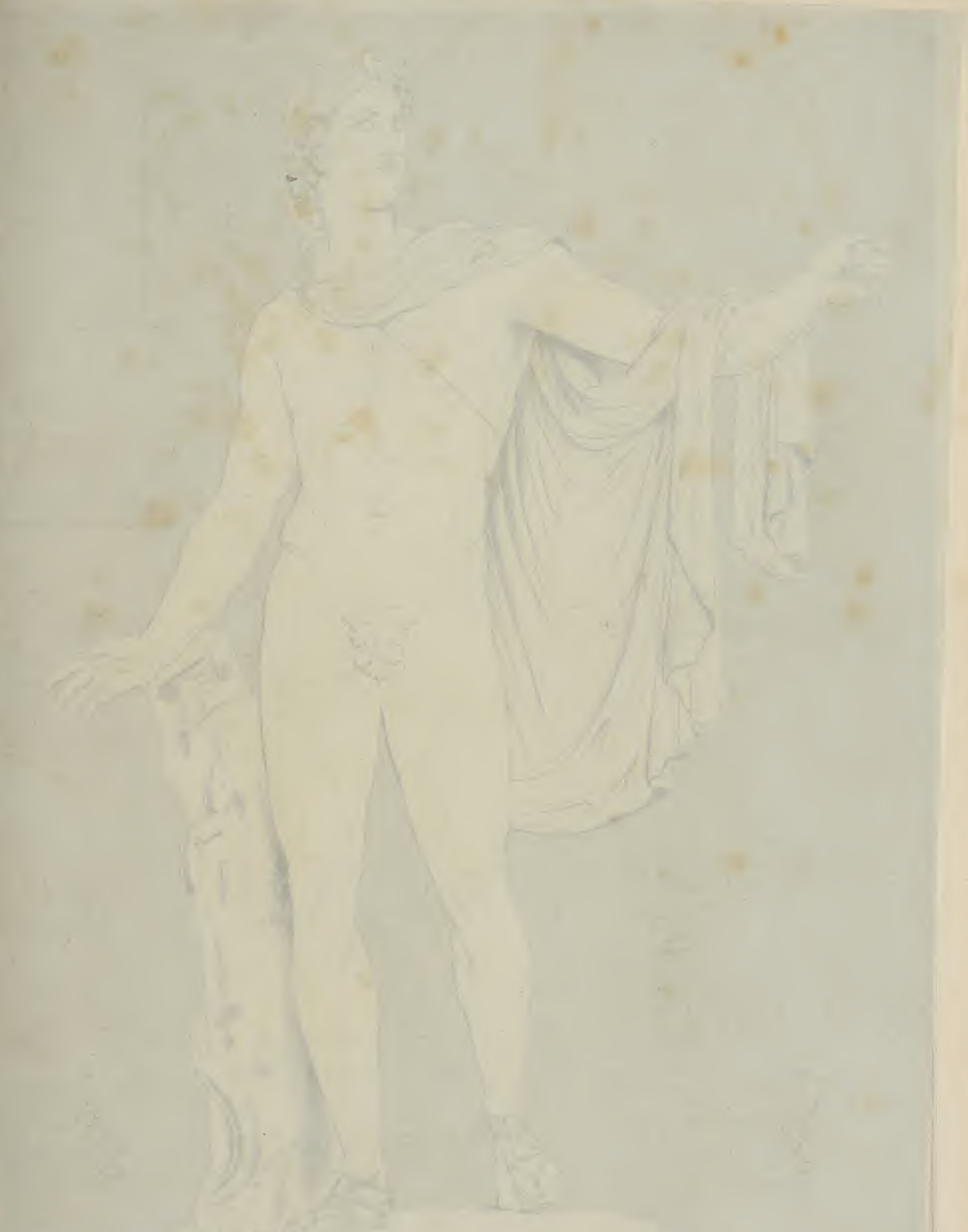


JASON

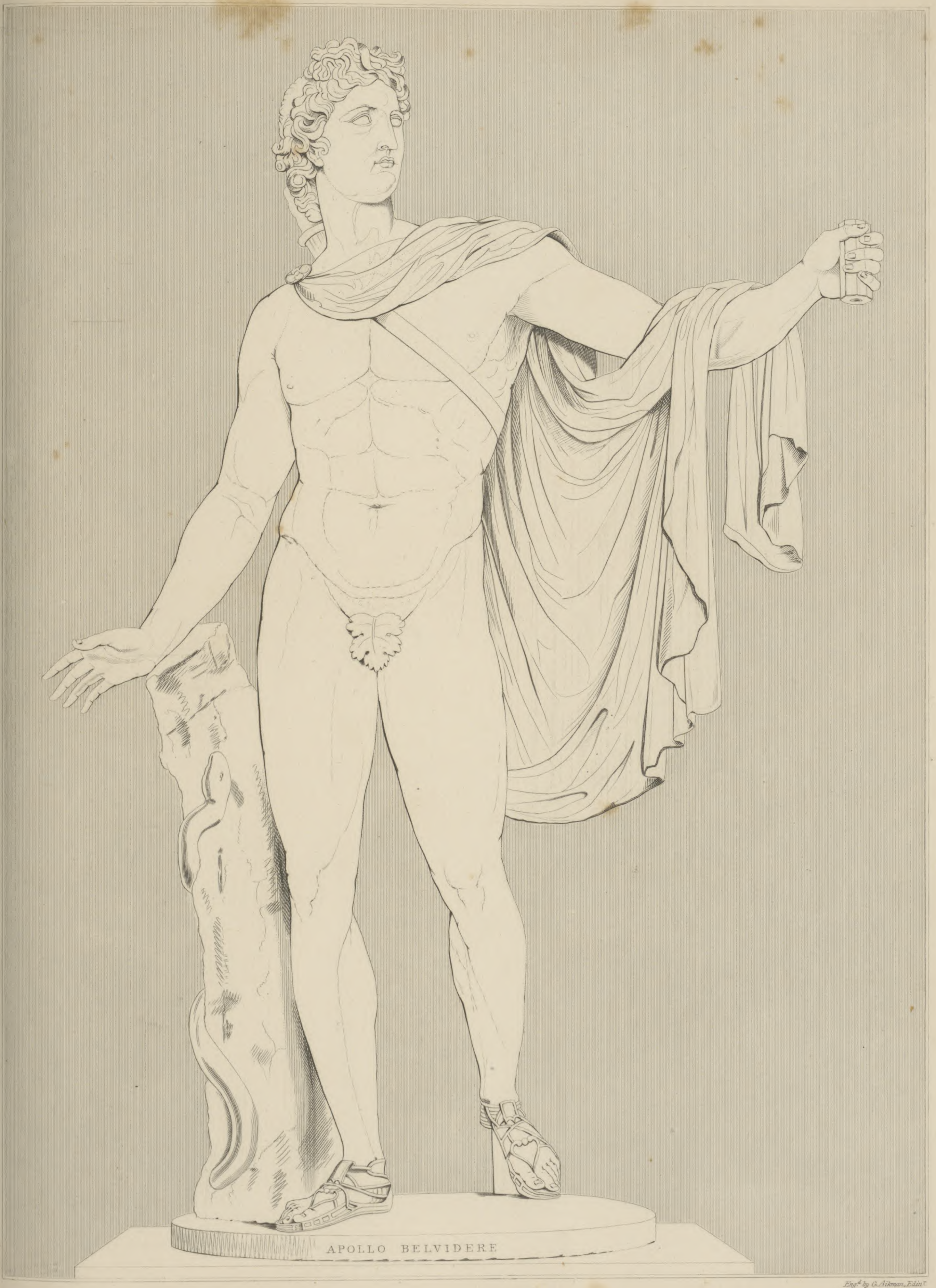


DYING GLADIATOR

Engd. by G. Aikman, Edinr.

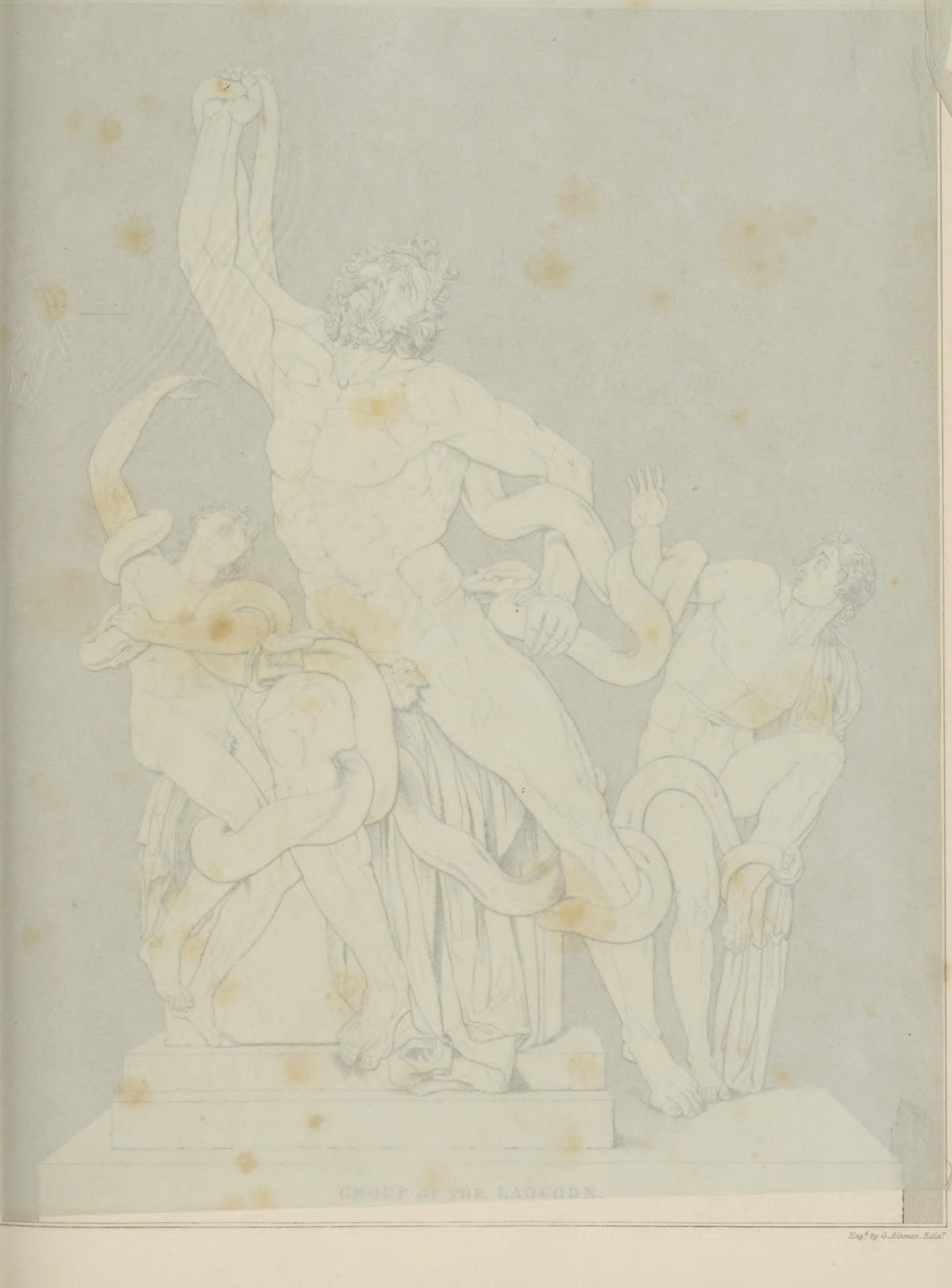


Eng.^d by G. Aikman, Edin.^r



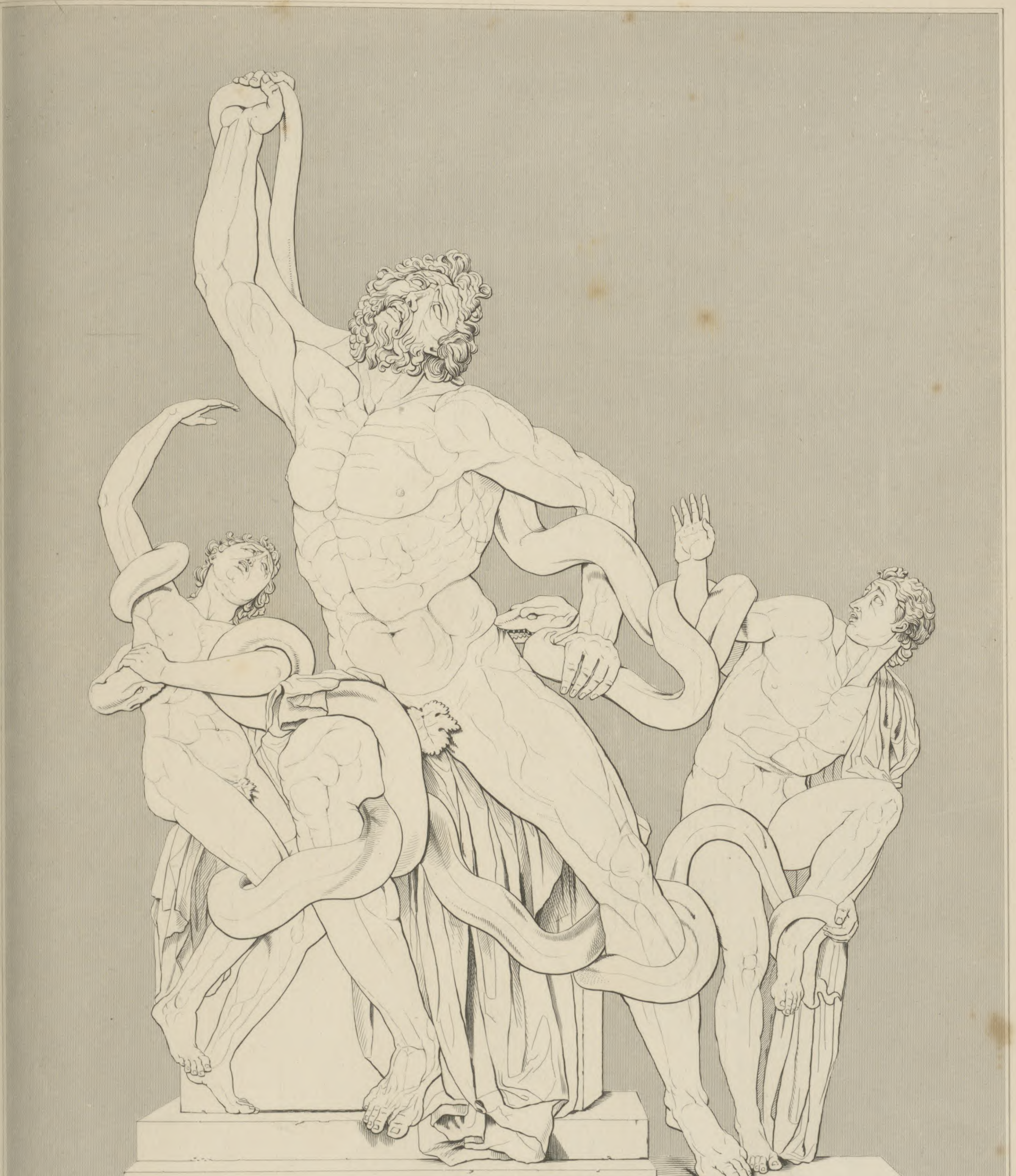
APOLLO BELVIDERE

Eng^{d} by G. Aikman, Edin^{r}



GROUP OF THE LAOCOON.

Engd by G. Aikman. Edinr

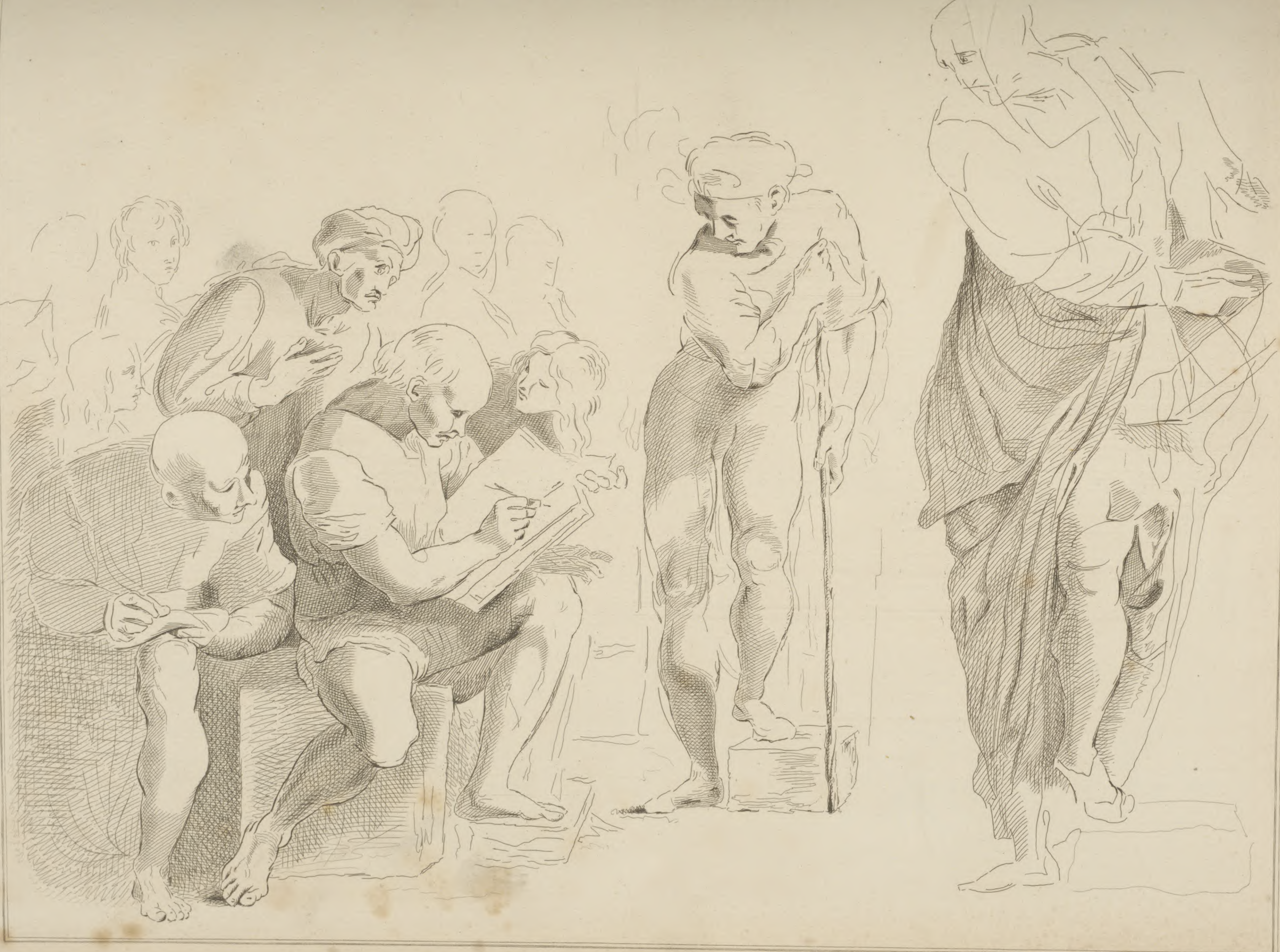


GROUP OF THE LAOCOON.

Engd by G. Aikman. Edinr

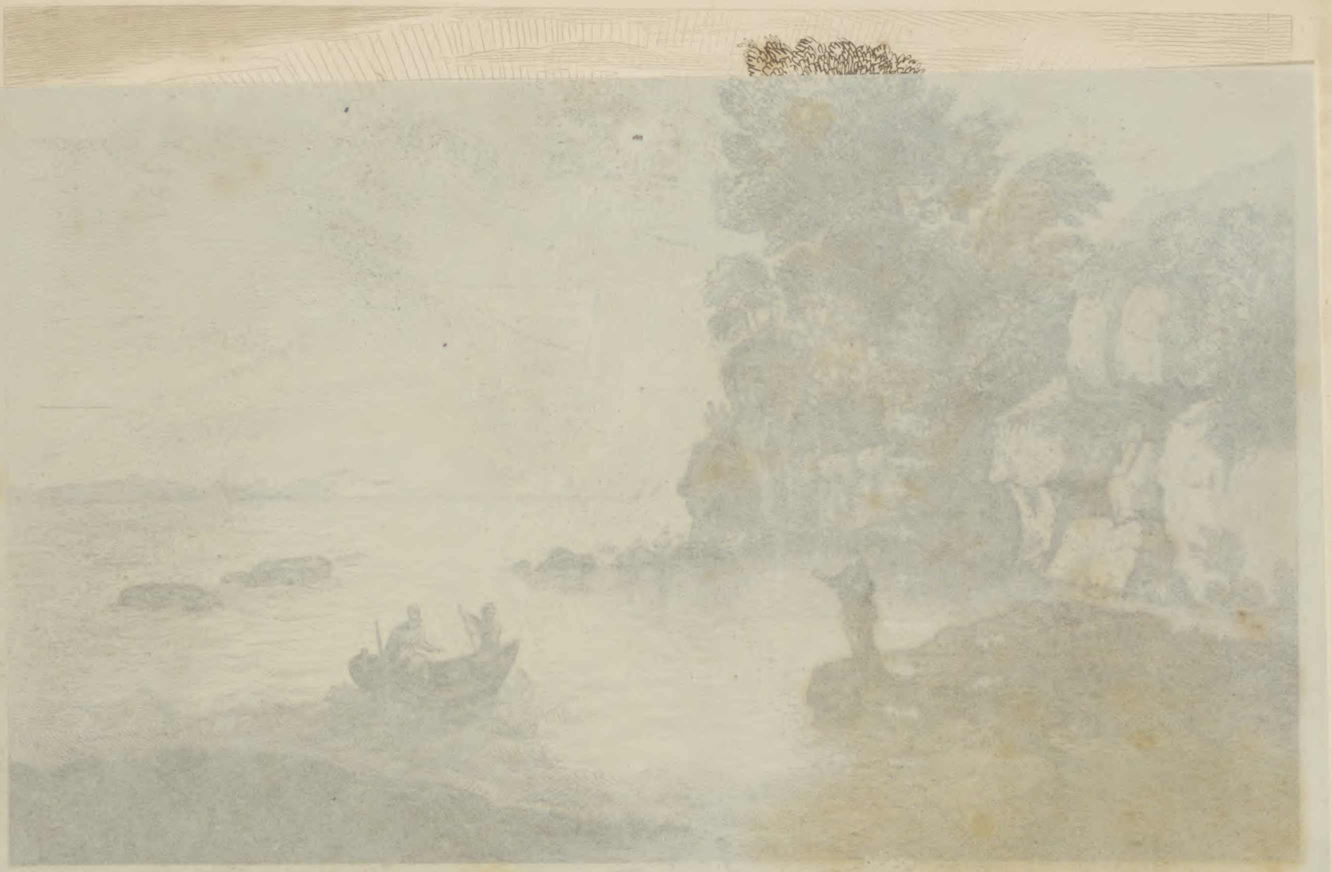
Engd. by G. Aikman, Edinr.

SPECIMEN OF SKETCHING BY RAPHAEL.

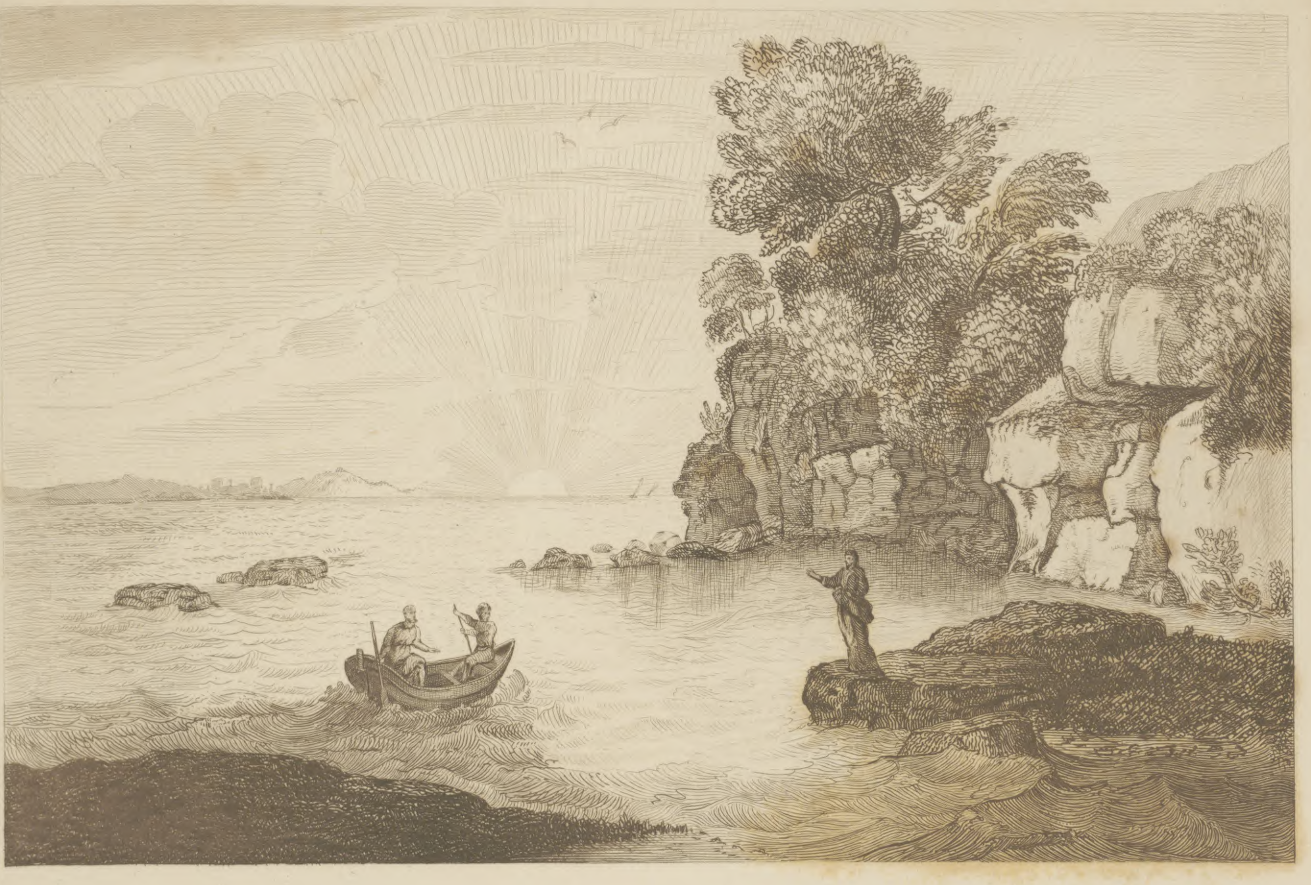


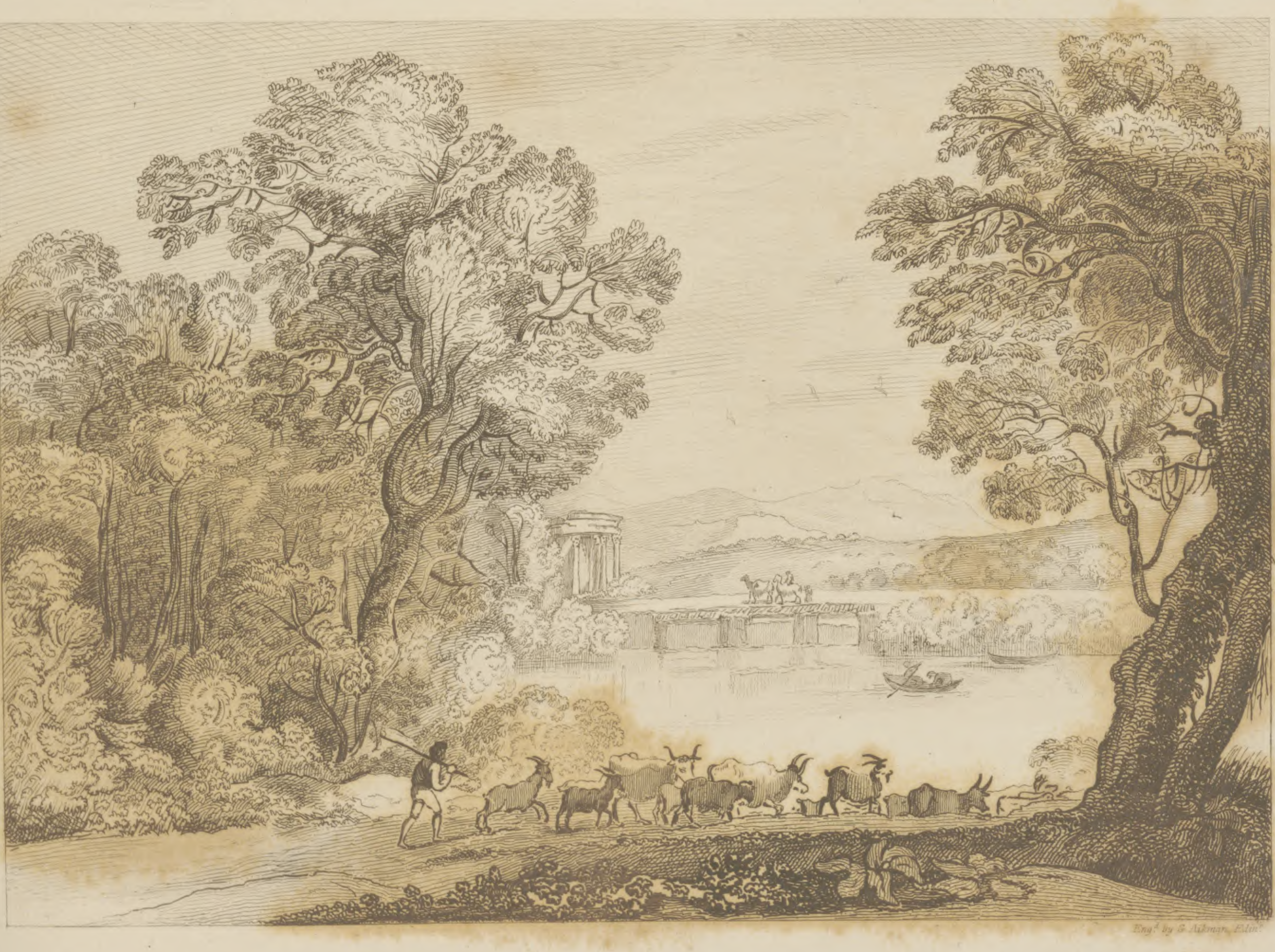
Engd by G. Aikman Edinr

SPECIMENS OF LANDSCAPE SKETCHING BY CLAUDE.

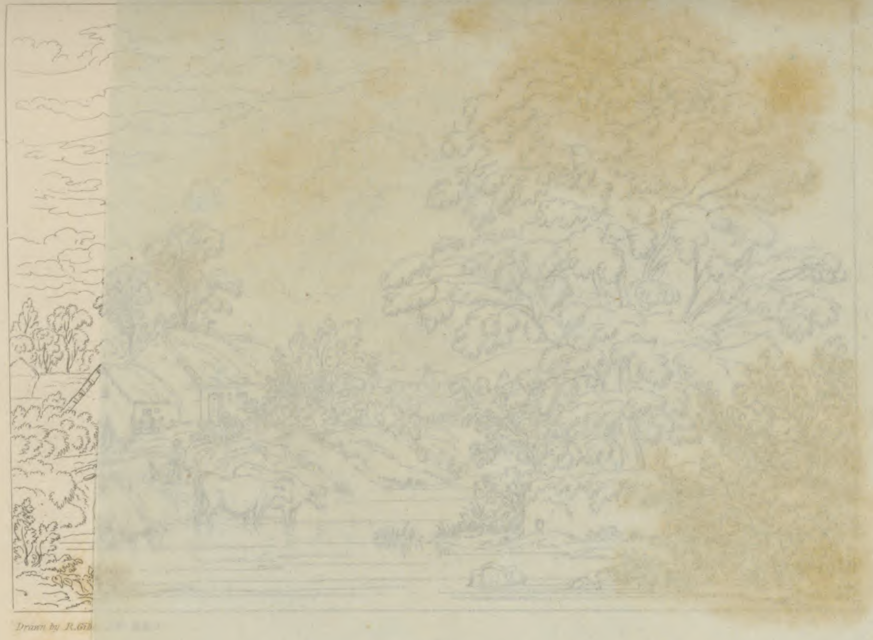


SPECIMENS OF LANDSCAPE SKETCHING BY CLAUDE.





Eng^d by G. Aikman, Edin^r



Drawn by R.Gib

Outline

Fig. 3

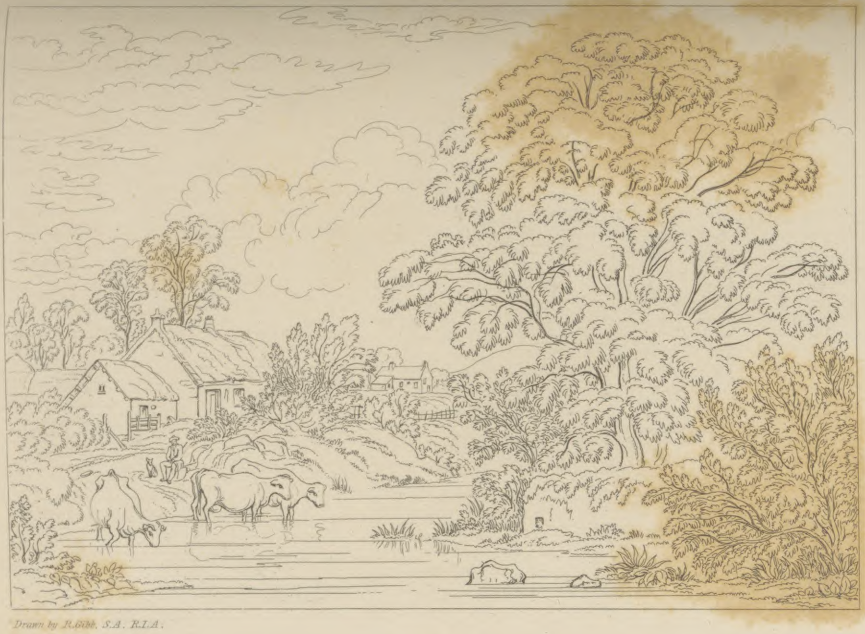
First Progression.

Fig. 4.

Second Progression.

Finished Landscape.

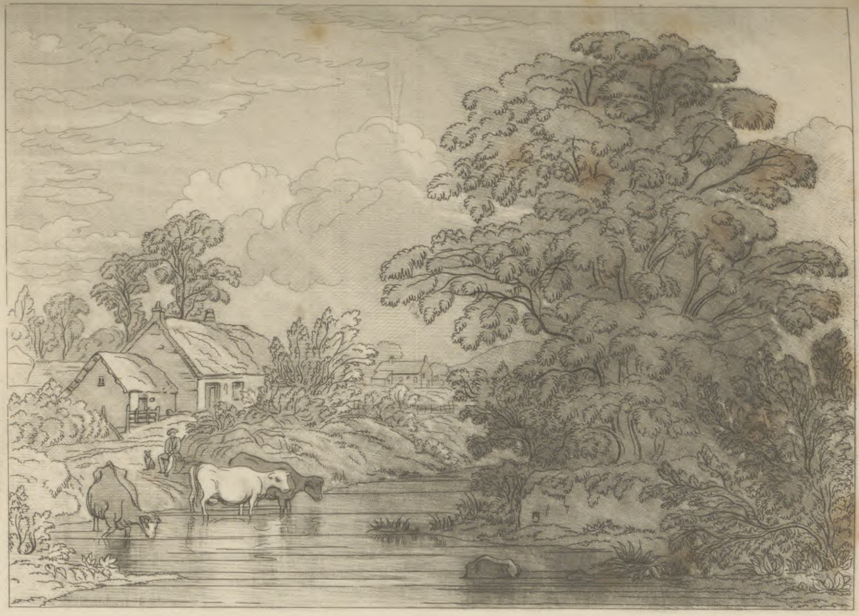
Fig. 1.



Drawn by R. Gibb, S.A. R.I.A.

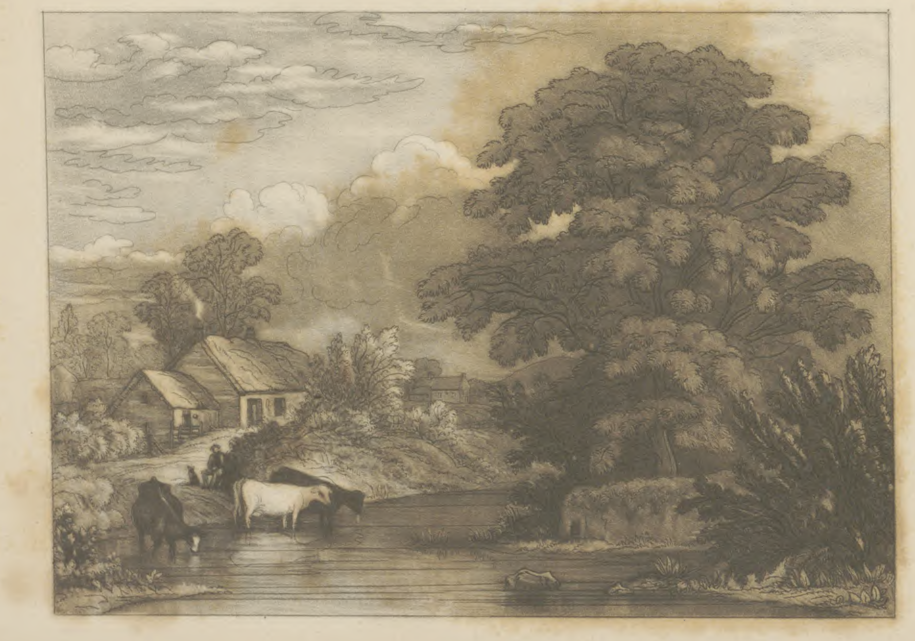
Outline.

Fig. 2.



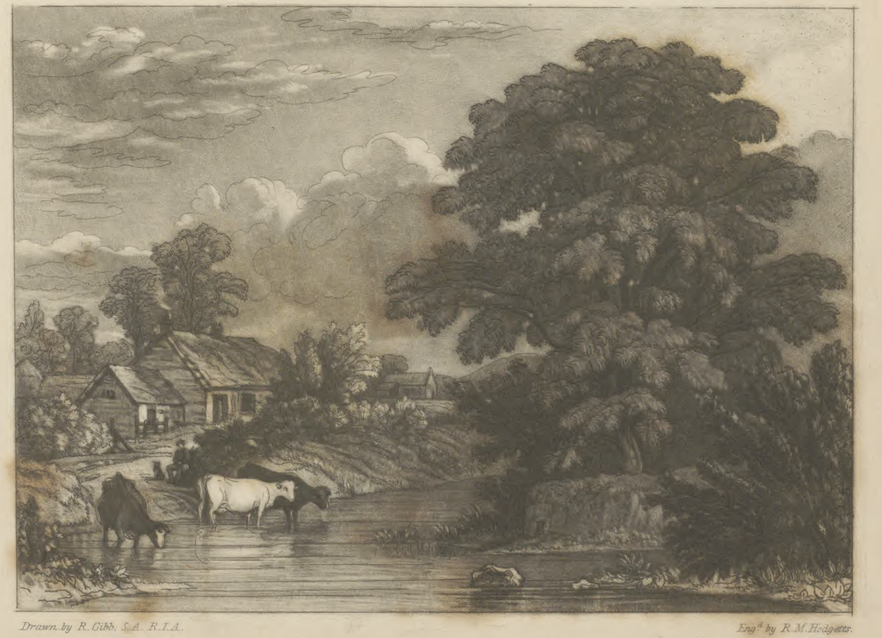
First Progression.

Fig. 3.



Second Progression.

Fig. 4.



Drawn by R. Gibb. S.A. R.I.A.

Engd by R.M. Hodgetts.

Finished Landscape.

DIAMOND.

PLATE CCII.

DIAMOND.

Fig. 2.

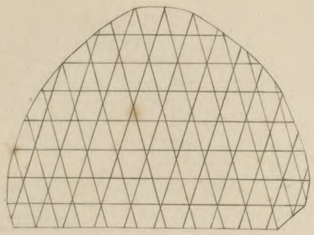


Fig. 1.

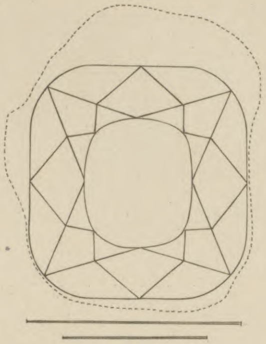


Fig. 3.

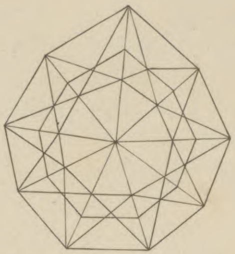


Fig. 4.

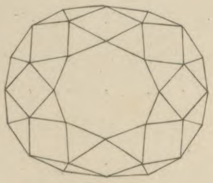


Fig. 6.

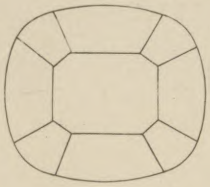


Fig. 8.

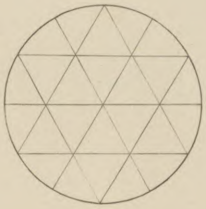


Fig. 10.

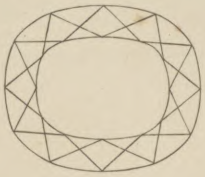


Fig. 5.

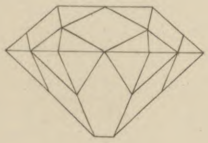


Fig. 7.

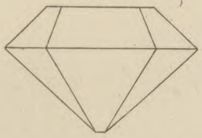
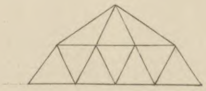


Fig. 9.



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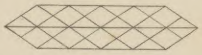

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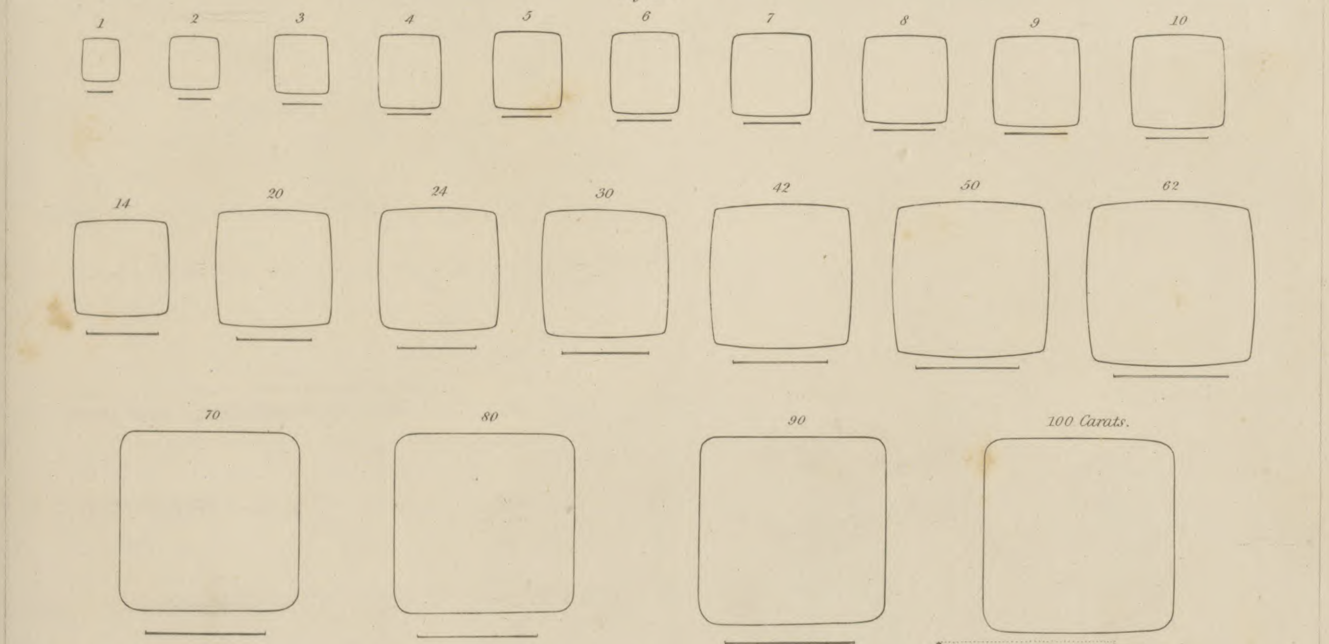

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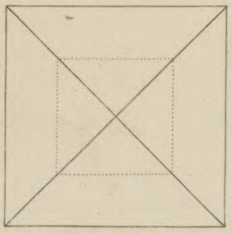
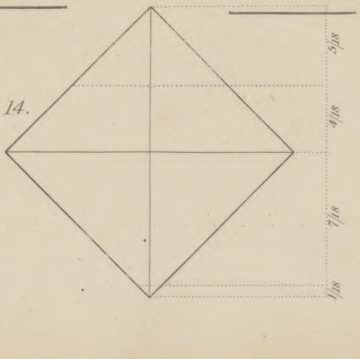
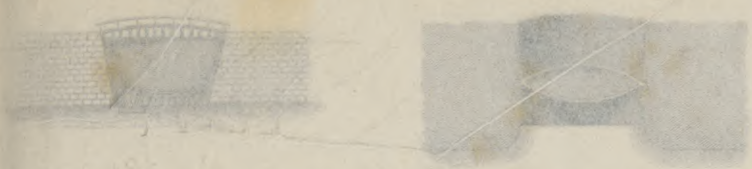


Fig. 14.



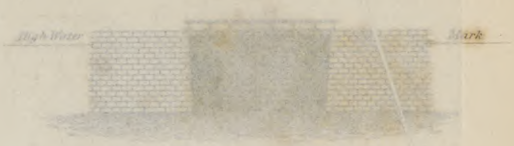
Engᵈ by G. Aikman, Edinʳ.

Fig. 1. Fig. 2.



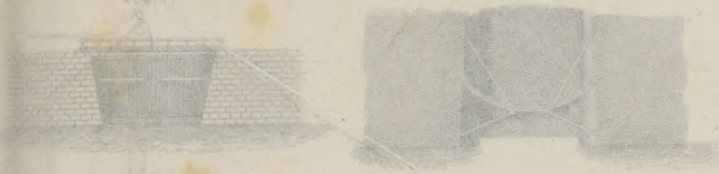
PLAN AND ELEVATION OF THE ENTRANCE TO THE DOCK WITH A FLOATING DAM.

Fig. 3.



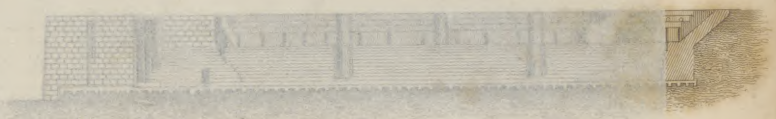
ELEVATION OF THE ENTRANCE TO THE DOCK WITH SWINGING GATES.

Fig. 5. Fig. 6.



PLAN AND ELEVATION OF THE ENTRANCE TO THE DOCK WITH WICKET GATES.

Fig. 4.



SECTIONAL ELEVATION OF THE DOCK.

Fig. 7.

PLAN OF A DOCK.

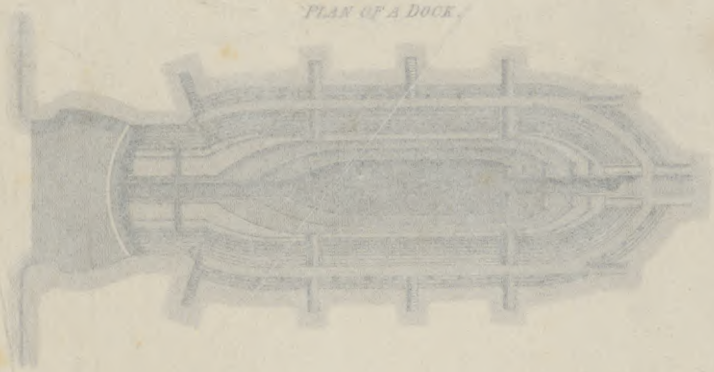


Fig. 8.

TRANSVERSE SECTION OF A ROOF OVER THE HEAD OF THE DOUBLE DOCK AT PLYMOUTH, ERECTED IN 1817, DESIGNED BY SIR R. SEPPINGS, SURVEYOR OF THE NAVY.

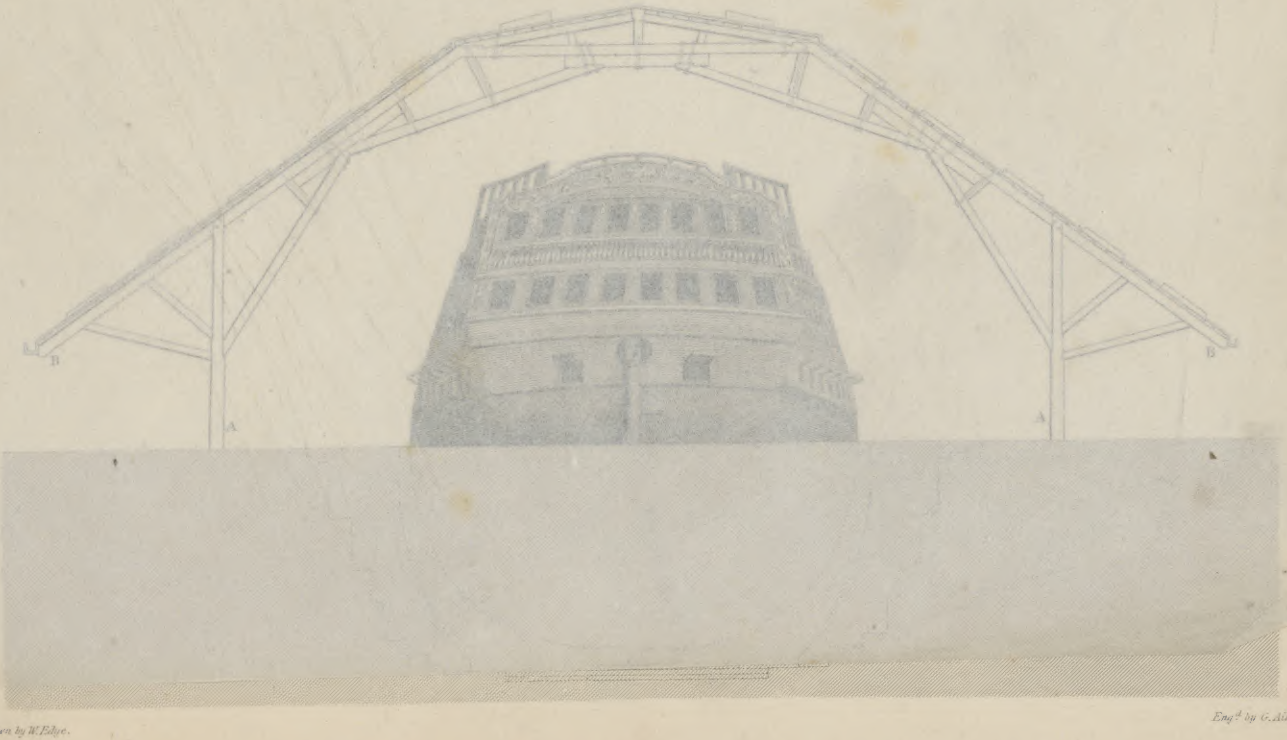


Fig. 8 Drawn by W. Edye.

Eng^{d} by G. Aikman, Edin^{r}

DOCKS.

Fig. 1.

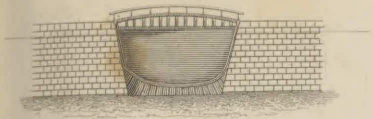
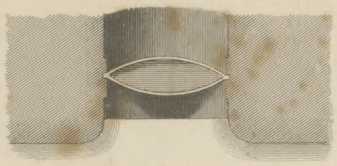
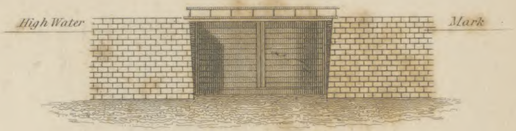


Fig. 2.



PLAN AND ELEVATION OF THE ENTRANCE TO THE DOCK WITH A FLOATING DAM.

Fig. 3.



ELEVATION
OF THE ENTRANCE TO THE DOCK WITH SWINGING GATES.

Fig. 5.

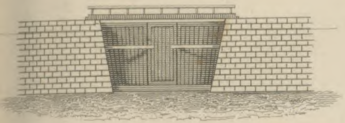
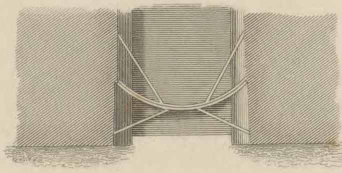
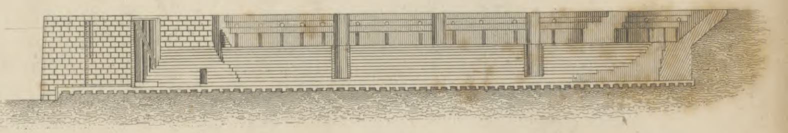


Fig. 6.



PLAN AND ELEVATION OF THE ENTRANCE TO THE DOCK WITH WICKET GATES.

Fig. 4.



SECTIONAL ELEVATION OF THE DOCK.

Fig. 7.
PLAN OF A DOCK.

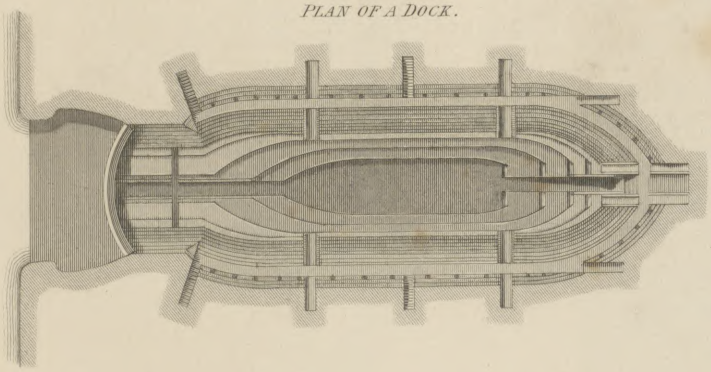


Fig. 8.

TRANSVERSE SECTION OF A ROOF OVER THE HEAD OF THE DOUBLE DOCK AT PLYMOUTH, ERECTED IN 1817. DESIGNED BY SIR R. SEPPINGS, SURVEYOR OF THE NAVY.

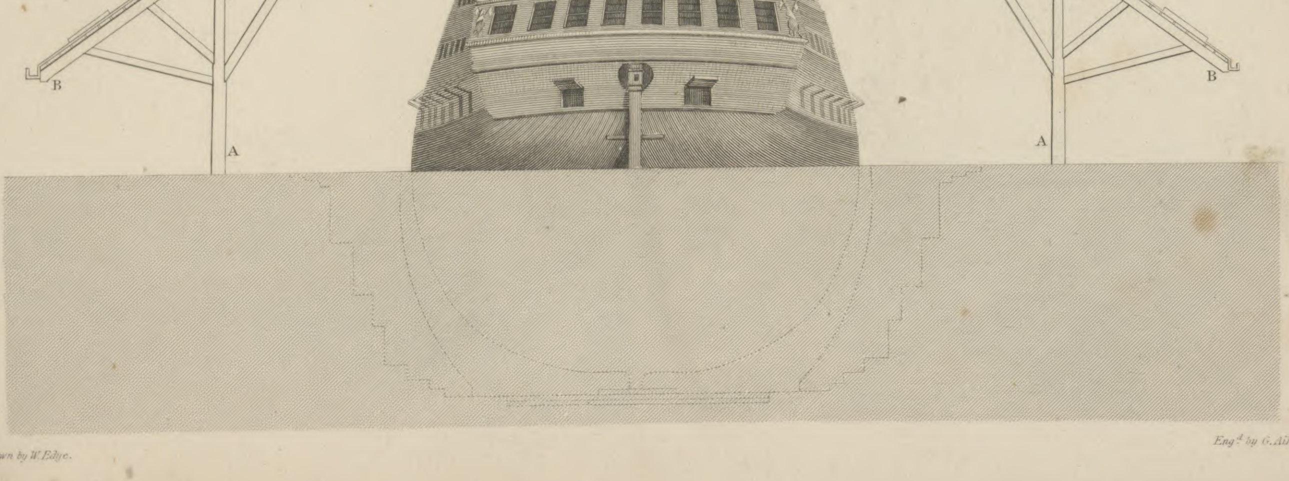


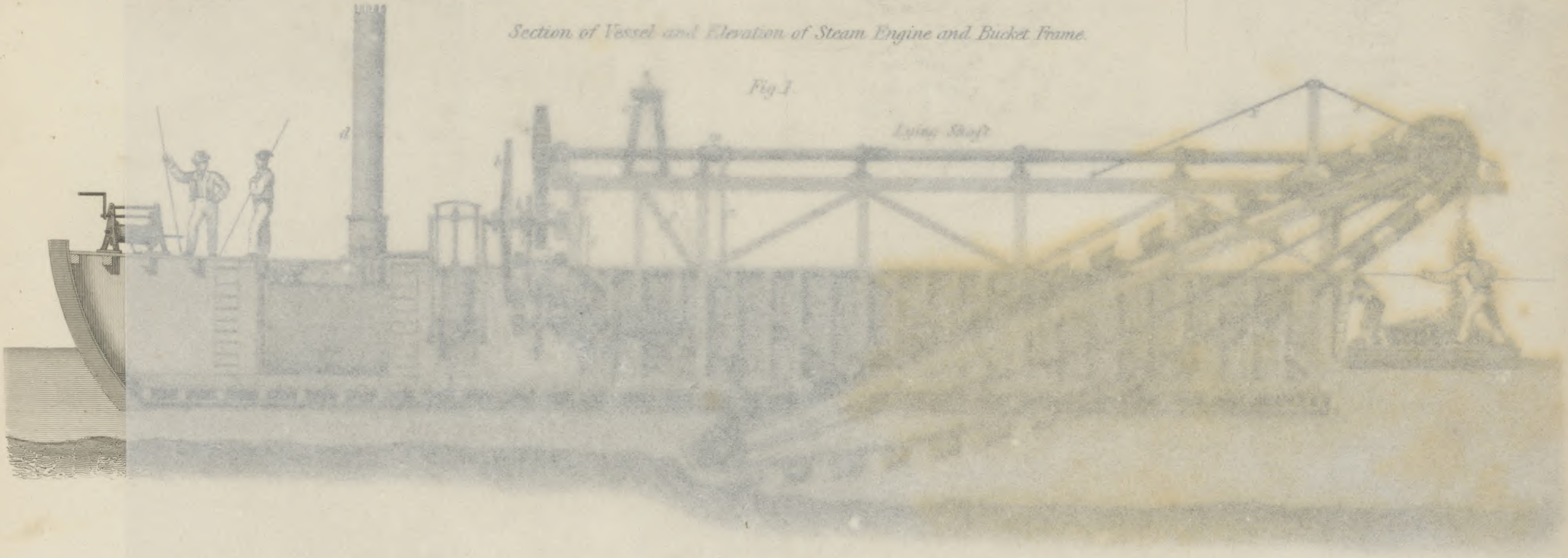
Fig. 8. Drawn by W. Edye.

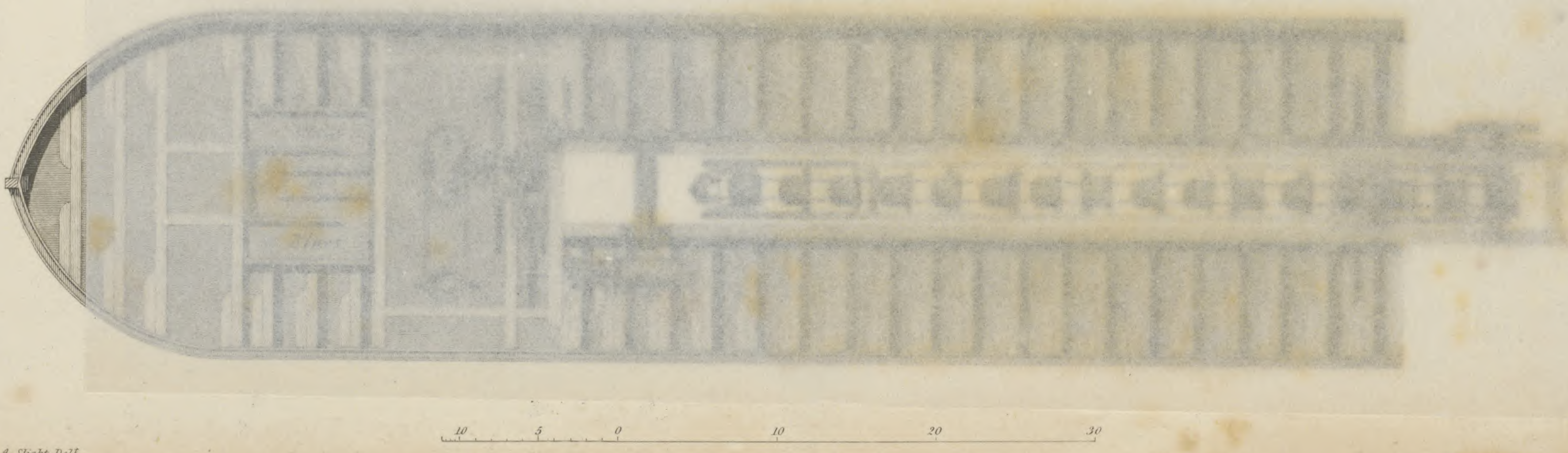
Eng.d by G. Aikman, Edin.r

BUCKET MACHINE.

Section of Vessel and Elevation of Steam Engine and Bucket Frame.

Fig. 1.





A. Slight, Delt.

Engd. by G. Aikman, Edinr.

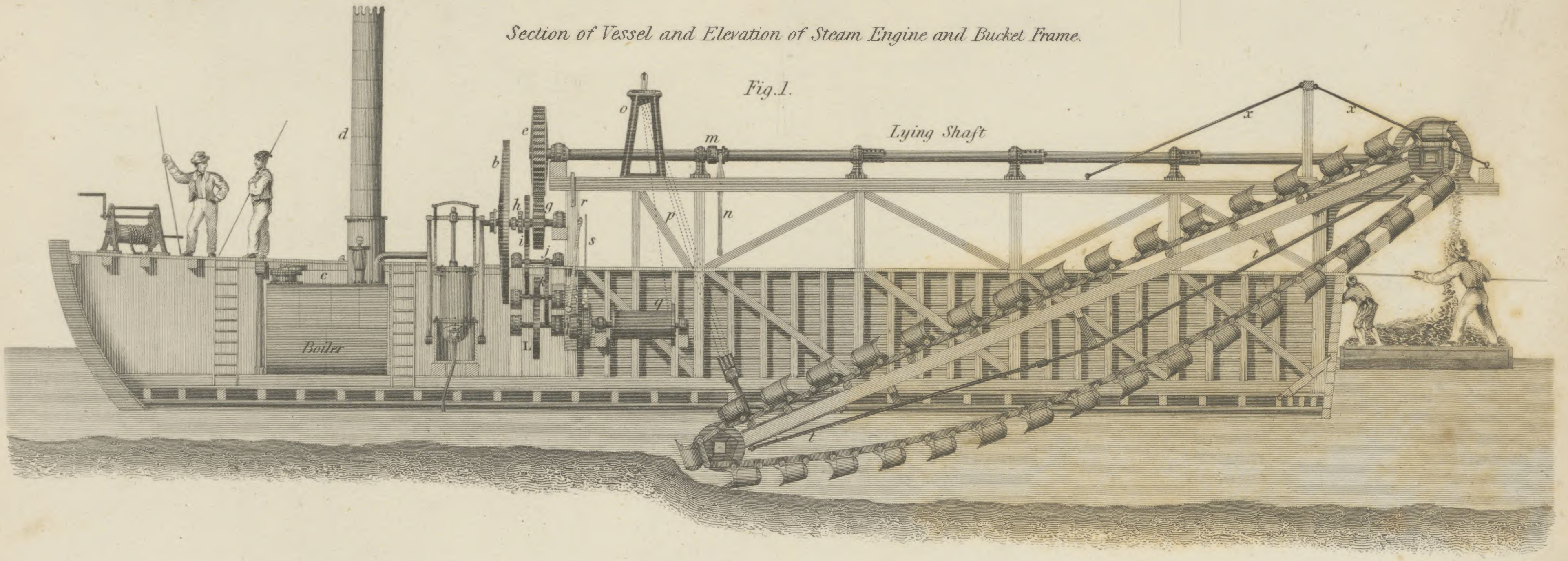
DREDGING.

PLATE CCIV.

BUCKET MACHINE.

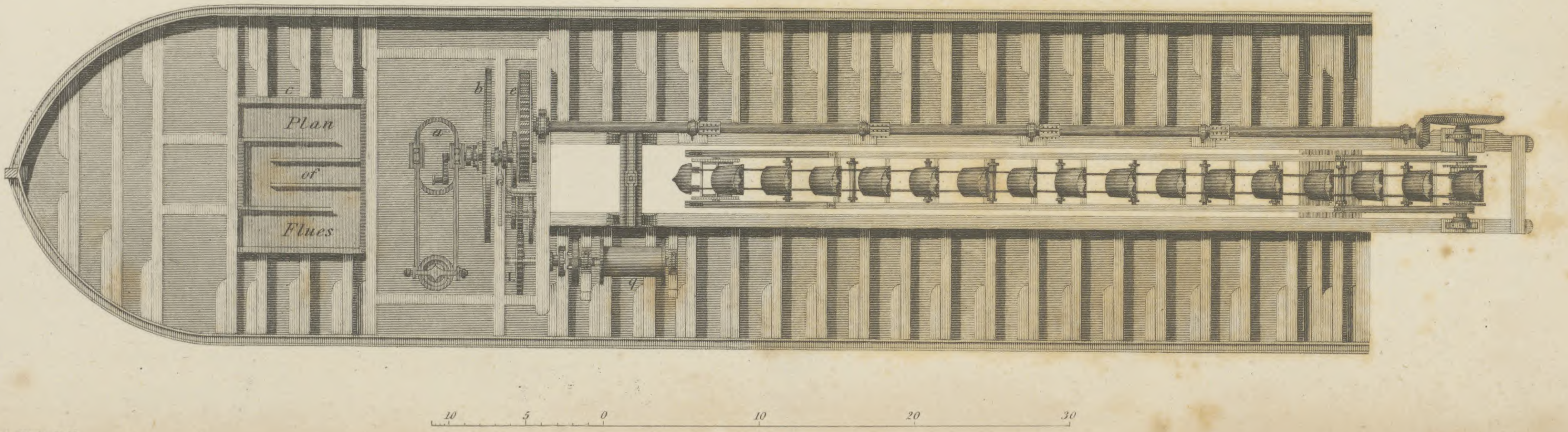
Section of Vessel and Elevation of Steam Engine and Bucket Frame.

Fig. 1.



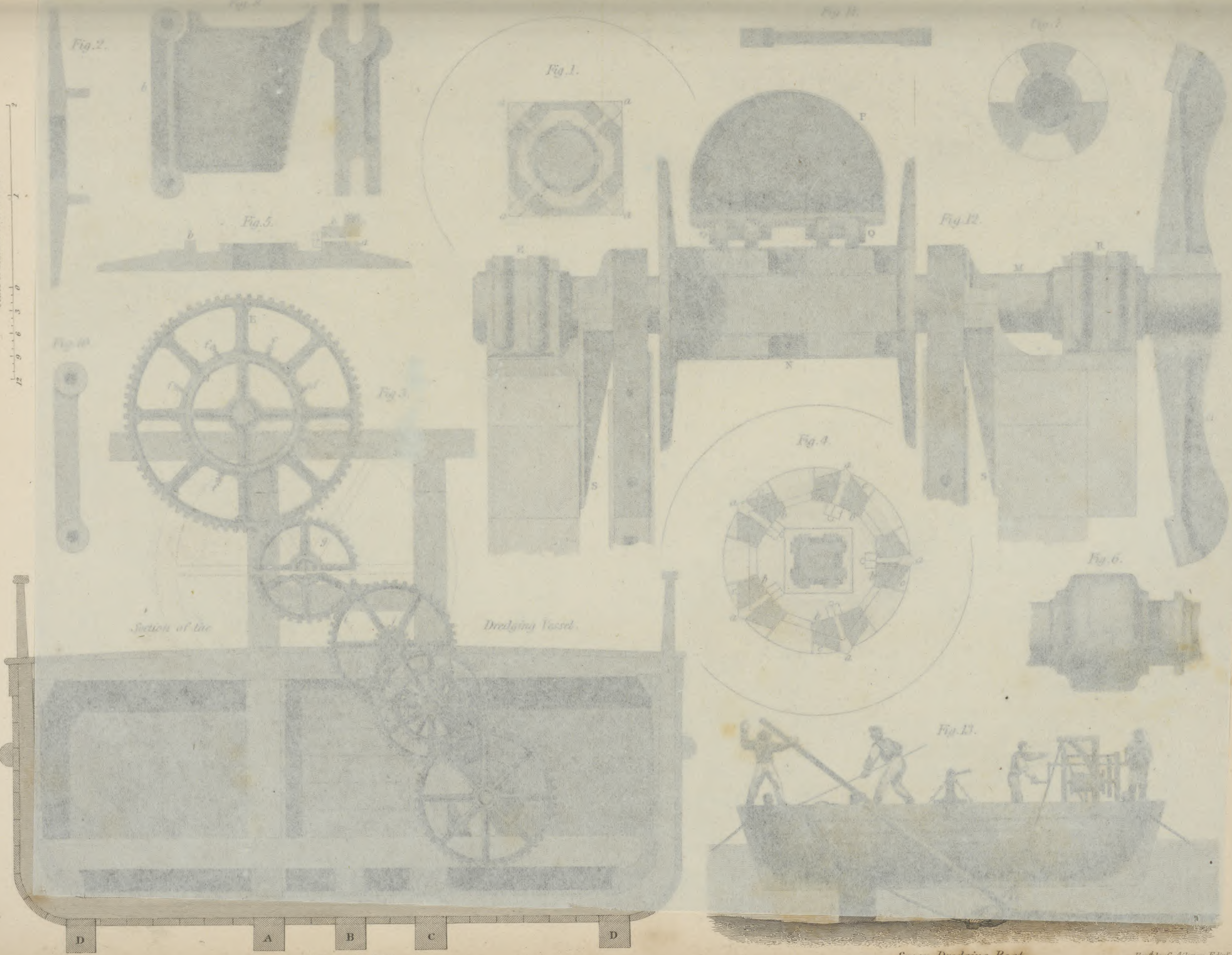
Plan.

Fig. 2.



A. Slight, Delt.

Engd. by G. Aikman, Edinr.

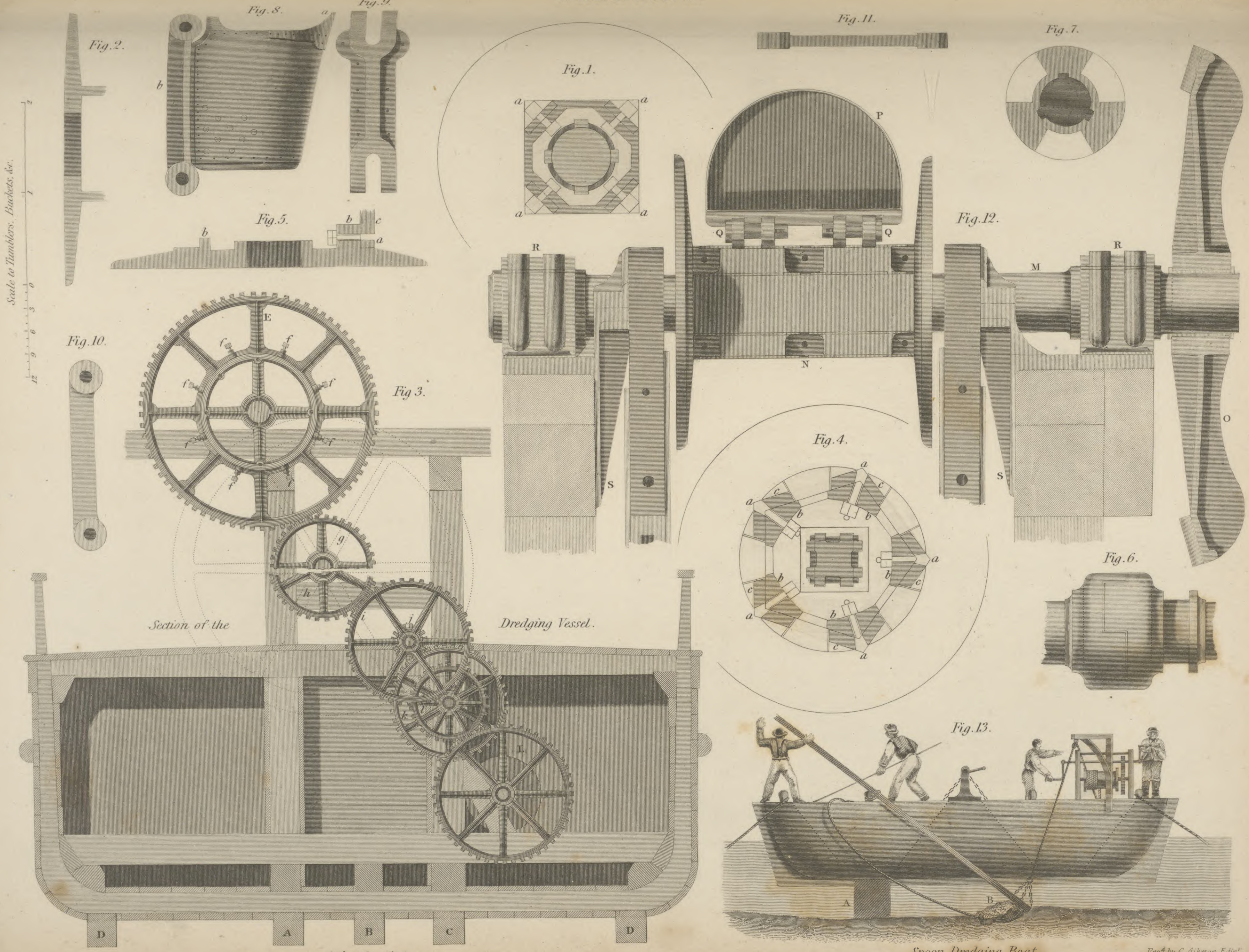


A. Slight Delt.

Spoon Dredging Boat.

Engd by G. Aikman, Edinr

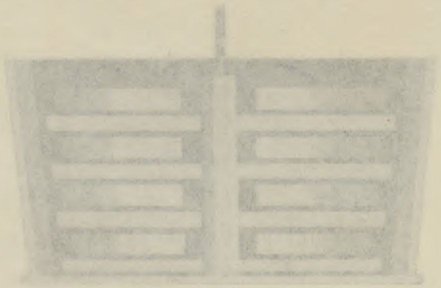
DREDGING.



A. Slight, Delt.

Engd by G. Aikman, Edinr.

Fig. 1.
Section of Liqour Tub.



End Elevation of Padding Machine

Fig. 3.

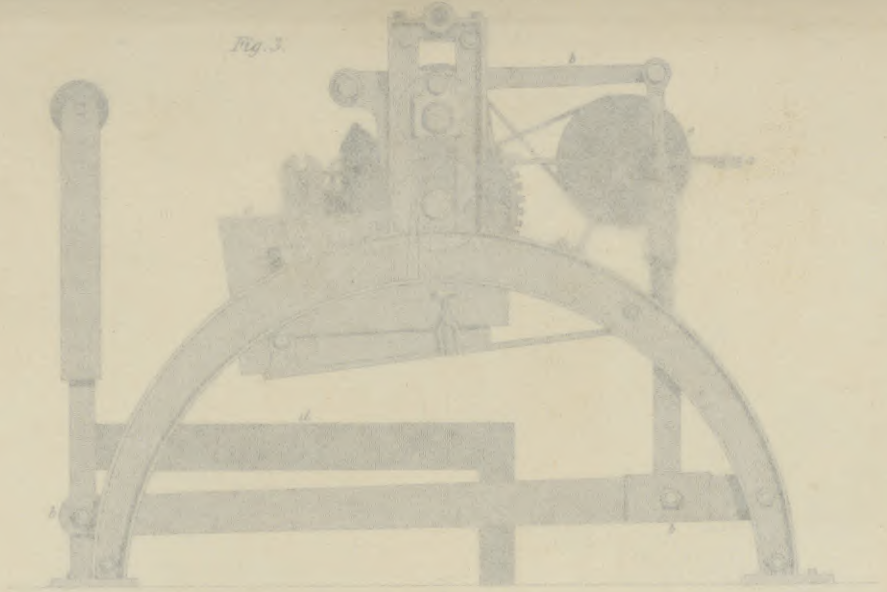


Fig. 2.
Plan of Liqour Tub

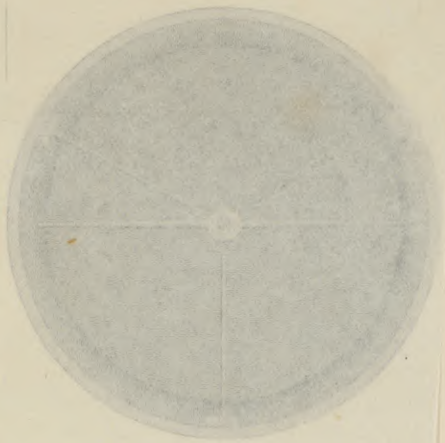


Fig. 4
Front Elevation of Padding Machine

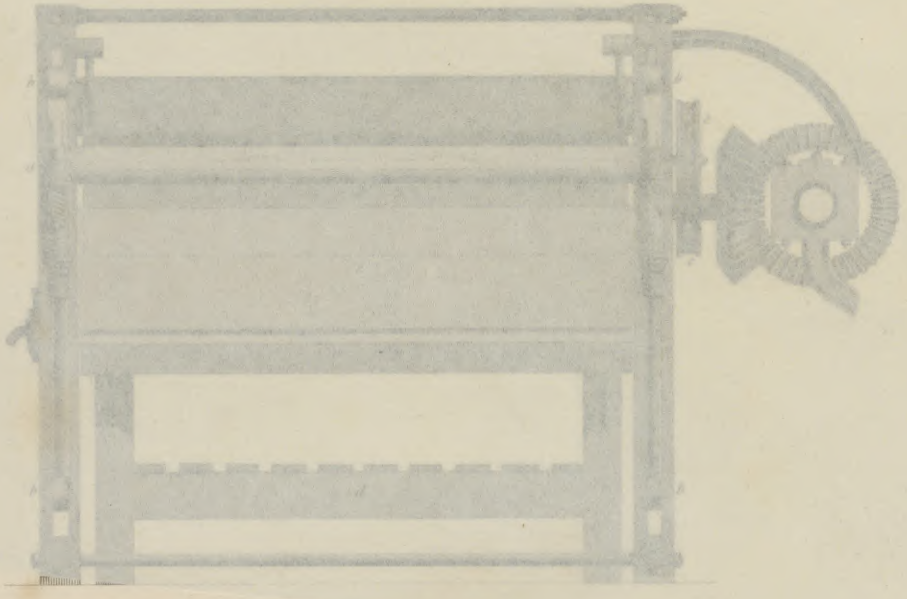
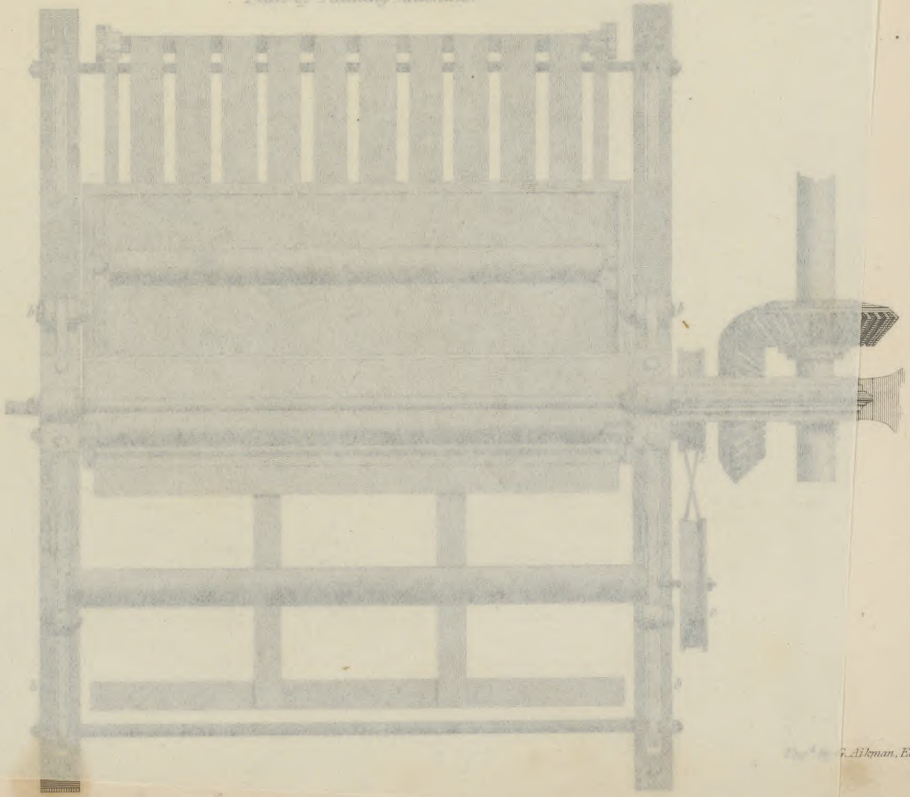


Fig. 5.
Plan of Padding Machine.



Drawn by W. Ross.

Engd by G. Aikman, Edinr.

Fig. 1.

Section of Liqour Tub.

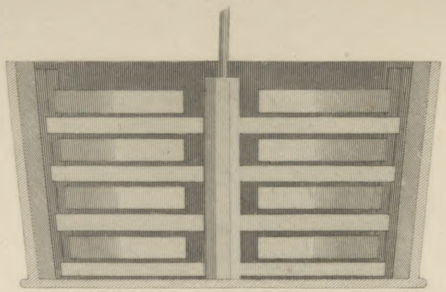


Fig. 3.

End Elevation of Padding Machine.

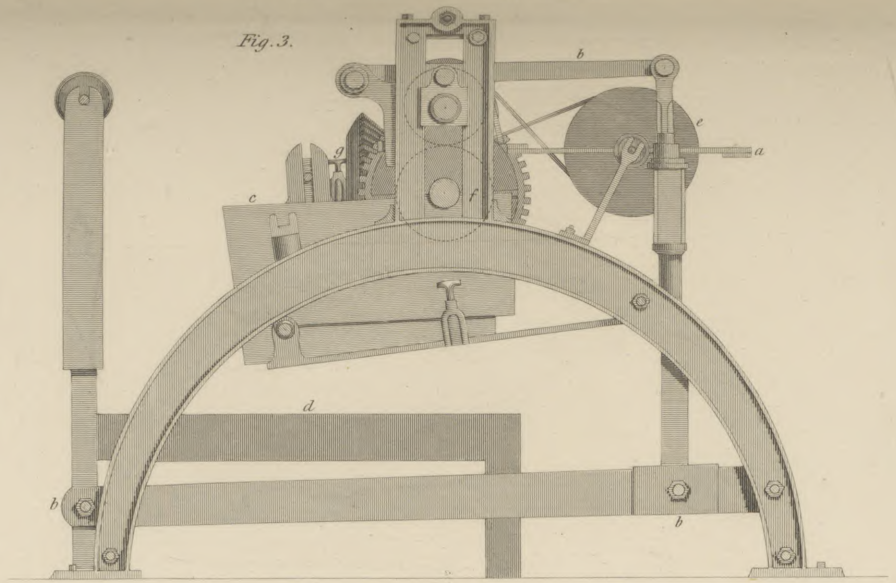


Fig. 2.

Plan of Liqour Tub.

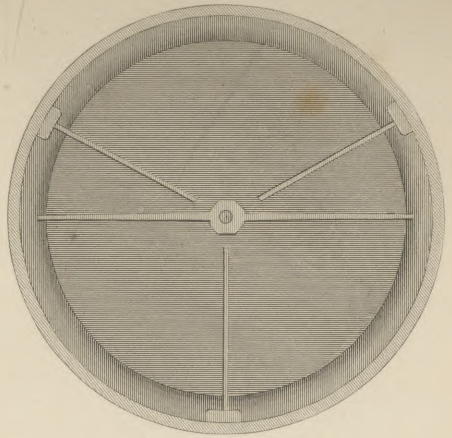


Fig. 4.

Front Elevation of Padding Machine.

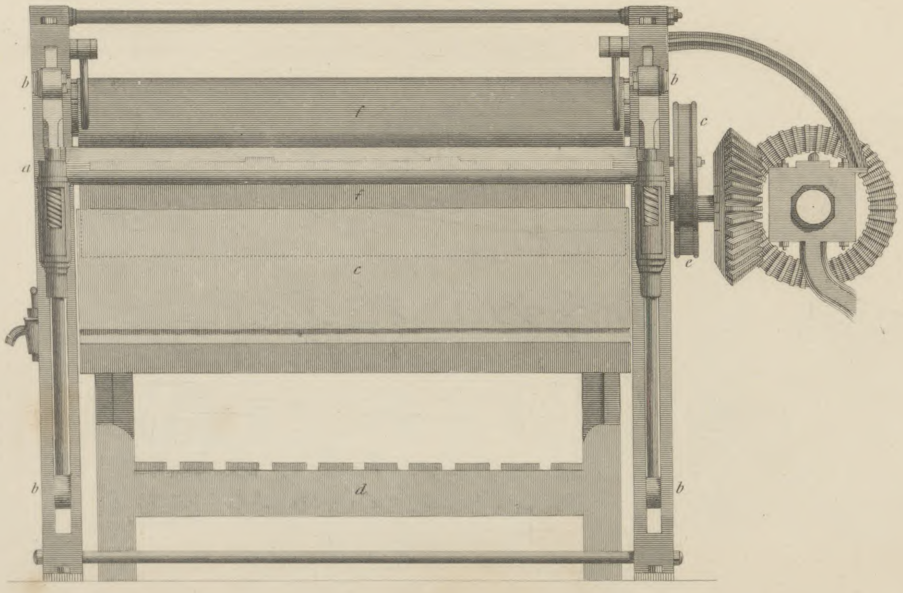
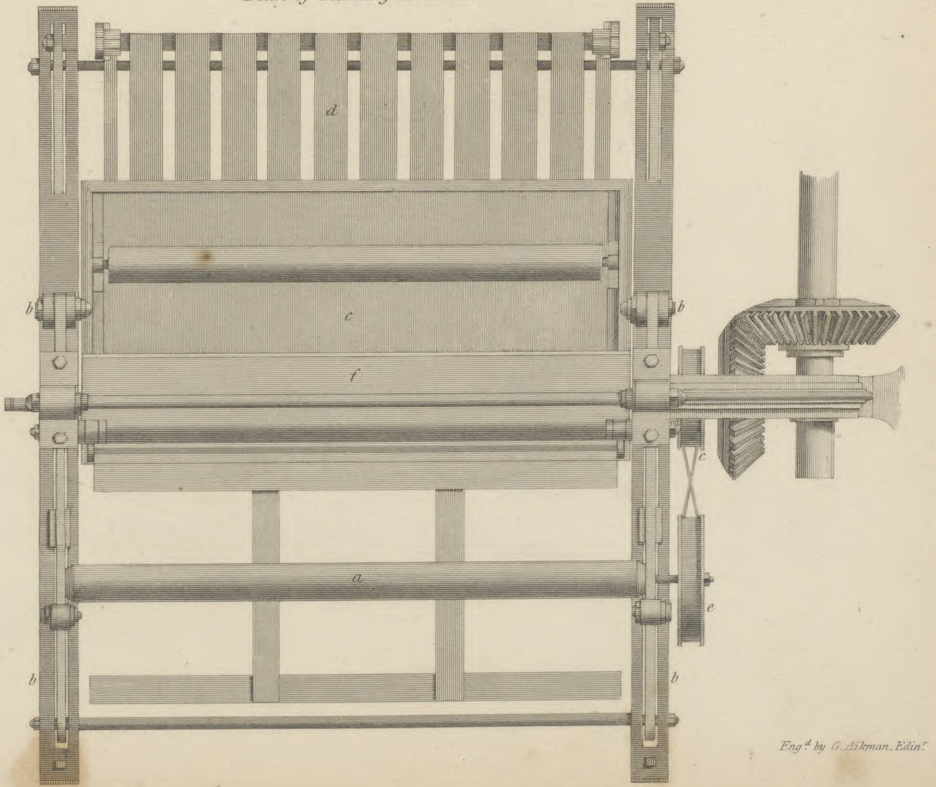


Fig. 5.

Plan of Padding Machine.



Drawn by W. Ross.

Eng.d by G. Aikman, Edin.r

Elevation of Dyeing Box.

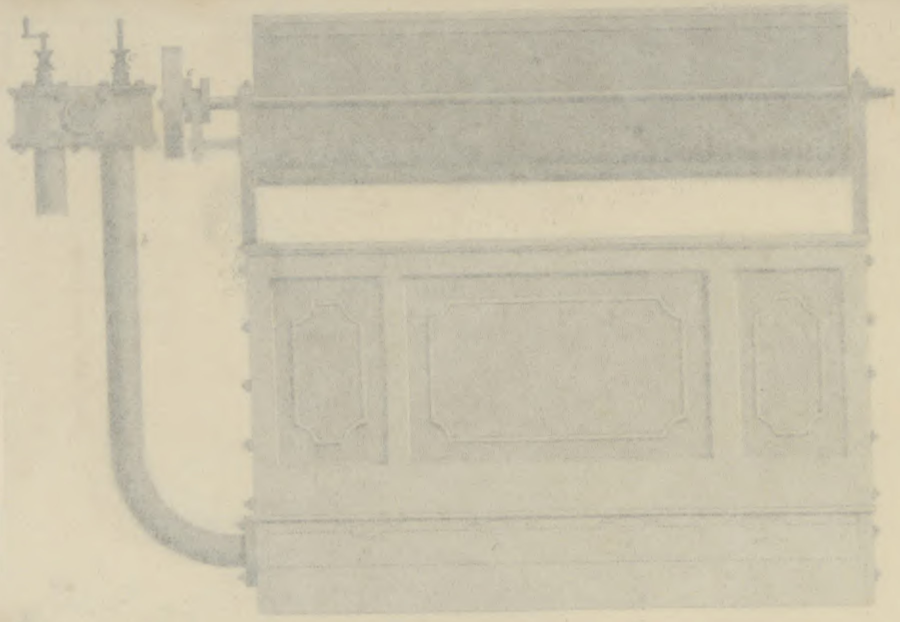
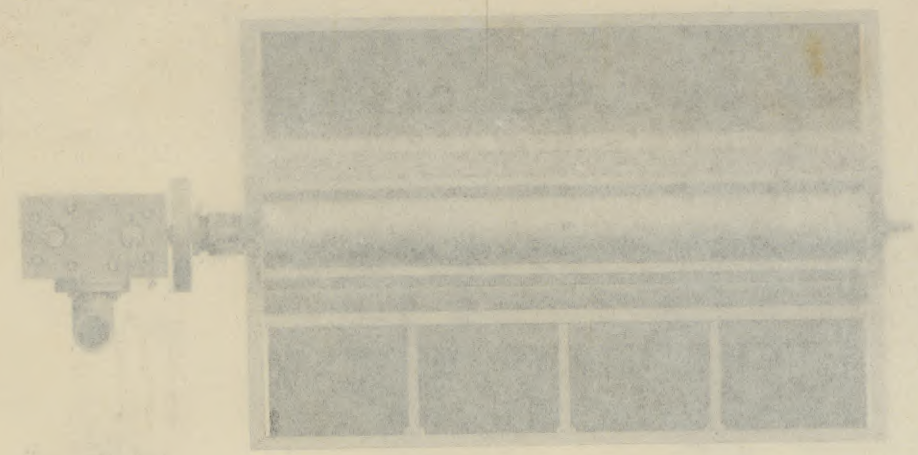


Fig. 7.

Plan of Dyeing Box.



Section of Clearing Boiler.

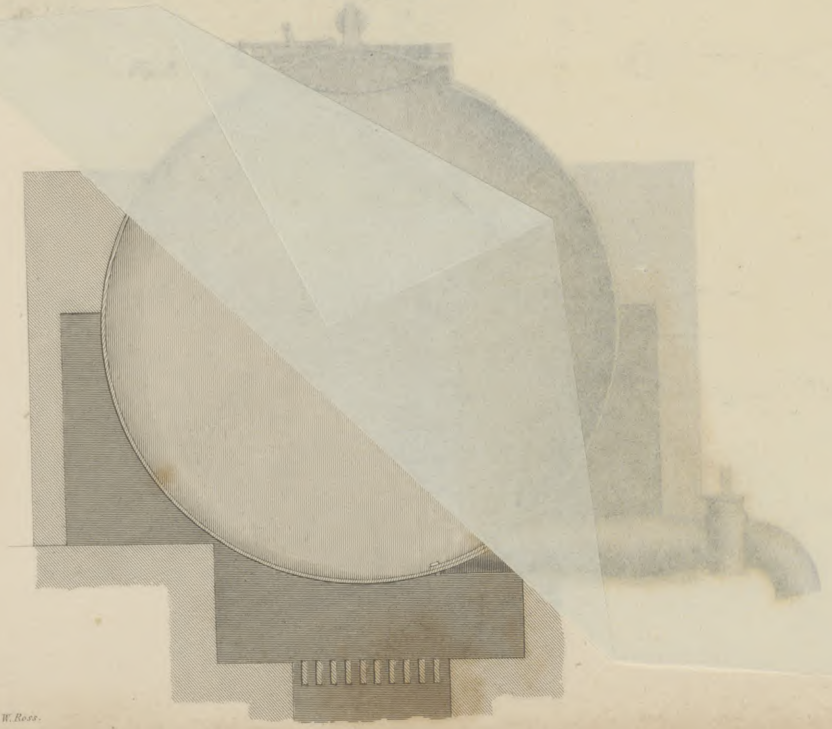


Fig. 9.

Elevation of Clearing Boiler.

Fig. 10.

Plan of Boiler Top.

Fig. 11.

Plan of Cover.

Drawn by W. Ross.

Engd by G. Aikman, Edinr.

DYEING.

Fig. 6.

Elevation of Dyeing Box.

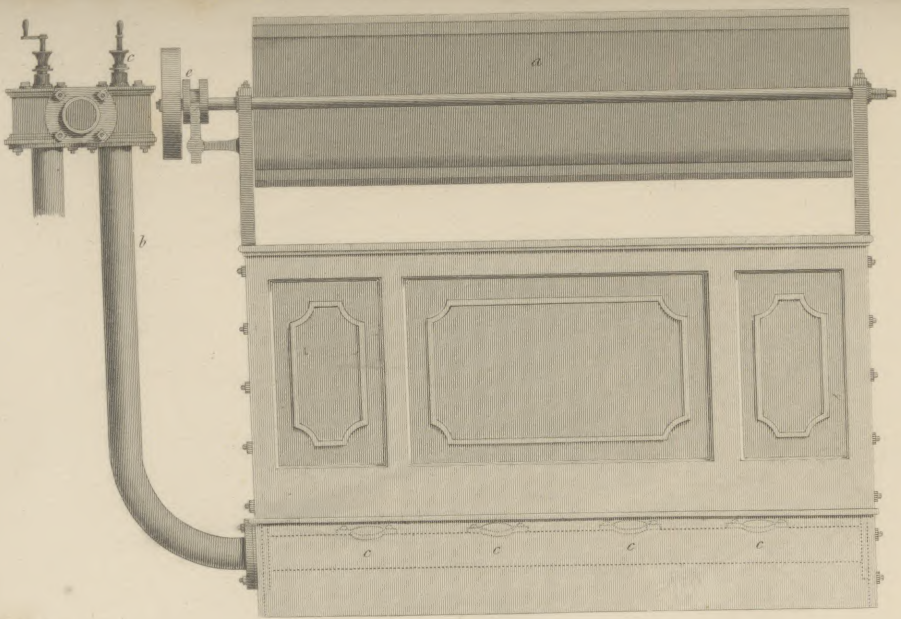
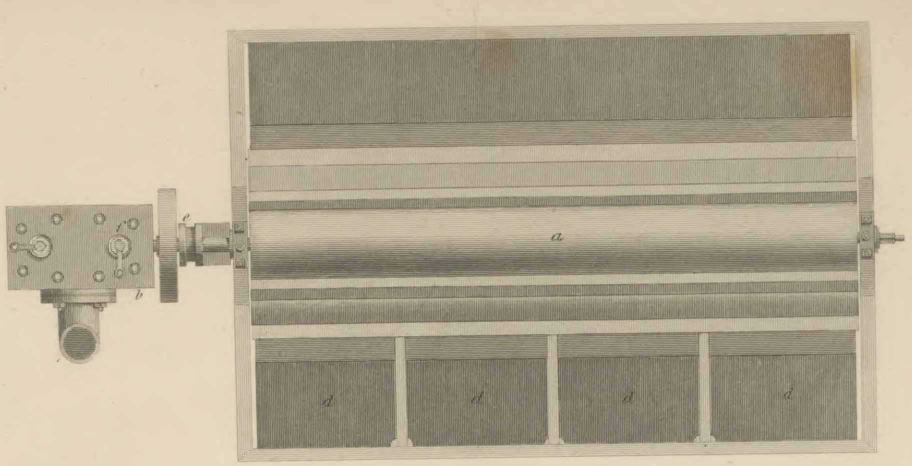


Fig. 7.

Plan of Dyeing Box.



Section of Clearing Boiler.

Fig. 8.

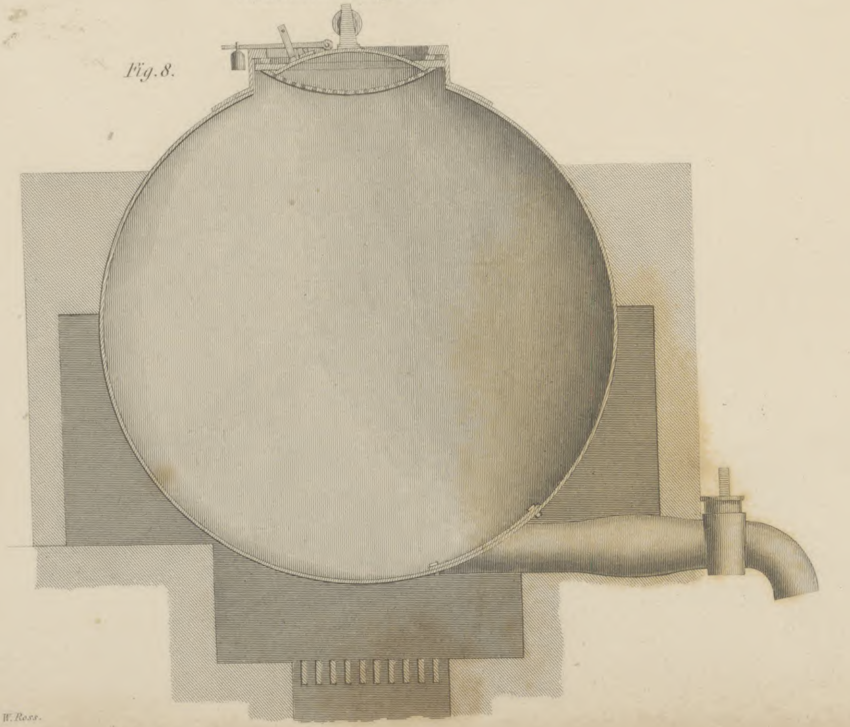


Fig. 9.

Elevation of Clearing Boiler.

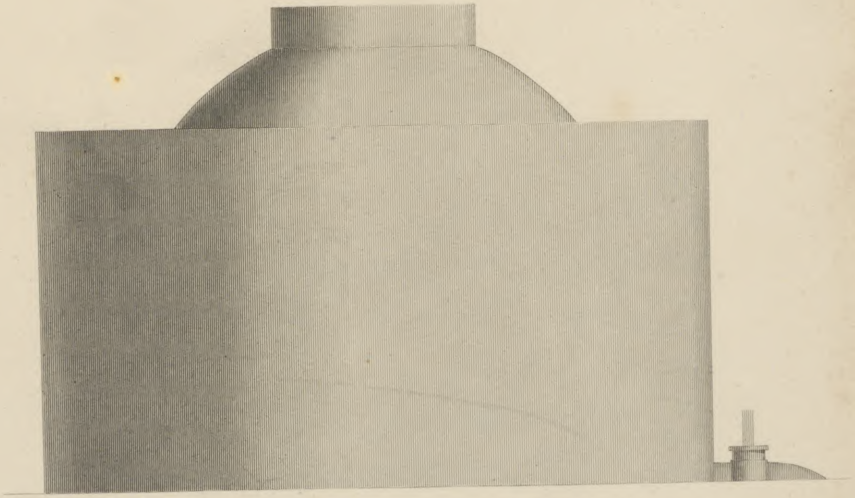
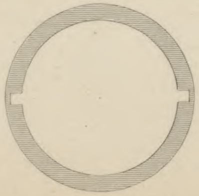
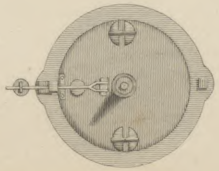


Fig. 10.



Plan of Boiler Top.

Fig. 11.

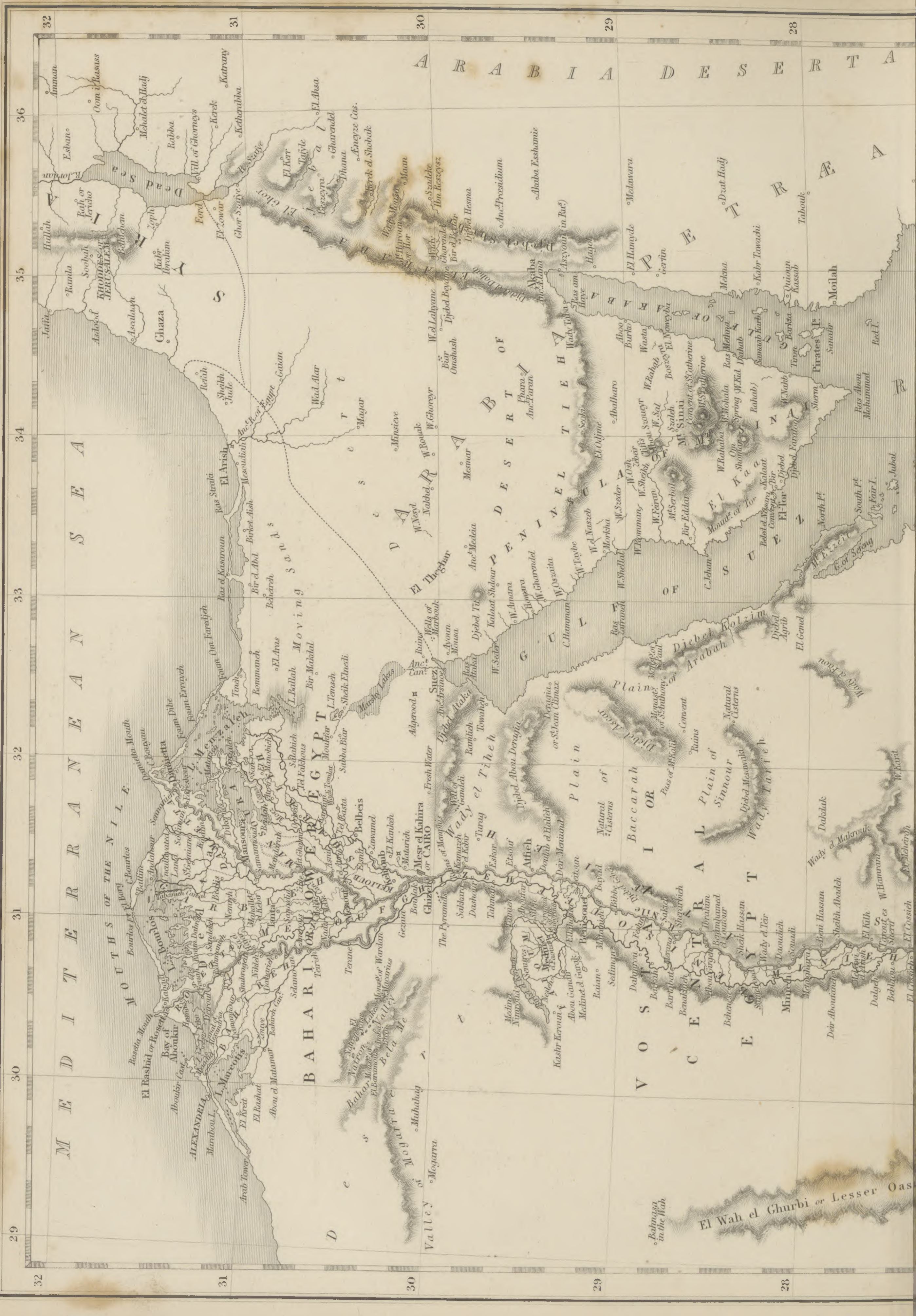


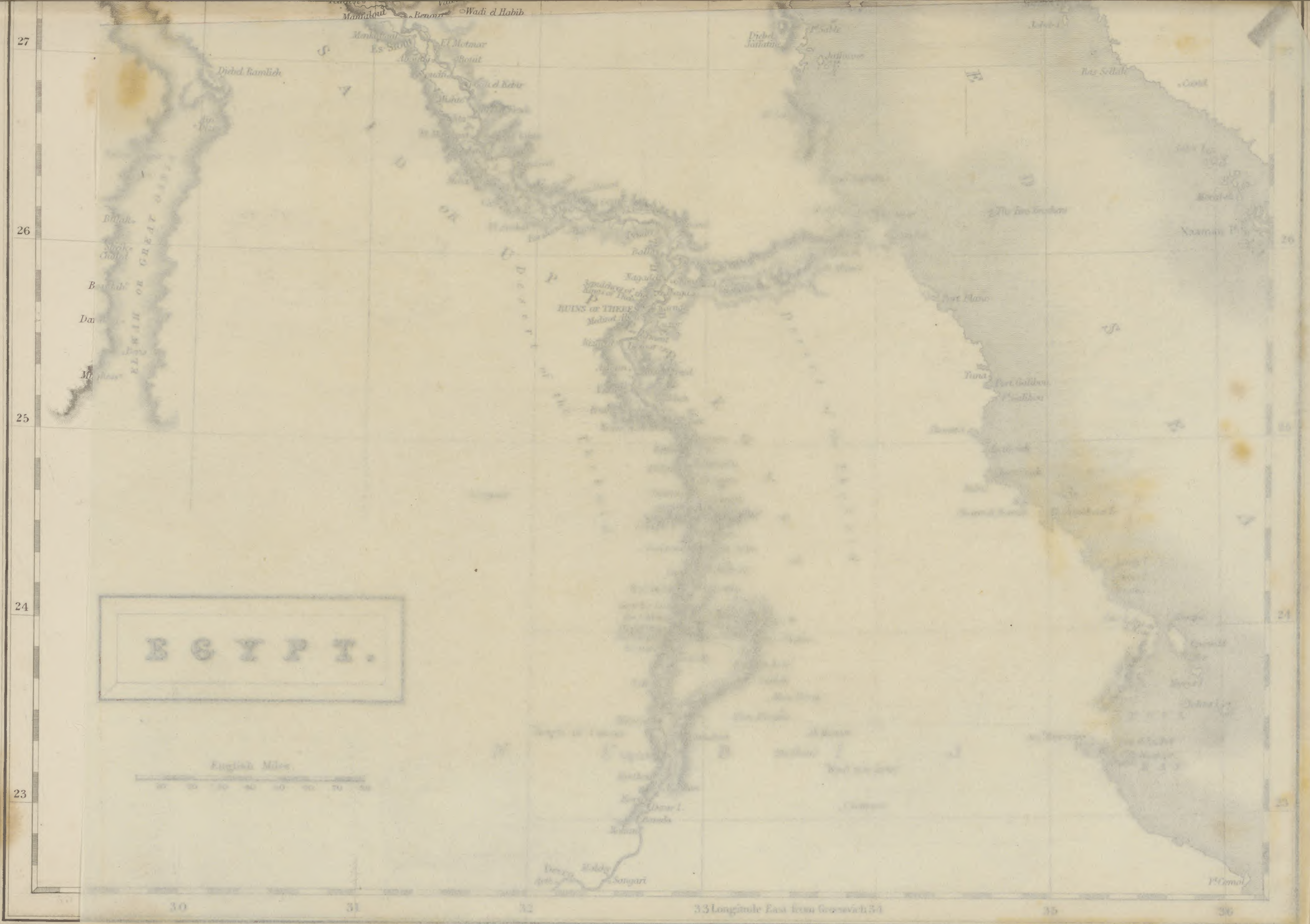
Plan of Cover.

Drawn by W. Ross.

Engd by G. Aikman, Edinr

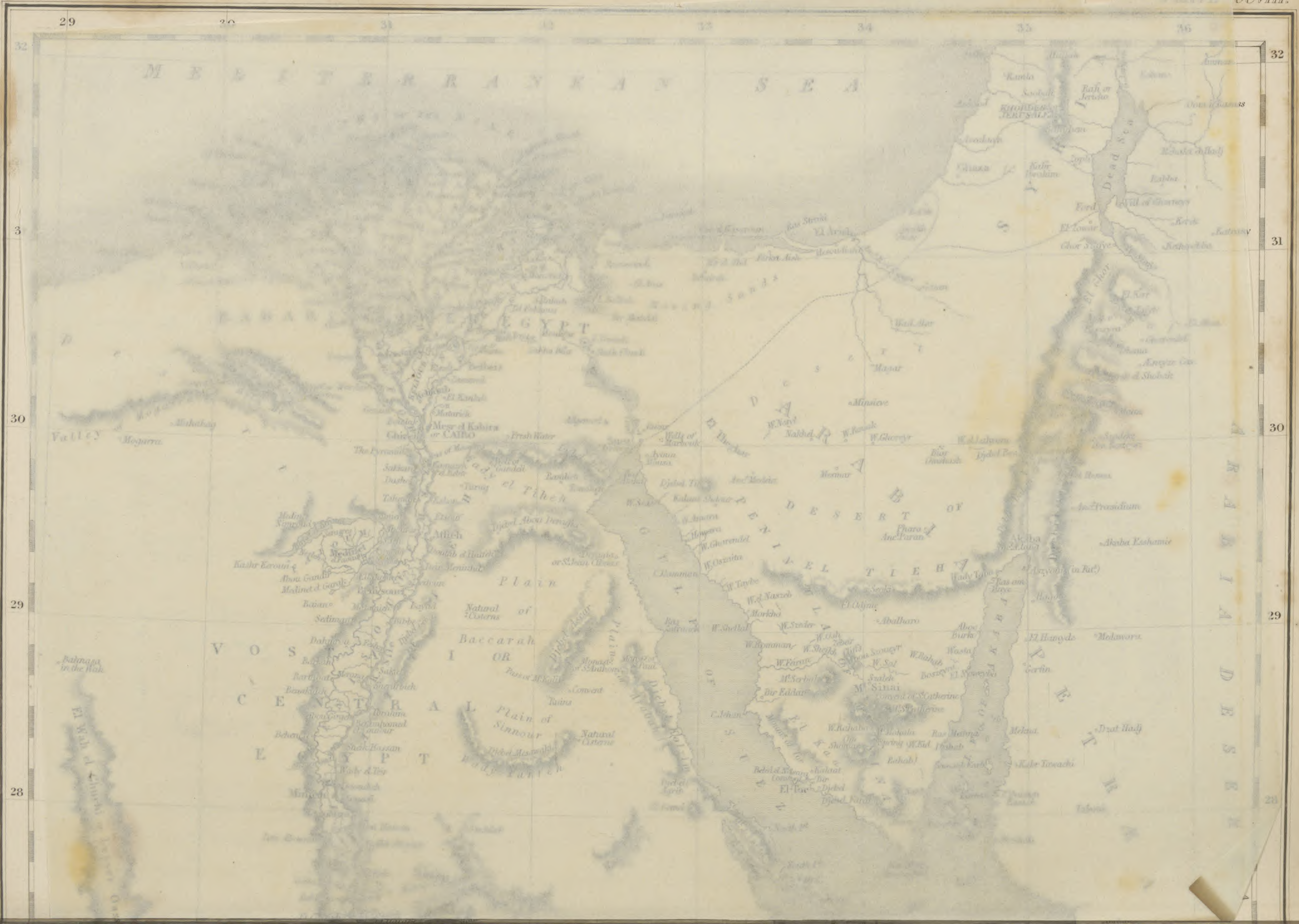
PLATE CCVIII.



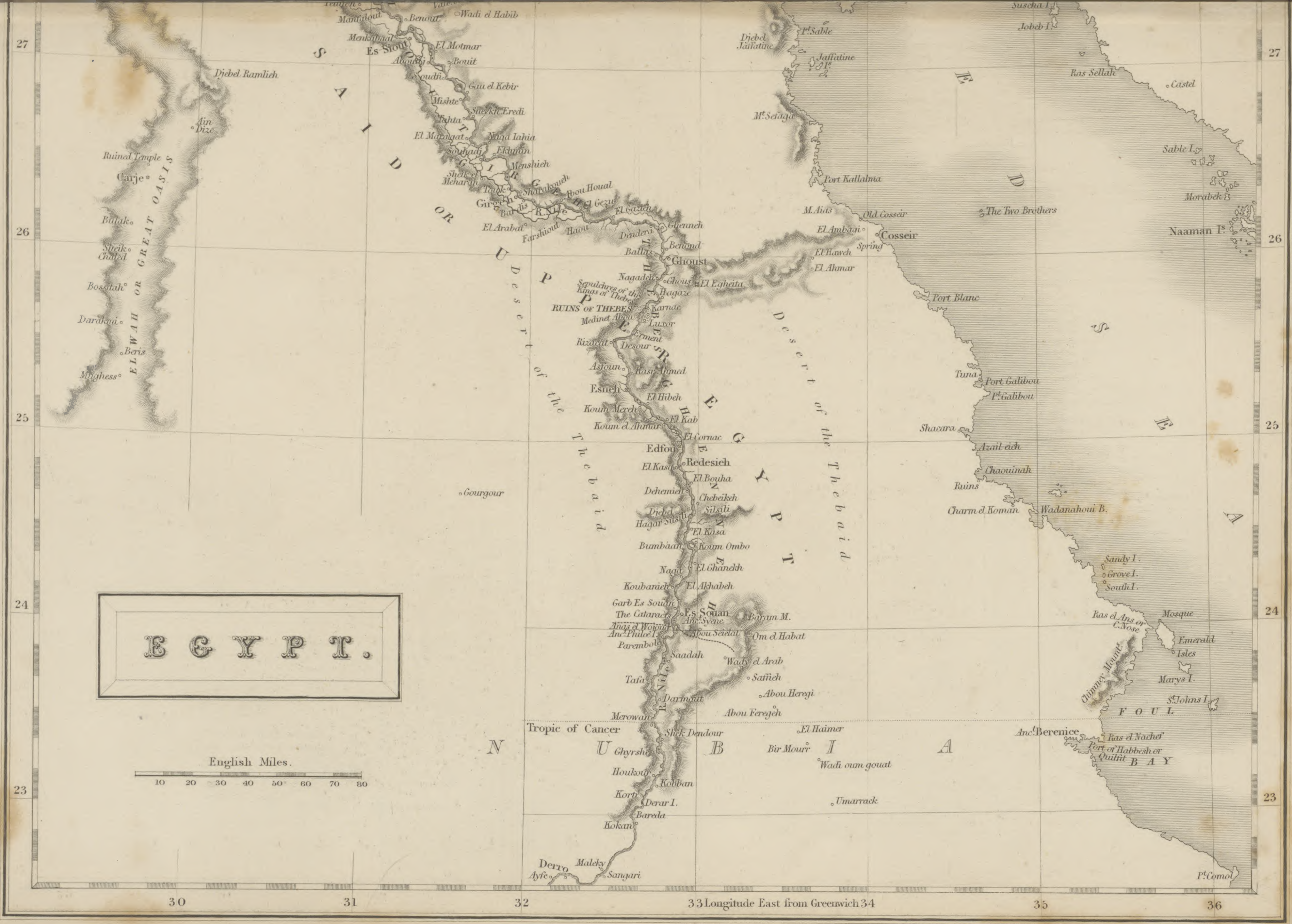


Engraved by S.Hall, Bury St. Blooms

PLATE CCVIII.



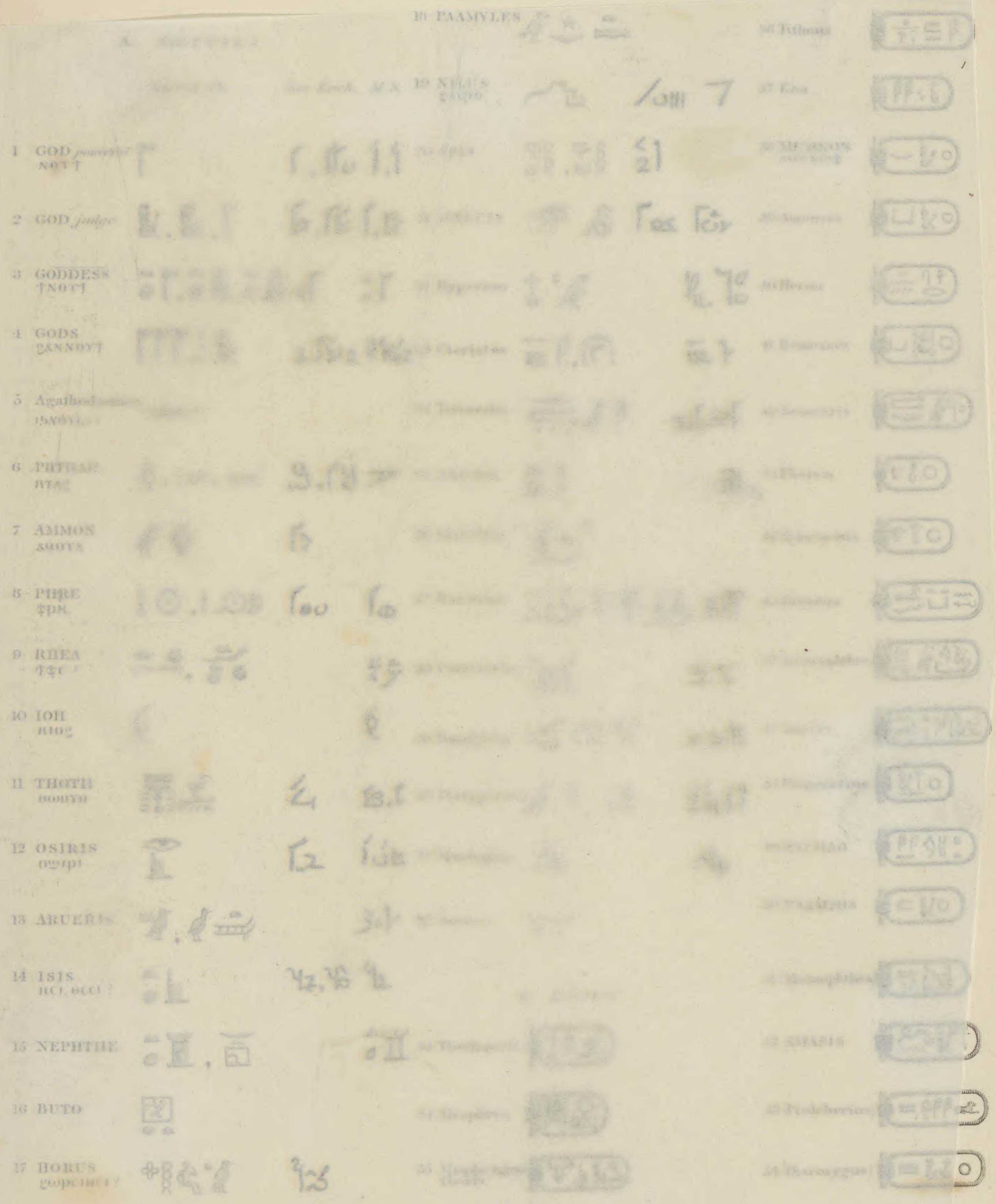
EGYPT.



Engraved by S. Hall, Bury Str.t Bloomsb.y

E G Y P T.

HIEROGLYPHICS.


1 GOD powerful
NOYT
2 GOD judge
3 GODDESS
†NOYT
4 GODS
ϩⲁⲛⲚⲞⲨⲦ
5 Agathodaemon
6 PHTHAH
ⲡⲧⲁϩ
7 AMMON
ⲁⲙⲟⲩⲛ
8 PHRE
ⲫⲣⲏ
9 RHEA
10 IOH
ⲓⲟϩ
11 THOTH
ⲑⲱⲟⲩⲑ
12 OSIRIS
ⲟⲩⲥⲓⲣⲓ
13 ARUERIS
14 ISIS
ⲏⲥⲓ, ⲉⲥⲓ ?
15 NEPHTHE
16 BUTO
17 HORUS
18 PAAMYLES
19 NILUS
36 Tithoës
37 Ena
38 MENDES

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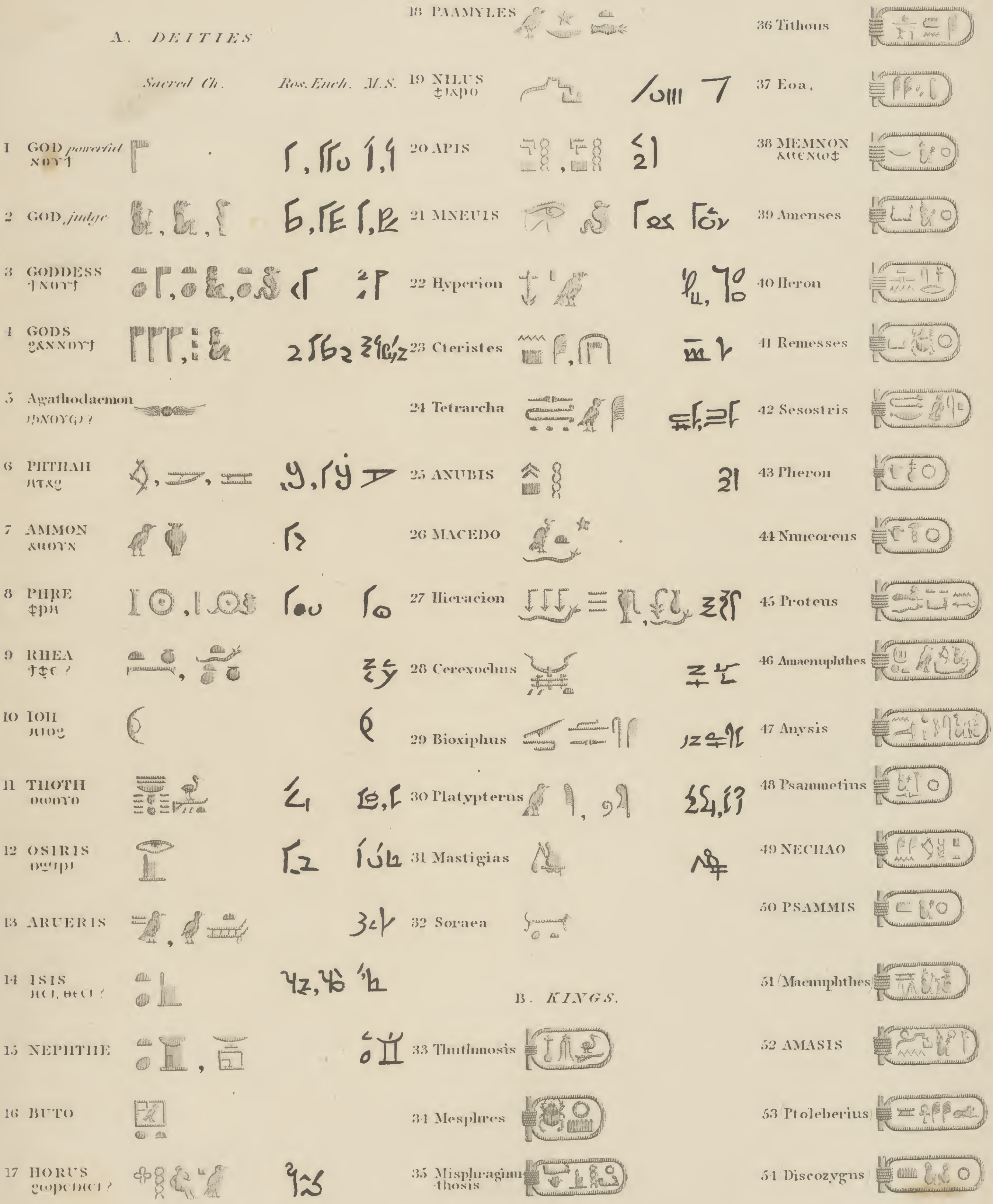
EGYPT.

PLATE CCIX.

HIEROGLYPHICS.



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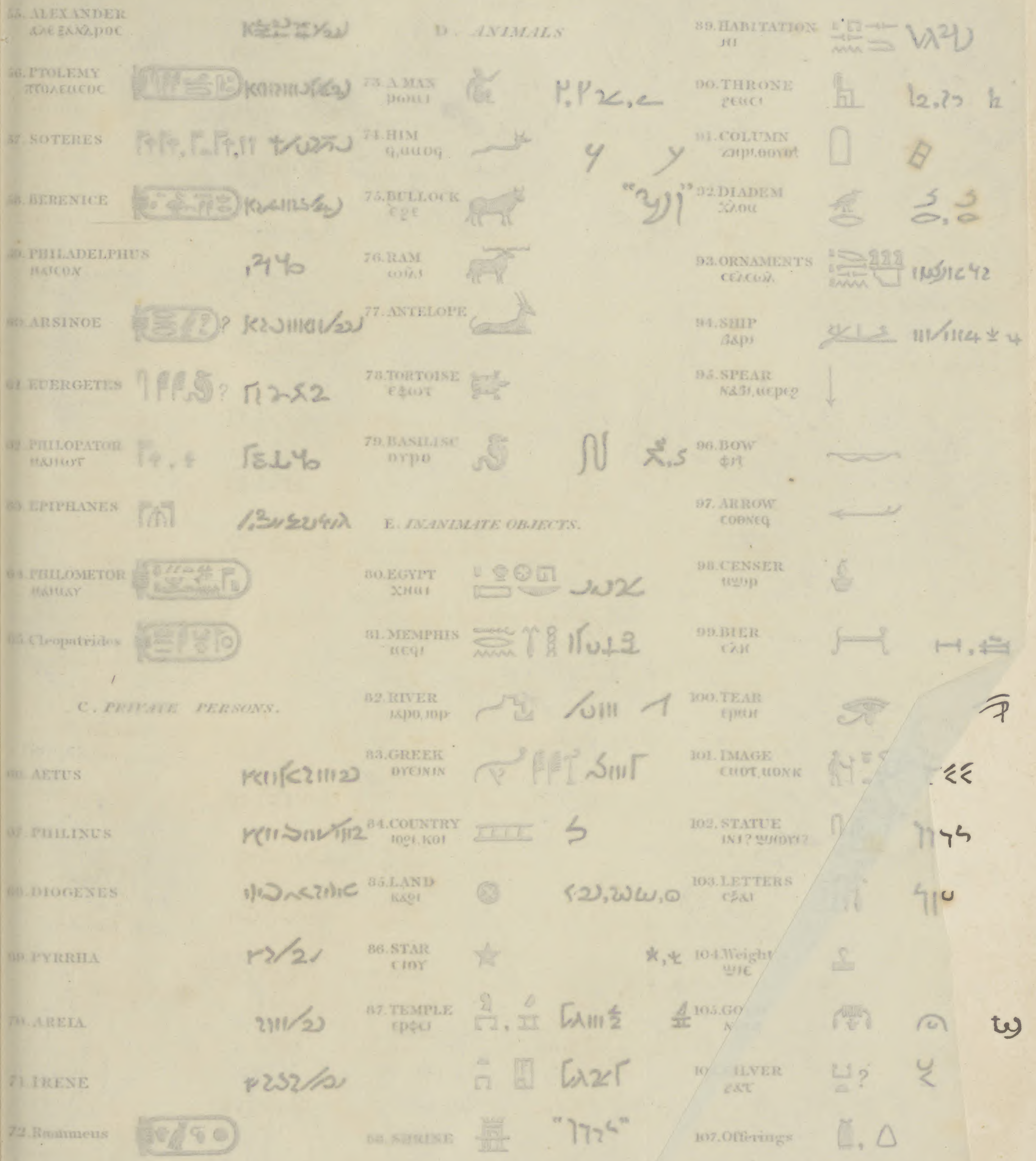
EGYPT.

HIEROGLYPHICS.

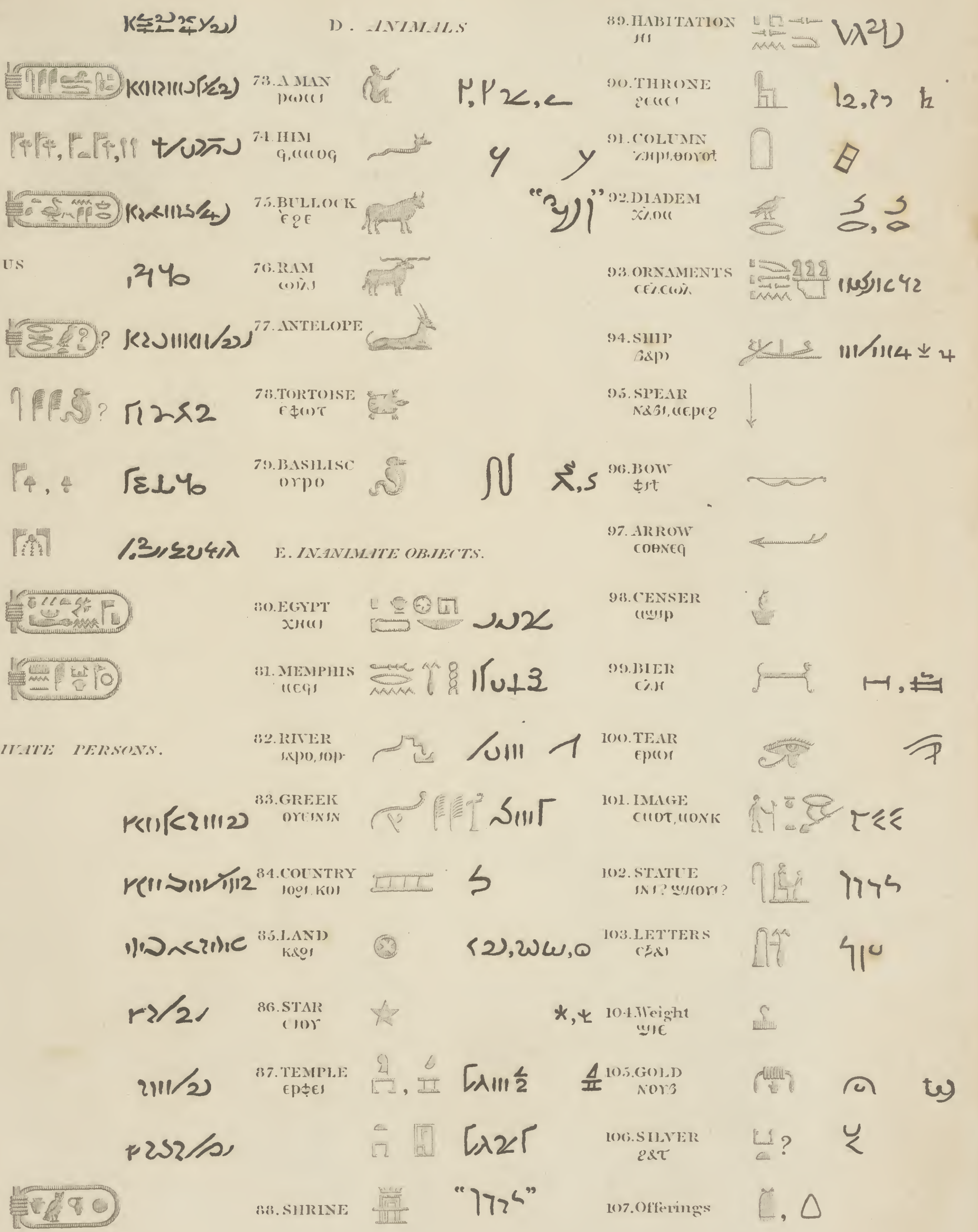


Eng.d by G. Aikman, Edin.r

E G Y P T.

PLATE CCX.

HIEROGLYPHICS.



55. ALEXANDER ⲁⲗⲉⲝⲁⲛⲇⲣⲟⲥ
56. PTOLEMY ⲡⲧⲟⲗⲉⲙⲉⲟⲥ
57. SOTERES
58. BERENICE
59. PHILADELPHUS ⲙⲁⲓⲥⲟⲛ
60. ARSINOE ?
61. EUERGETES ?
62. PHILOPATOR ⲙⲁⲓⲓⲱⲧ
63. EPIPHANES
64. PHILOMETOR ⲙⲁⲓⲙⲁⲩ
65. Cleopatrides

C. PRIVATE PERSONS.

66. AETUS
67. PHILINUS
68. DIOGENES
69. PYRRHA
70. AREIA
71. IRENE
72. Rammeus

D. ANIMALS

73. A MAN ⲣⲱⲙⲓ
74. HIM ϥ,ⲙⲙⲟϥ
75. BULLOCK ⲉϩⲉ
76. RAM ⲱⲓⲗ
77. ANTELOPE
78. TORTOISE ⲥⲫⲱⲧ
79. BASILISC ⲟⲩⲣⲟ

E. INANIMATE OBJECTS.

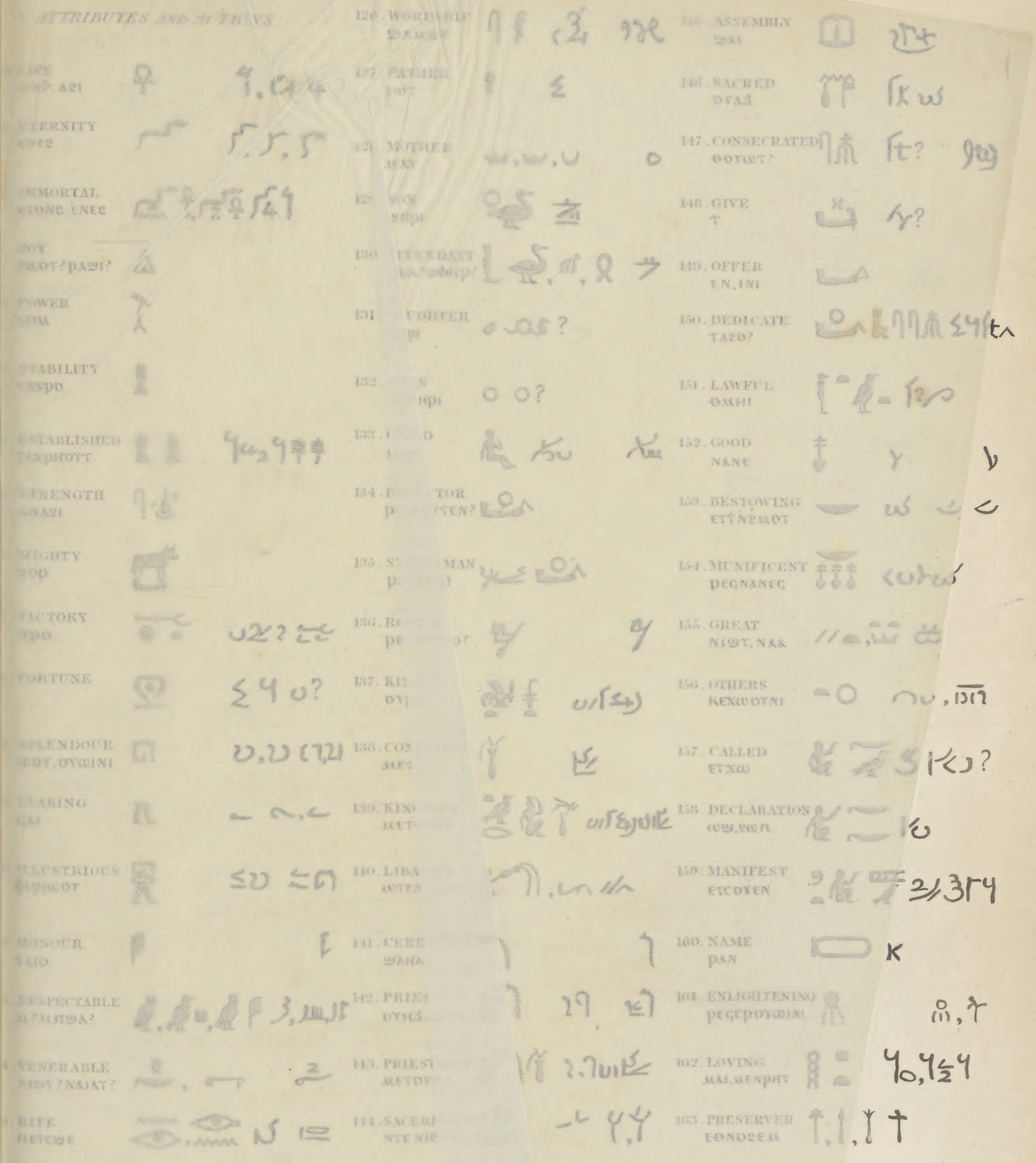
80. EGYPT ⲭⲏⲙⲓ
81. MEMPHIS ⲙⲉϥⲓ
82. RIVER ⲓⲁⲣⲟ,ⲓⲟⲣ
83. GREEK ⲟⲩⲉⲓⲛⲓⲛ
84. COUNTRY ⲓⲟϩⲓ,ⲕⲟⲓ
85. LAND ⲕⲁϩⲓ
86. STAR ⲥⲓⲟⲩ
87. TEMPLE ⲉⲣⲫⲉⲓ
88. SHRINE
89. HABITATION ⲏⲓ
90. THRONE ϩⲙⲙⲓ
91. COLUMN ⲗⲏⲡⲓⲑⲟⲩⲟⲧ
92. DIADEM ⲭⲗⲟⲙ
93. ORNAMENTS ⲥⲉⲗⲥⲱⲗ
94. SHIP ϭⲁⲣⲓ
95. SPEAR ⲛⲁϭⲓ,ⲙⲉⲣⲉϩ
96. BOW ⲫⲓⲧ
97. ARROW ⲥⲟⲑⲛⲉϥ
98. CENSER ⲙϣⲓⲣ
99. BIER ⲥⲗⲏ
100. TEAR ⲉⲣⲙⲟⲓ
101. IMAGE ⲥⲙⲟⲧ,ⲙⲟⲛⲕ
102. STATUE ⲓⲛⲓ? ϣⲙⲟⲩⲓ?
103. LETTERS ⲥϧⲁⲓ
104. Weight ϣⲓⲉ
105. GOLD ⲛⲟⲩⲃ
106. SILVER ϩⲁⲧ ?
107. Offerings

EGYPT.

PLATE CCXI.

HIEROGLYPHICS.

ATTRIBUTES AND ACTIONS



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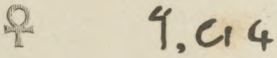
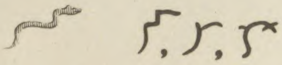
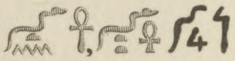
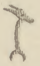
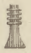
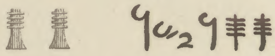
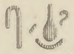
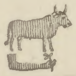
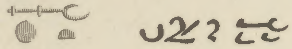
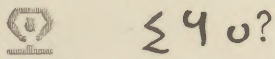
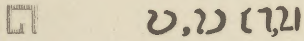
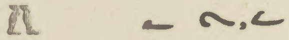
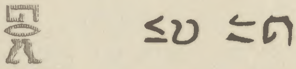
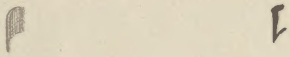
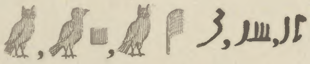
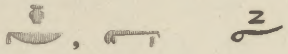
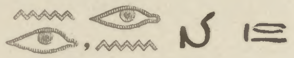
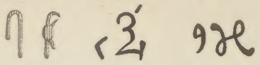
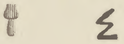
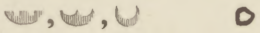
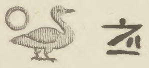
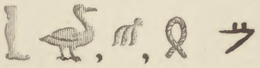
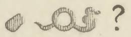
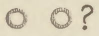
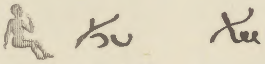
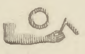
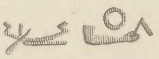
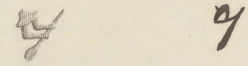
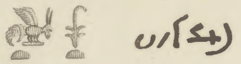
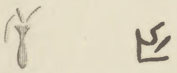
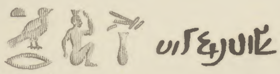
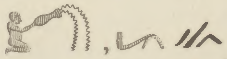
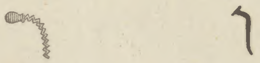
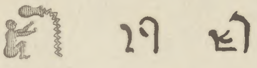
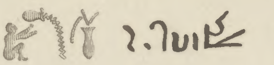
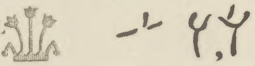
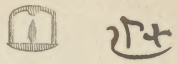
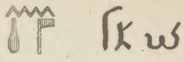
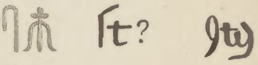
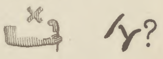
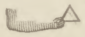
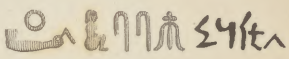
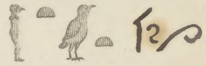
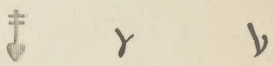
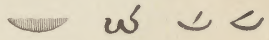
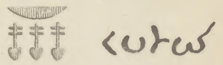
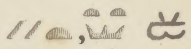
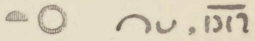
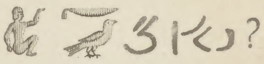
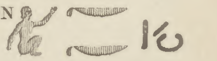
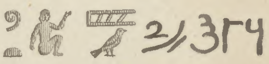
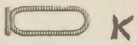
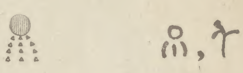
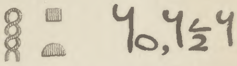
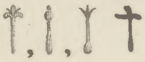
EGYPT.

HIEROGLYPHICS.

F. *ATTRIBUTES AND ACTIONS*

08. LIFE	ⲱⲛϩ, ⲁϩⲓ	
09. ETERNITY	ⲉ̀ⲛⲉϩ	
110. IMMORTAL	ⲉⲧⲟⲛϩ ⲉ̀ⲛⲉϩ	
111. JOY	ϩⲙⲟⲧ? ⲣⲁϣⲓ?	
112. POWER	ϫⲟⲙ	
113. STABILITY	ⲧⲁϫⲣⲟ	
114. ESTABLISHED	ⲧⲁϫⲣⲏⲟⲩⲧ	
115. STRENGTH	ⲁⲙⲁϩⲓ	
116. MIGHTY	ϫⲟⲣ	
117. VICTORY	ϭⲣⲟ	
118. FORTUNE		
119. SPLENDOUR	ⲱⲟⲩ, ⲟⲩⲱⲓⲛⲓ	
120. BEARING	ϥⲁⲓ	
121. ILLUSTRIOUS	ⲫⲉⲣⲓⲱⲟⲩ	
122. HONOUR	ⲧⲁⲓⲟ	
123. RESPECTABLE	ⲙ?ⲙ̇ⲡϣⲁ?	
124. VENERABLE	ⲛⲓϣⲧ? ⲛⲁⲓⲁⲧ?	
125. RITE	ⲡⲉⲧⲥϣⲉ	
126. WORPSHIP	ϣⲁⲙϣⲉ	
127. FATHER	ⲓⲱⲧ	
128. MOTHER	ⲙⲁⲩ	
129. SON	ϣⲏⲣⲓ	
130. ATTENDANT	ⲃⲱⲕ? ϣⲫⲏⲣ?	
131. DAUGHTER	ϣⲉⲣⲓ	
132. SONS	ⲛⲓϣⲏⲣⲓ	
133. CHILD	ⲁⲗⲟⲩ	
134. DIRECTOR	ⲣⲉϥⲥⲟⲩⲧⲉⲛ?	
135. STEERSMAN	ⲣⲉϥϩⲉⲙⲓ	
136. ROWER	ⲣⲉϥⲃⲟⲥⲉⲣ?	
137. KING	ⲟⲩⲣⲟ	
138. CONDITION	ⲙⲉⲧ. . .	
139. KINGDOM	ⲙⲉⲧⲟⲩⲣⲟ	
140. LIBATION	ⲱⲧⲉⲛ ⲉ̀ⲃⲟⲗ	
141. CEREMONY	ϣⲗⲏⲗ?	
142. PRIEST	ⲟⲩⲏⲃ, ϩⲟⲛⲧ	
143. PRIESTHOOD	ⲙⲉⲧⲟⲩⲏⲃ	
144. SACERDOTAL	ⲛⲧⲉ ⲛⲓϩⲟⲛⲧ	
146. ASSEMBLY	ϣⲁⲓ	
146. SACRED	ⲟⲩⲁⲃ	
147. CONSECRATED	ⲑⲟⲩⲱⲧ?	
148. GIVE	ϯ	
149. OFFER	ⲉⲛ, ⲓⲛⲓ	
150. DEDICATE	ⲧⲁϩⲟ?	
151. LAWFUL	ⲑⲙⲏⲓ	
152. GOOD	ⲛⲁⲛⲉ	
153. BESTOWING	ⲉⲧϯⲛϩⲙⲟⲧ	
154. MUNIFICENT	ⲣⲉϥⲛⲁⲛⲉϥ	
155. GREAT	ⲛⲓϣⲧ, ⲛⲁⲁ	
156. OTHERS	ⲕⲉϫⲱⲟⲩⲛⲓ	
157. CALLED	ⲉⲧϫⲱ	
158. DECLARATION	ⲱϣ, ϩⲱⲡ	
159. MANIFEST	ⲉⲧⲥⲟⲩⲉⲛ	
160. NAME	ⲣⲁⲛ	
161. ENLIGHTENING	ⲣⲉϥⲉⲣⲟⲩⲱⲓⲛⲓ	
162. LOVING	ⲙⲁⲓ, ⲙⲉⲛⲣⲏⲧ	
163. PRESERVER	ⲉⲑⲛⲟϩⲉⲙ	

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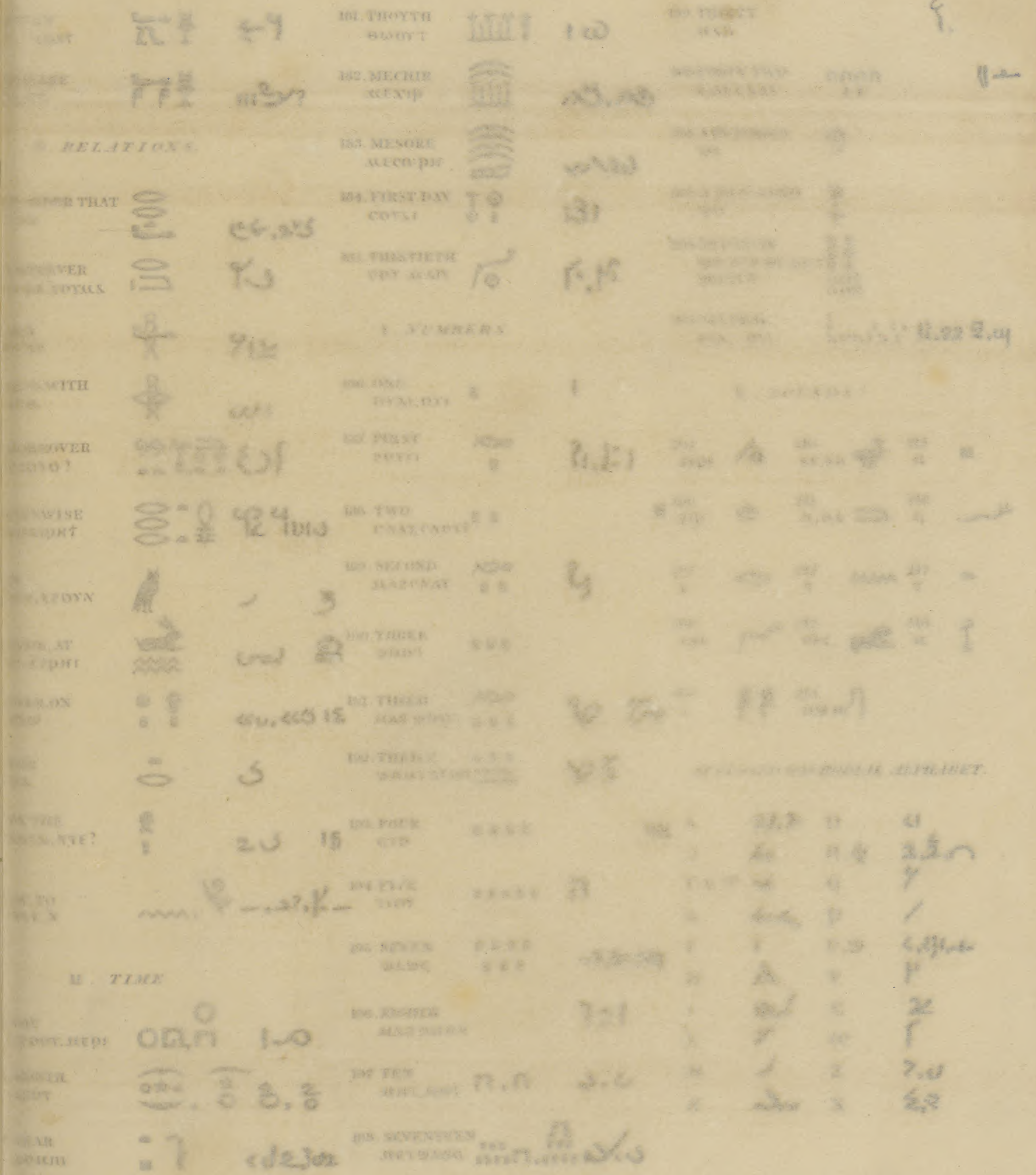
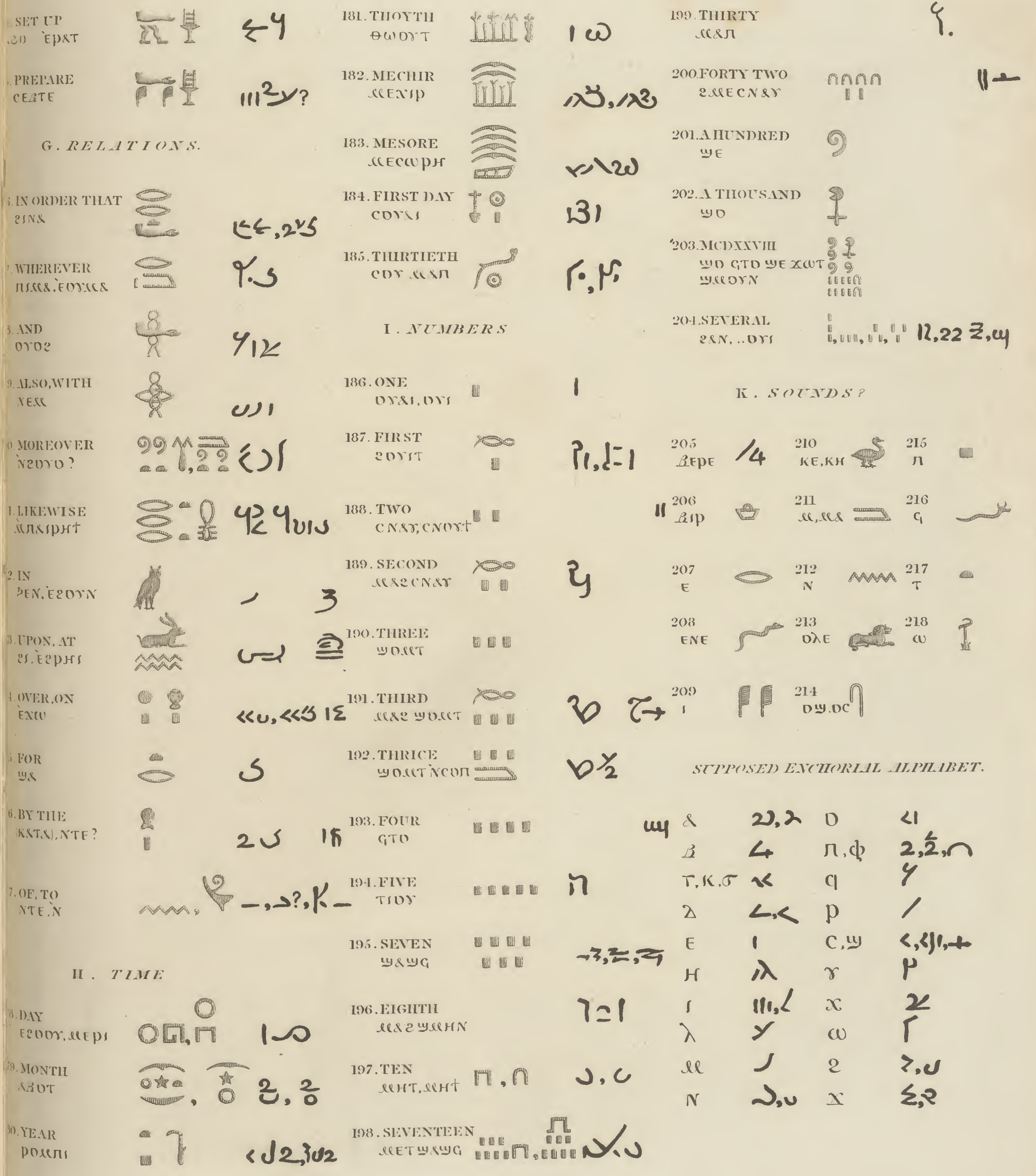
HIEROGLYPHICS.



EGYPT.

HIEROGLYPHICS.



. SET UP
ⲍⲟ ̀ⲉⲣⲁⲧ

. PREPARE
ⲥⲉⲃⲧⲉ

G. RELATIONS.

6. IN ORDER THAT
ϩⲓⲛⲁ

7. WHEREVER
ⲡⲓⲙⲁ.̀ⲉⲟⲩⲙⲁ

8. AND
ⲟⲩⲟϩ

9. ALSO, WITH
ⲛⲉⲙ

0. MOREOVER
̀ⲛϩⲟⲩⲟ?

1. LIKEWISE
ⲙ̀ⲡⲁⲓⲣⲏϯ

2. IN
ϧⲉⲛ.̀ⲉϩⲟⲩⲛ

3. UPON, AT
ϩⲓ.̀ⲉϩⲣⲏⲓ

4. OVER, ON
̀ⲉϫⲱ

5. FOR
ϣⲁ

6. BY THE
(ⲕⲁⲧⲁ), ⲛⲧⲉ?

7. OF, TO
ⲛⲧⲉ.̀ⲛ

H. TIME

8. DAY
ⲉϩⲟⲟⲩ, ⲙⲉⲣⲓ

9. MONTH
ⲁⲃⲟⲧ

0. YEAR
ⲣⲟⲙⲡⲓ

181. THOYTH
ⲑⲱⲟⲩⲧ

182. MECHIR
ⲙⲉⲭⲓⲣ

183. MESORE
ⲙⲉⲥⲱⲣⲏ

184. FIRST DAY
ⲥⲟⲩⲁⲓ

185. THIRTIETH
ⲥⲟⲩ ⲙⲁⲡ

I. NUMBERS

186. ONE
ⲟⲩⲁⲓ, ⲟⲩⲓ

187. FIRST
ϩⲟⲩⲓⲧ

188. TWO
ⲥⲛⲁⲩ, ⲥⲛⲟⲩϯ

189. SECOND
ⲙⲁϩⲥⲛⲁⲩ

190. THREE
ϣⲟⲙⲧ

191. THIRD
ⲙⲁϩ ϣⲟⲙⲧ

192. THRICE
ϣⲟⲙⲧ ̀ⲛⲥⲟⲡ

193. FOUR
ϥⲧⲟ

194. FIVE
ϯⲟⲩ

195. SEVEN
ϣⲁϣϥ

196. EIGHTH
ⲙⲁϩ ϣⲙⲏⲛ

197. TEN
ⲙⲏⲧ, ⲙⲏϯ

198. SEVENTEEN
ⲙⲉⲧϣⲁϣϥ

199. THIRTY
ⲙⲁⲡ

200. FORTY TWO
ϩⲙⲉⲥⲛⲁⲩ

201. A HUNDRED
ϣⲉ

202. A THOUSAND
ϣⲟ

203. MCDXXVIII
ϣⲟ ϥⲧⲟ ϣⲉ ϫⲱⲧ
ϣⲙⲟⲩⲛ

204. SEVERAL
ϩⲁⲛ, ..ⲟⲩⲓ

K. SOUNDS?

205 ⲃⲉⲣⲉ	210 ⲕⲉ, ⲕⲏ	215 ⲡ
206 ⲃⲓⲣ	211 ⲙ, ⲙⲁ	216 ϥ
207 ⲉ	212 ⲛ	217 ⲧ
208 ⲉⲛⲉ	213 ⲟⲗⲉ	218 ⲱ
209 ⲓ	214 ⲟϣ.ⲟⲥ	

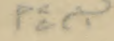
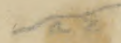
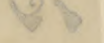
SUPPOSED ENCHORIAL ALPHABET.

ⲁ
ⲃ
ⲅ, ⲕ, ϭ
ⲇ
ⲉ
ⲏ
ⲓ
ⲗ
ⲙ
ⲛ
ⲟ
ⲡ, ⲫ
ϥ
ⲣ
ⲥ, ϣ
ⲩ
ⲭ
ⲱ
ϩ
ϫ

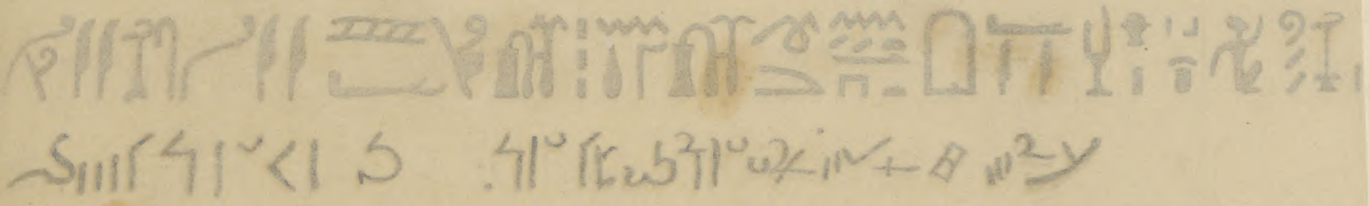
Eng.d by [illegible]kman, Edin.

EGYPT.

HIEROGLYPHICS.

L. ADDITIONS 21 * Damalis  78 * CROCODILE a  , b 155* UPPER , LOWER 

M. SPECIMENS OF PHRASES. ROS. INSCR. LAST LINE.



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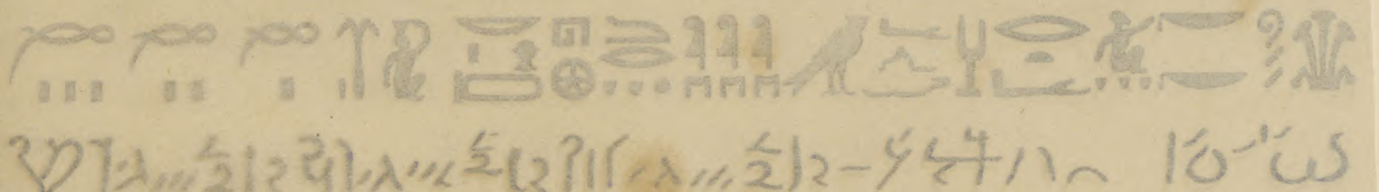

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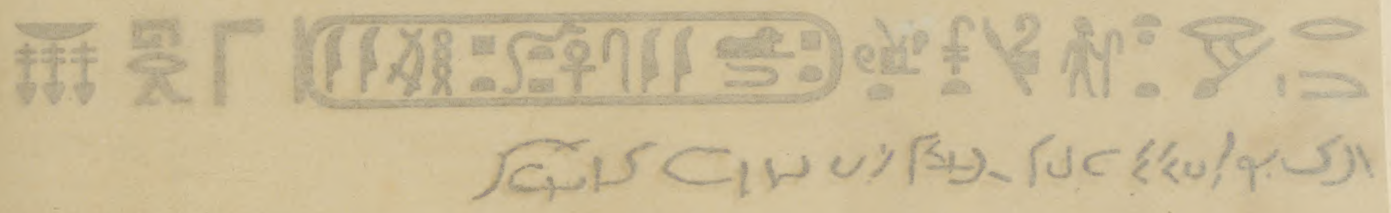
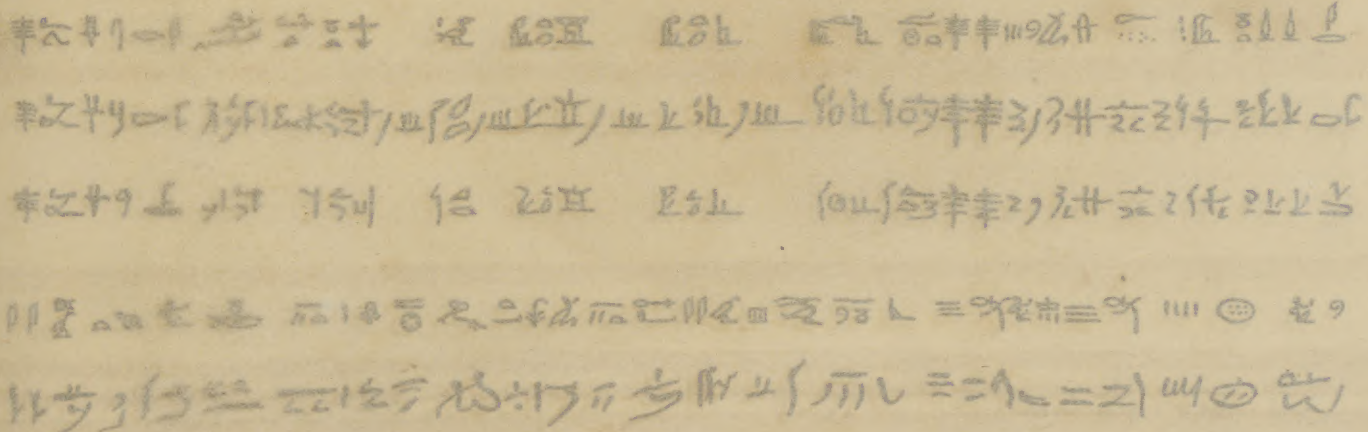
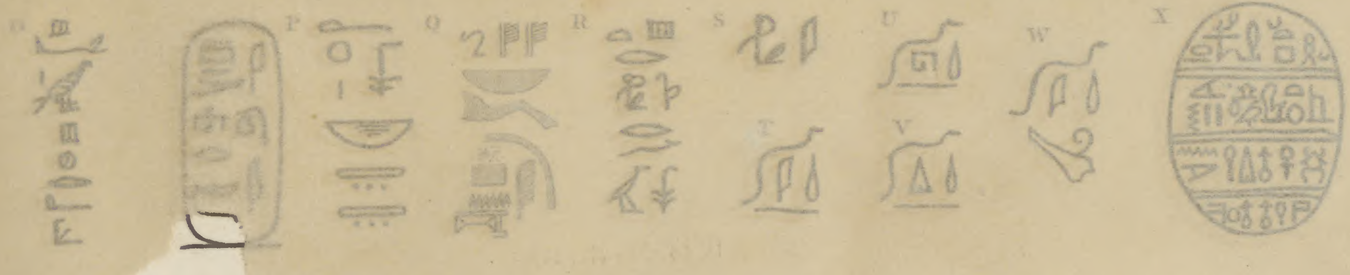


N. COMPARISON OF MANUSCRIPTS.





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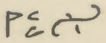
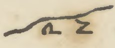
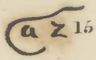
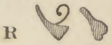
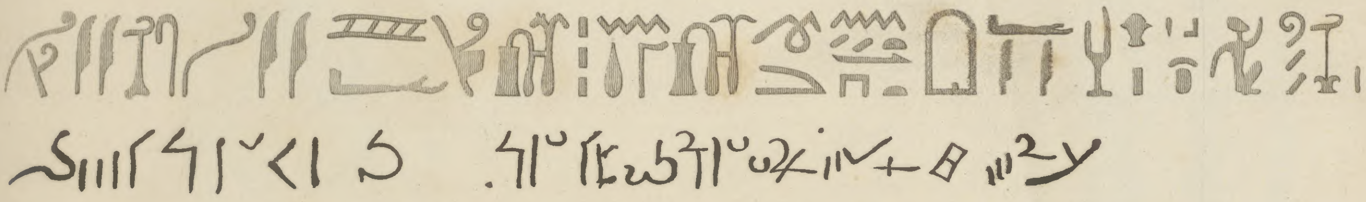
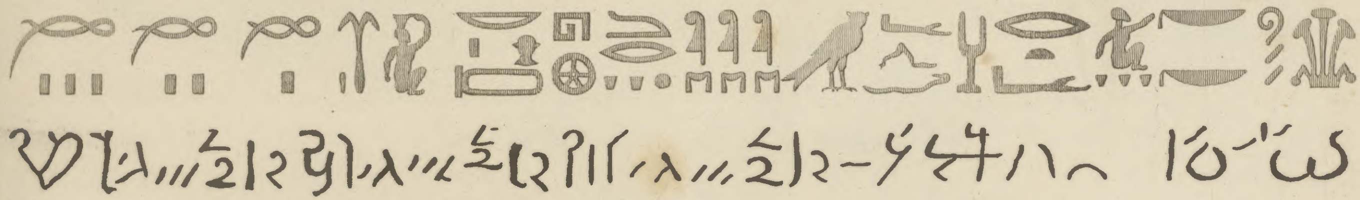
HIEROGLYPHICS.

L. *ADDITIONS* 21 * Damalis  78 * CROCODILE a  , b  155 * UPPER, LOWER 

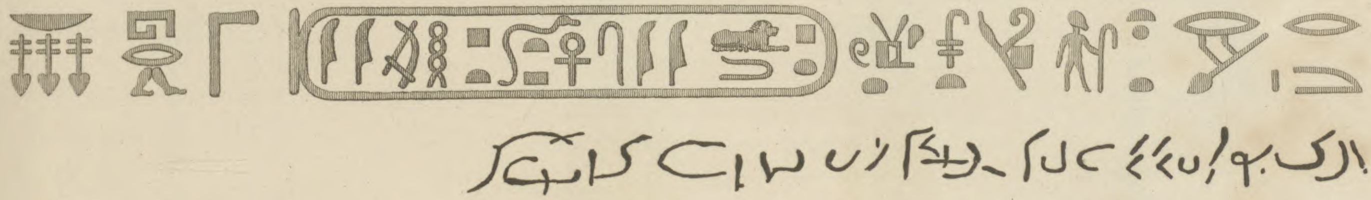
M. *SPECIMENS OF PHRASES. ROS. INSCR. LAST LINE.*



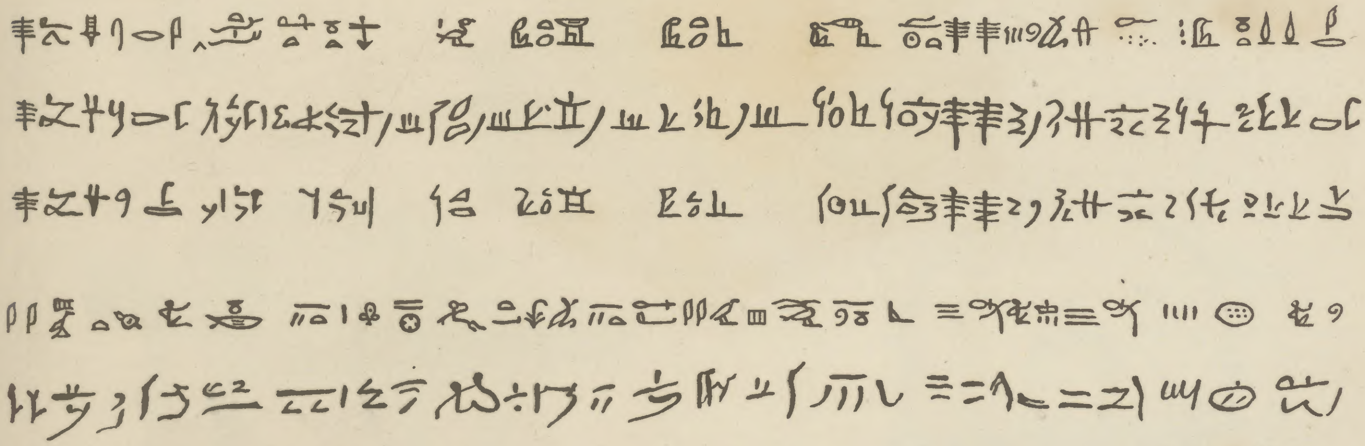
.... ΣΤΕΡΕΟΥΛΙΘΟΥΤΟΙΣΤΕΙΕΡΟΙΣΚΑΙΕΓΧΩΡΙΟΙΣΚΑΙΕΛΛΗΝΙΚΟΙΣΓΡΑΜΜΑΣΙΝ



ΚΑΙΣΤΗΣΑΙΕΝΕΚΑΣΤΩΙΤΩΝΤΕΠΡΩΤΩΝΚΑΙΔΕΥΤΕΡΩΝ ....



N. *COMPARISON OF MANUSCRIPTS.*



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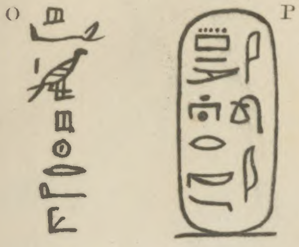

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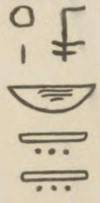

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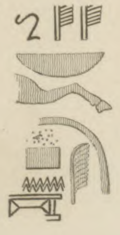

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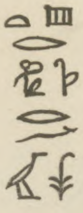

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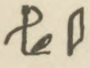

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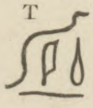

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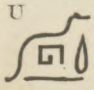

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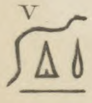

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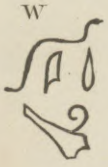

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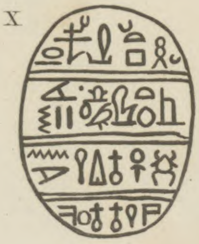

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Fig. 1.

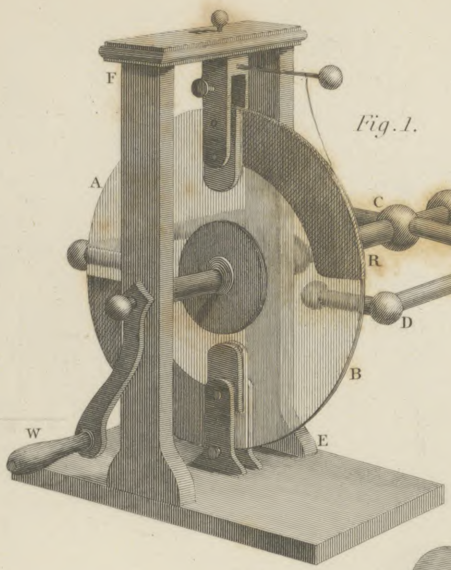


Fig. 2.

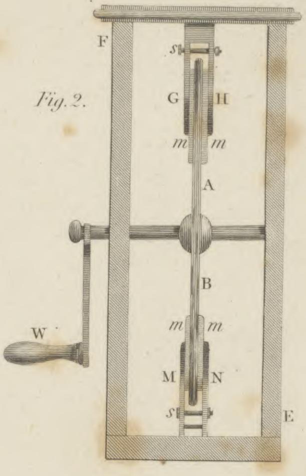
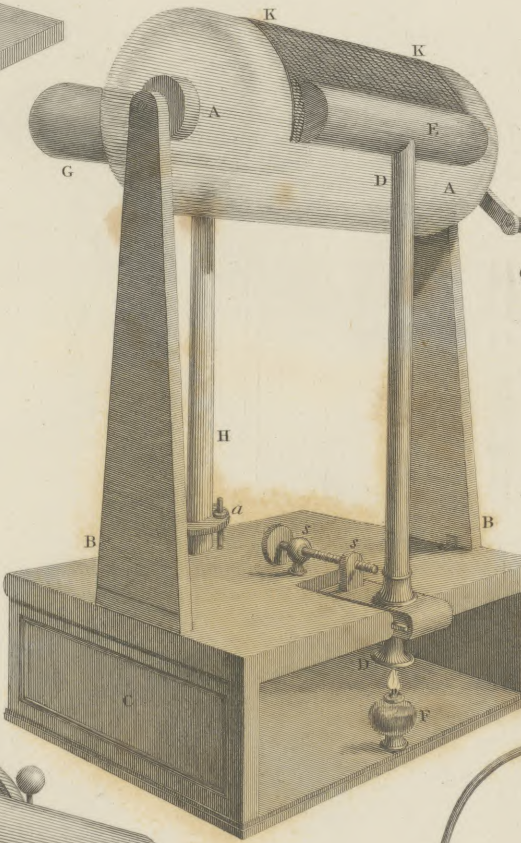


Fig. 3.



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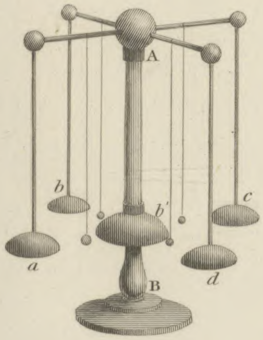


Fig. 5.

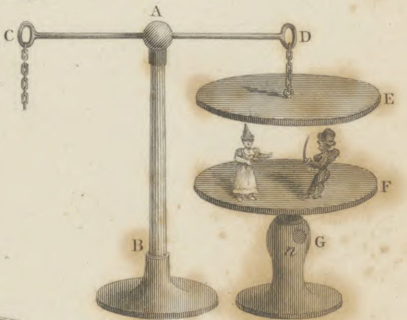


Fig. 6.

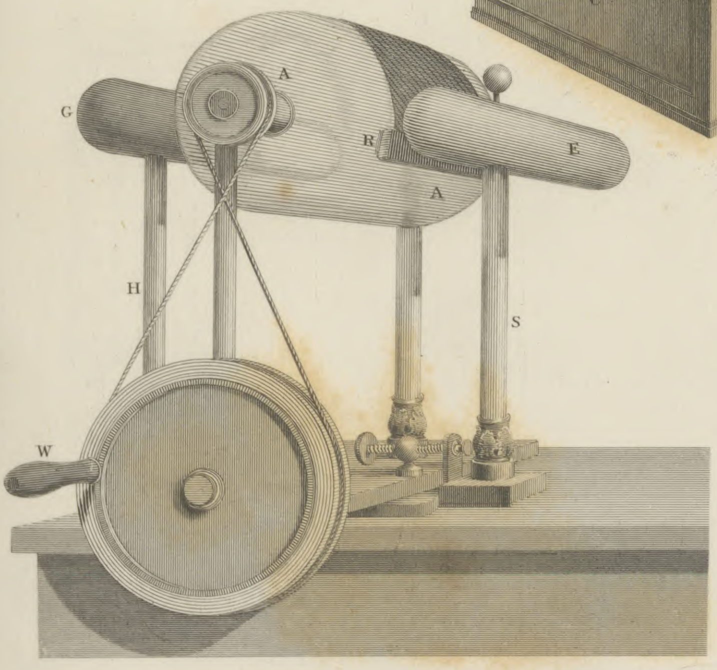
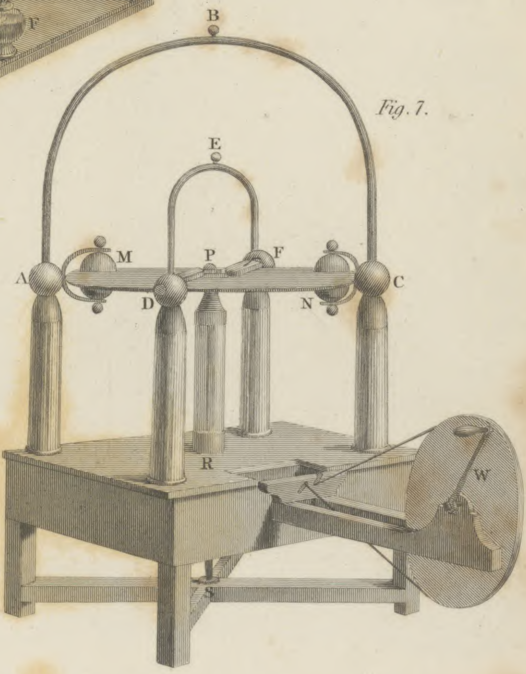


Fig. 7.



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ELECTRICITY. PLATE CCX.

Fig. 6.

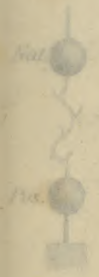


Fig. 7.

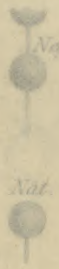


Fig. 8.

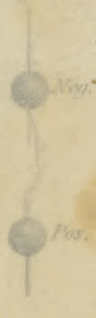
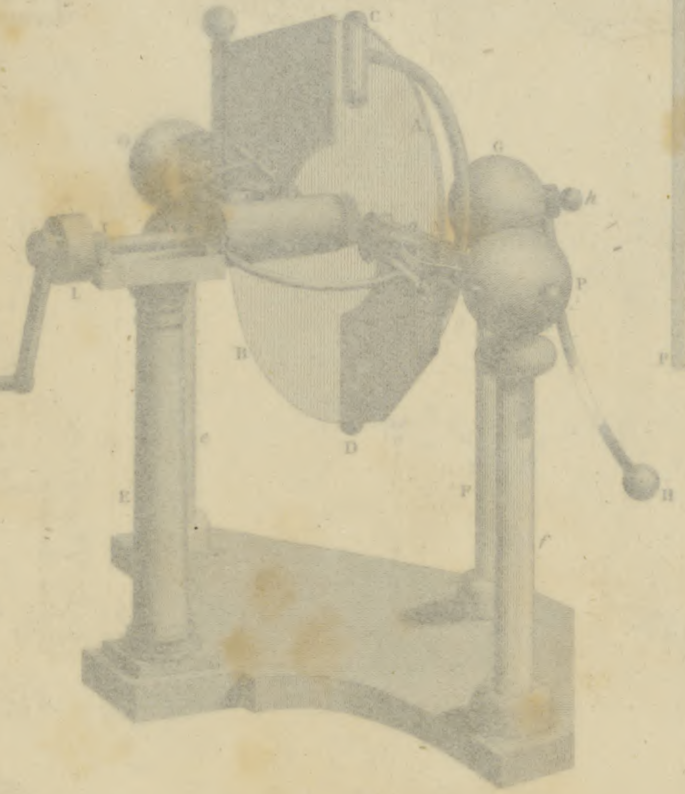


Fig. 1.



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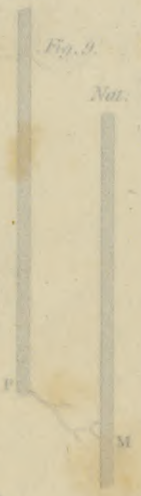

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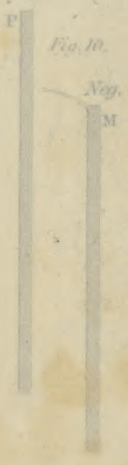

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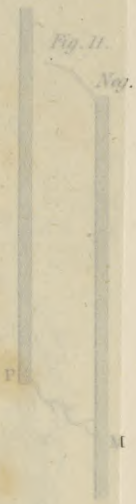

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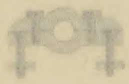

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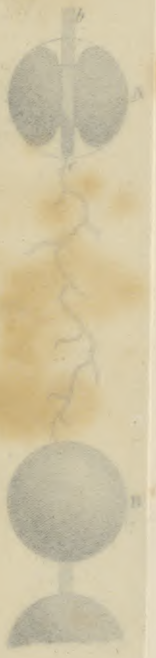

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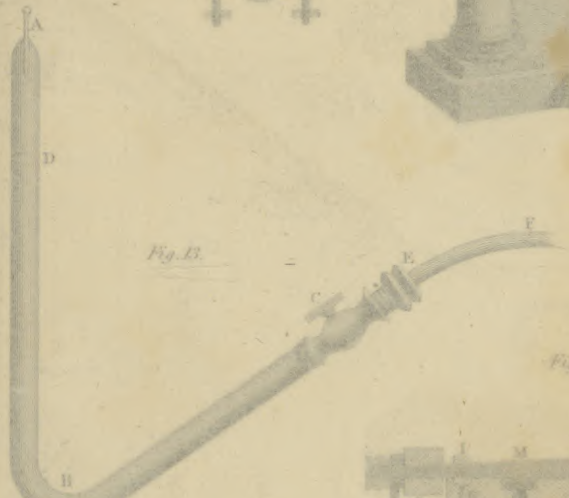

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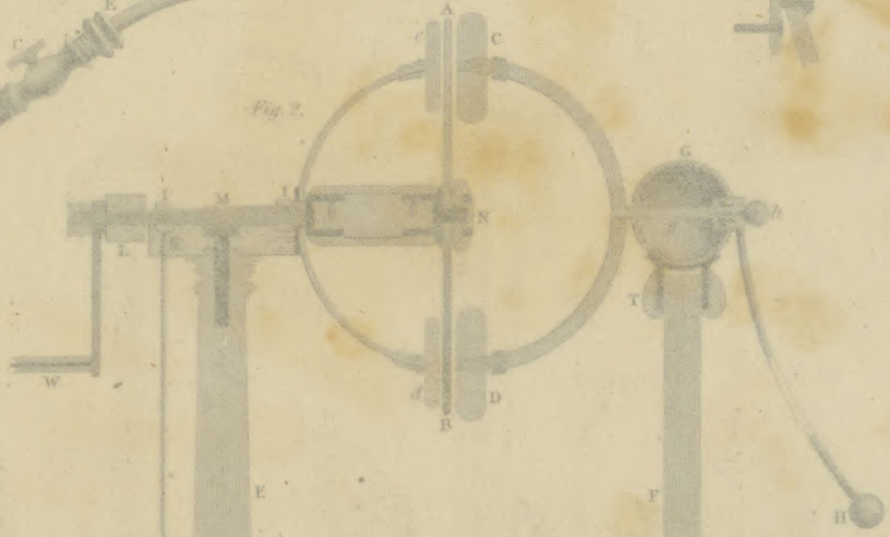

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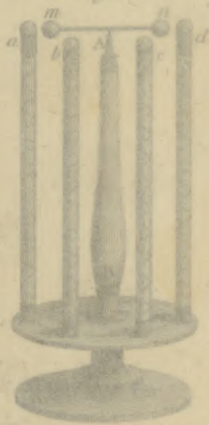

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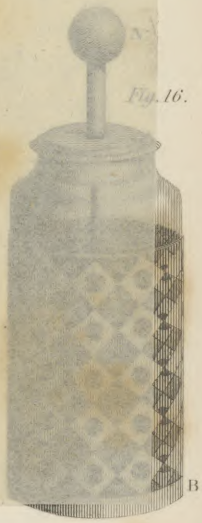

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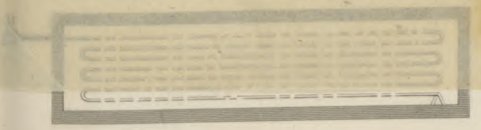

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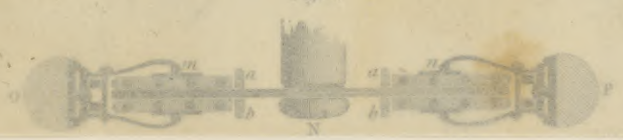

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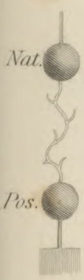
ELECTRICITY.

PLATE CCX.

Fig. 6.



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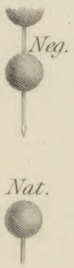

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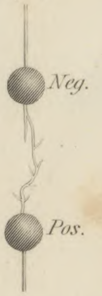

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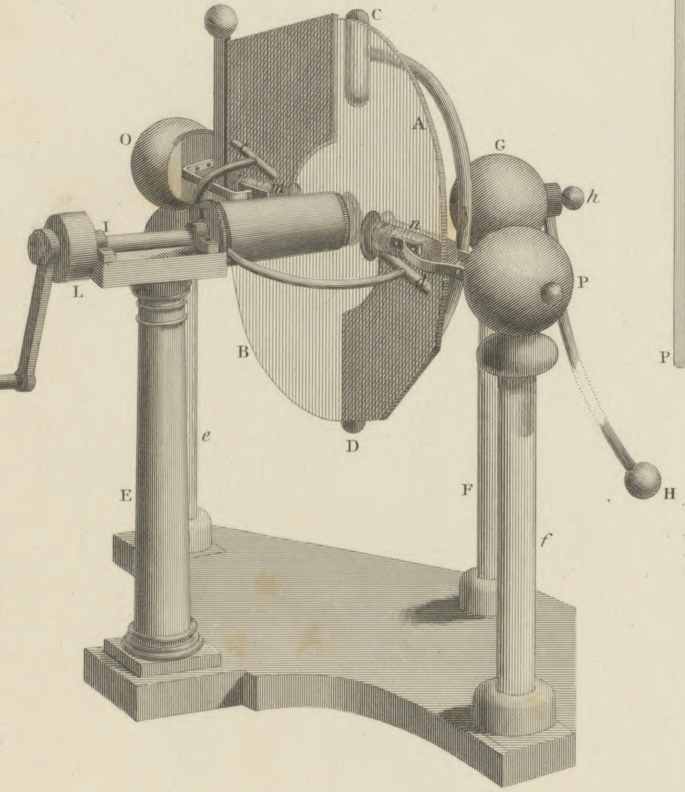

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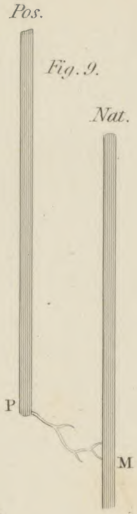

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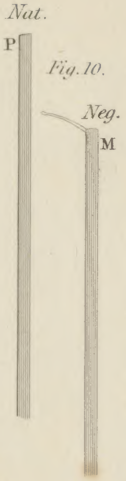

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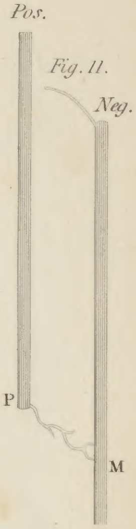

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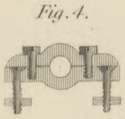

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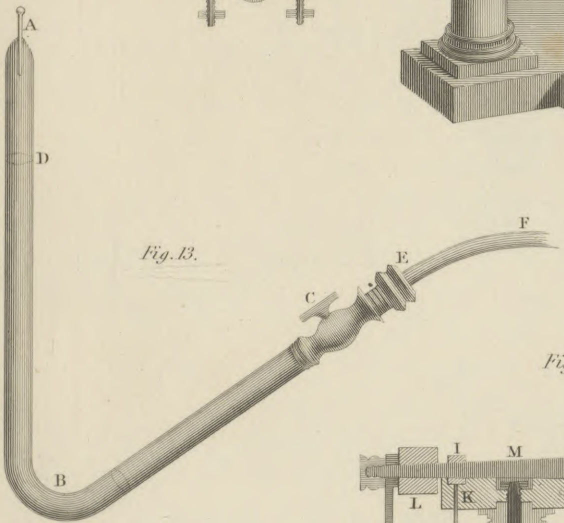

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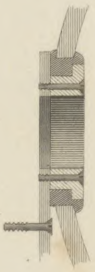

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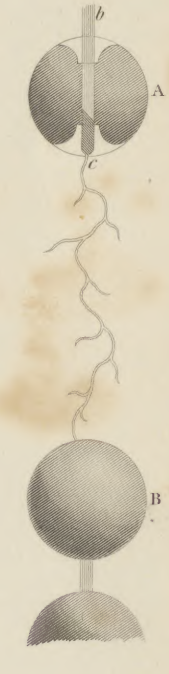

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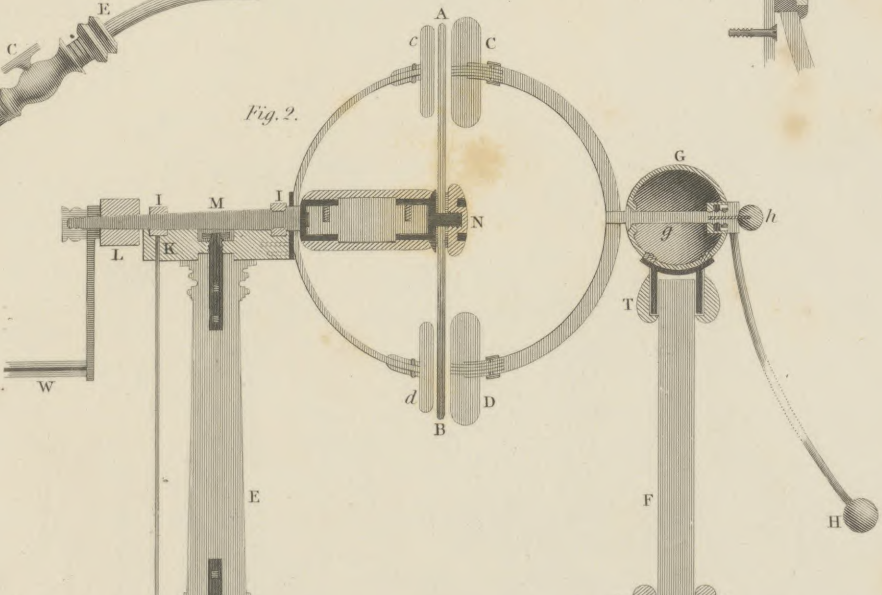

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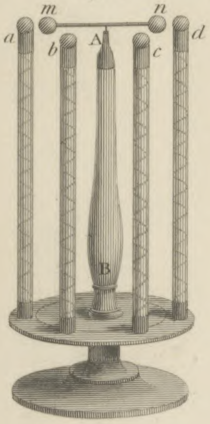

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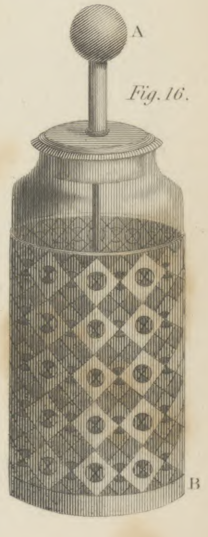

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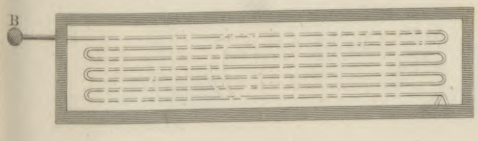

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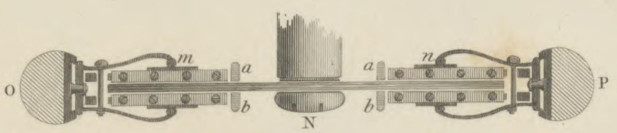

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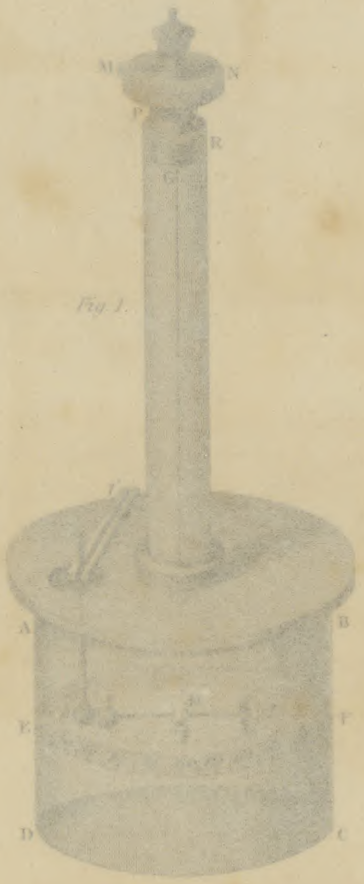

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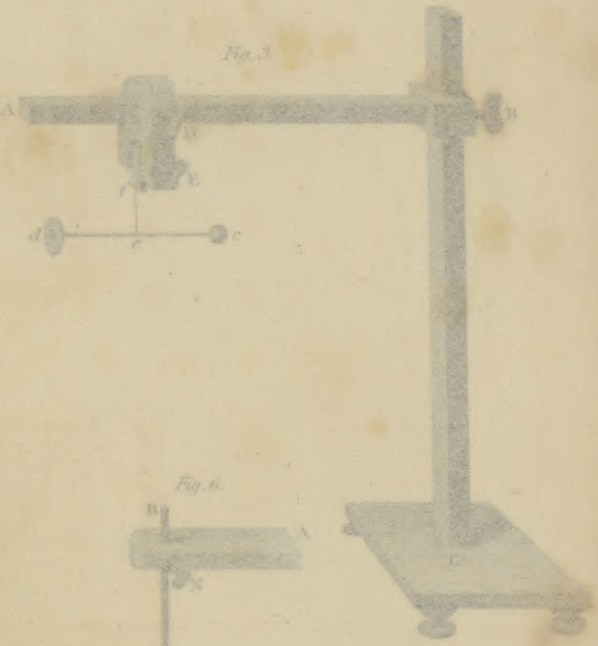

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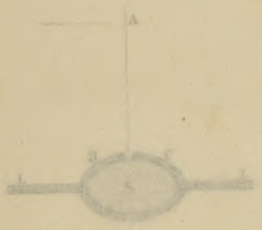

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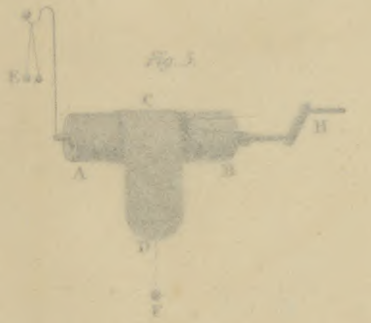

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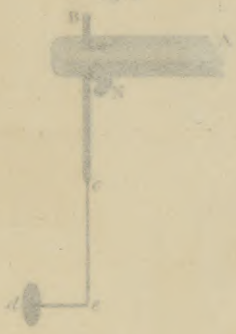

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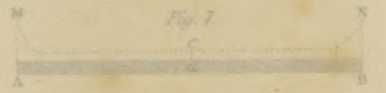

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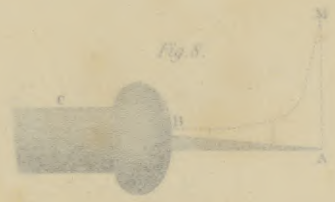

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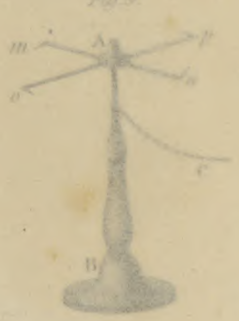

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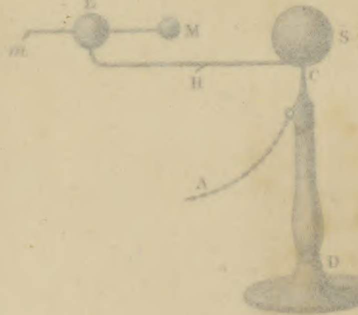

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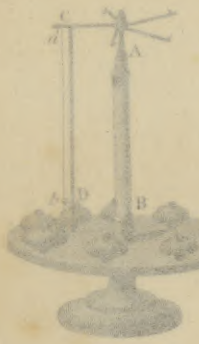

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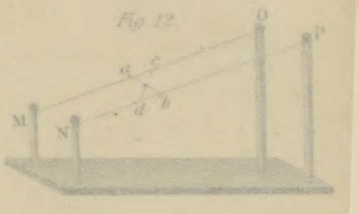

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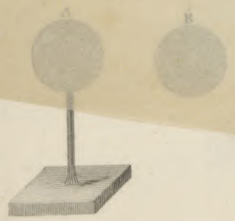

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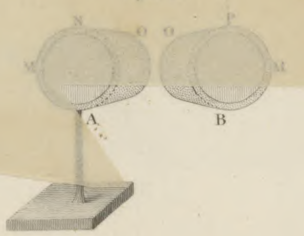

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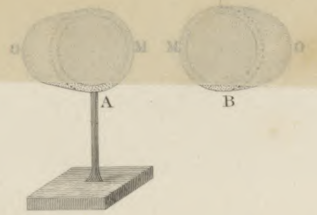

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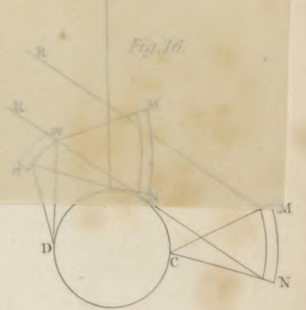

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ELECTRICITY.

PLATE CCXI.

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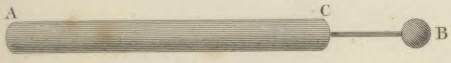

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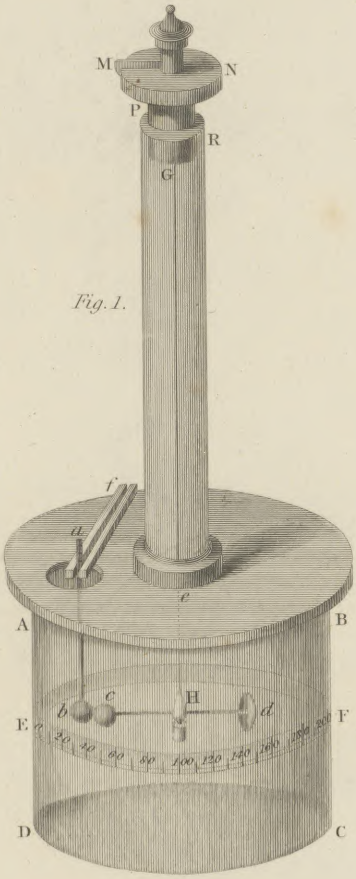

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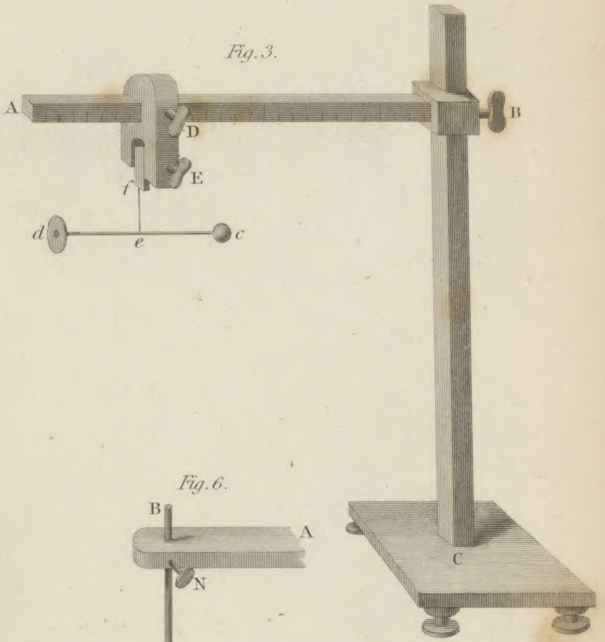

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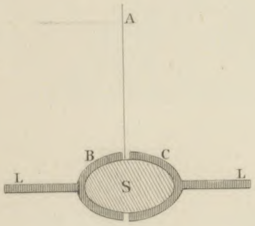

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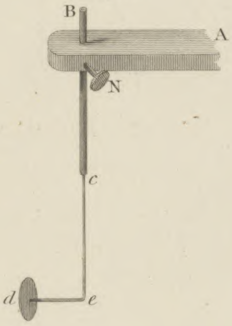

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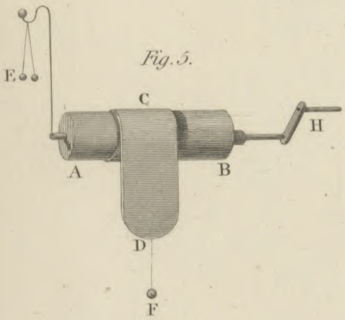

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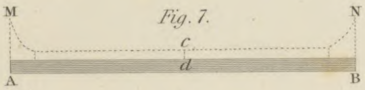

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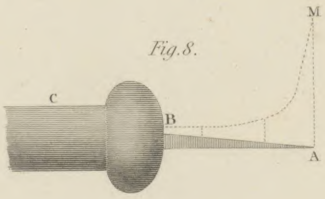

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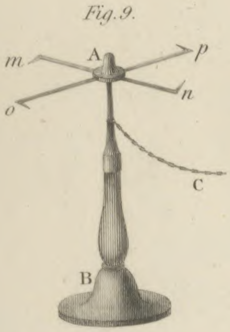

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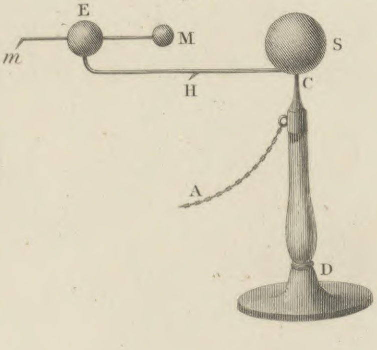

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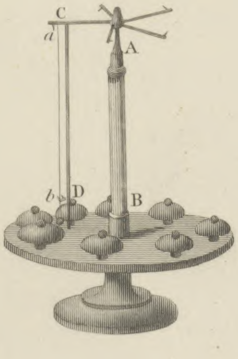

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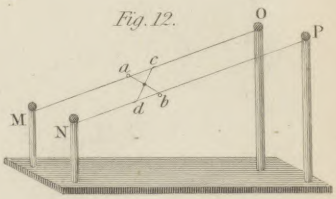

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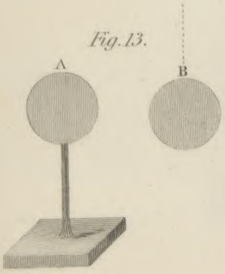

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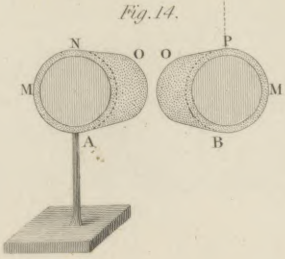

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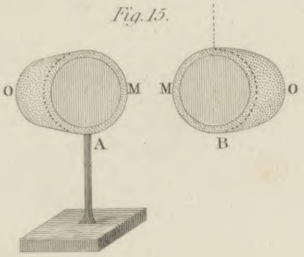

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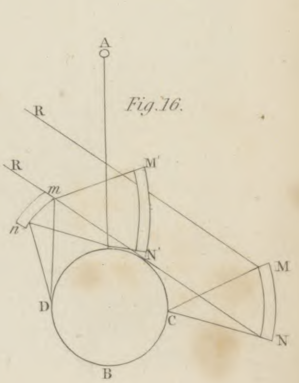

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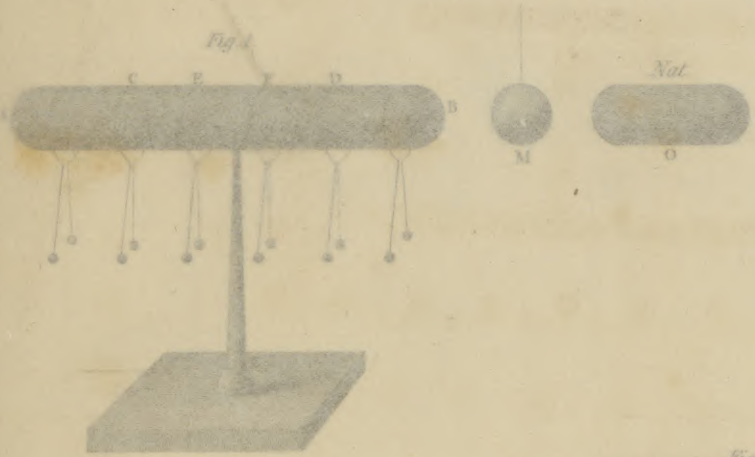

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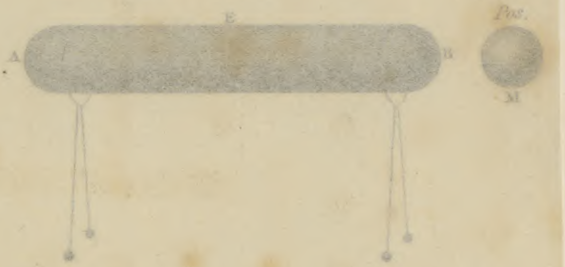

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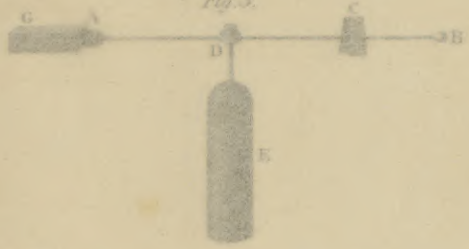

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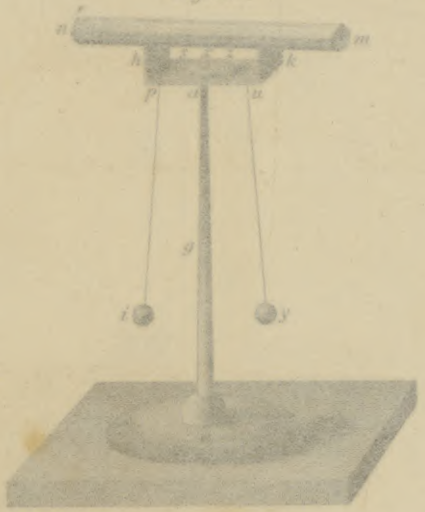

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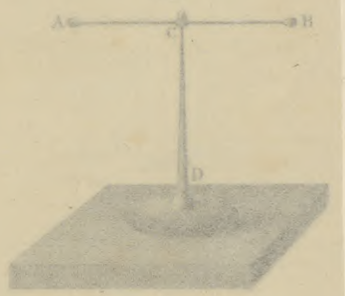

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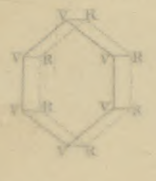

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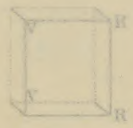

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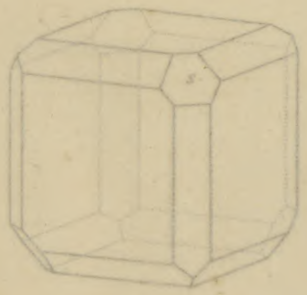

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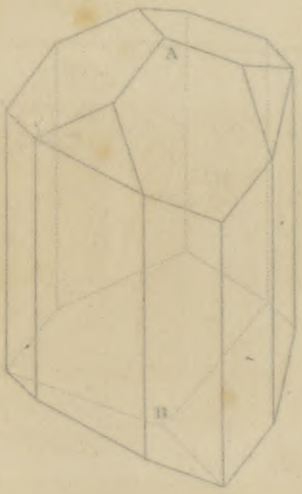

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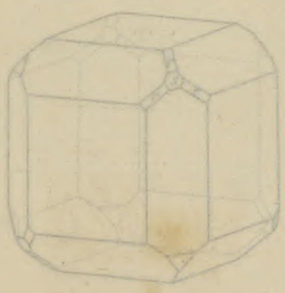

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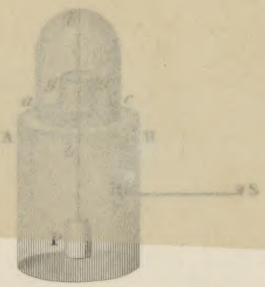

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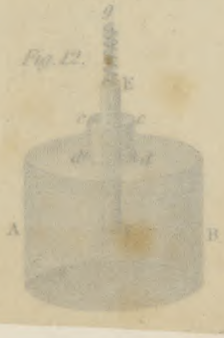

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ELECTRICITY.

PLATE CCXII.

Fig. 1.

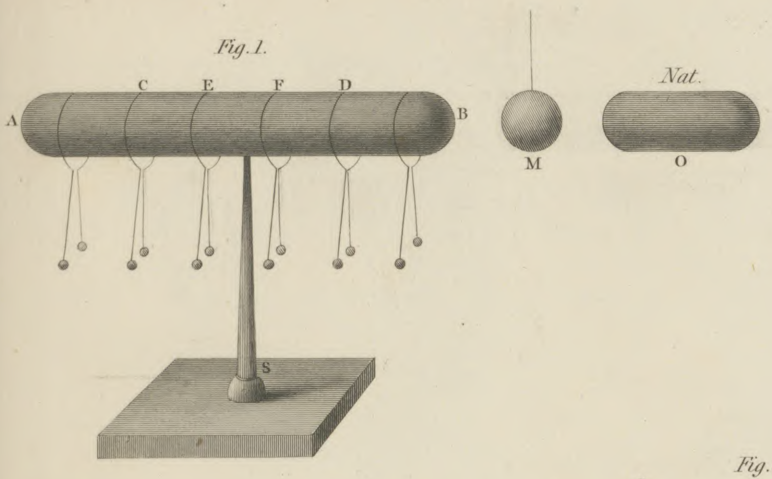


Fig. 2.

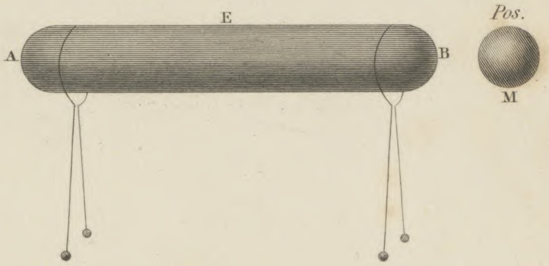


Fig. 3.

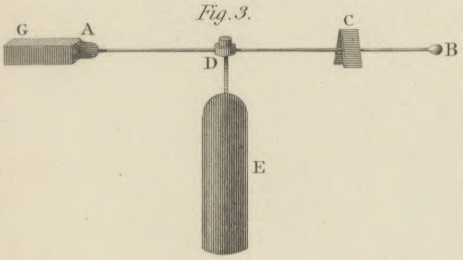


Fig. 5.

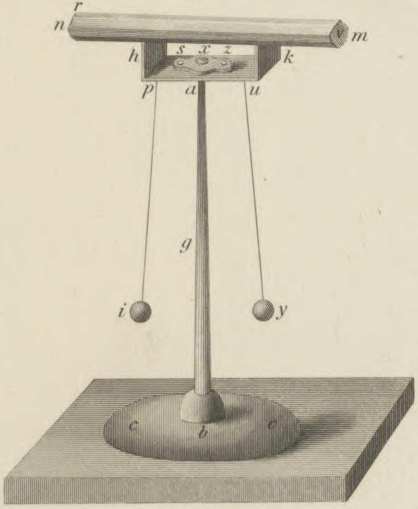


Fig. 4.

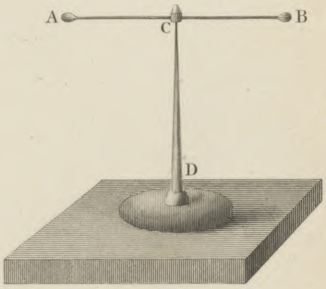
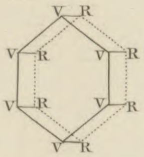


Fig. 6.



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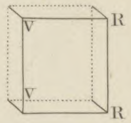

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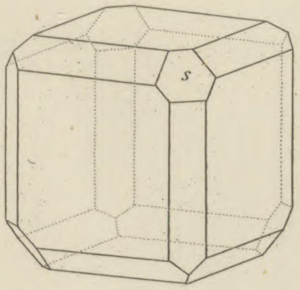

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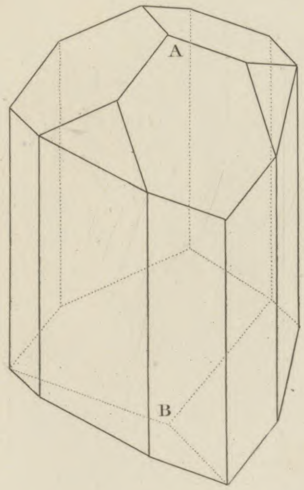

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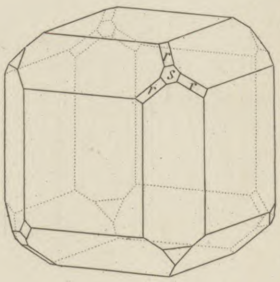


Fig. 11.

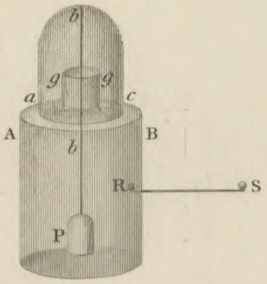
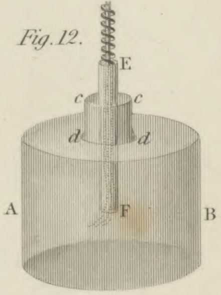


Fig. 12.



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TORPEDO.

Fig. 1.

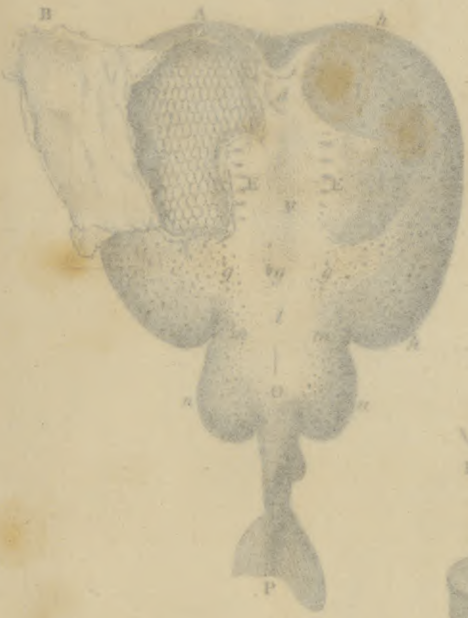


Fig. 2.

GYMNOTUS.

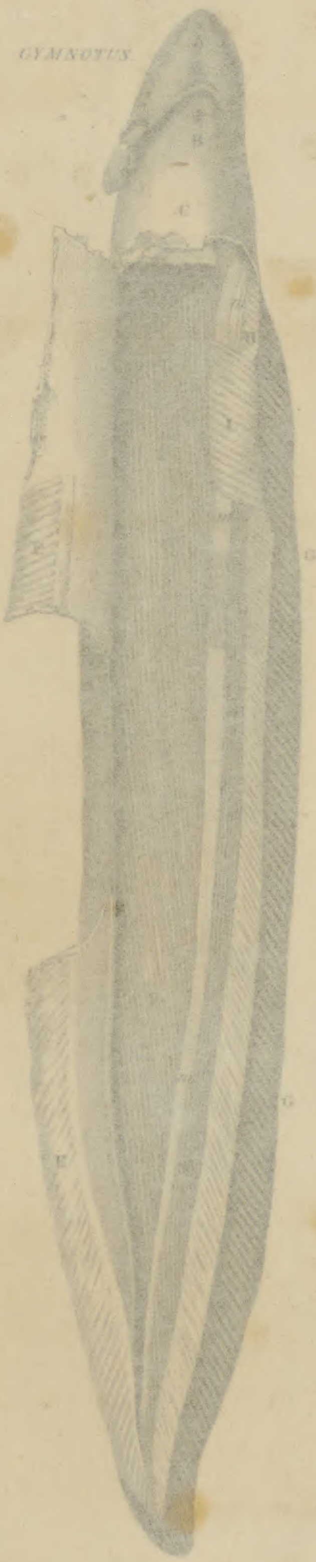


Fig. 3.

SILURUS.

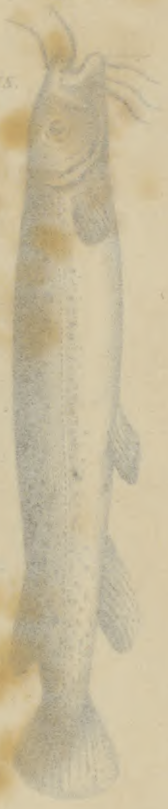
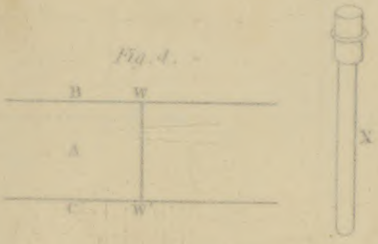


Fig. 4.



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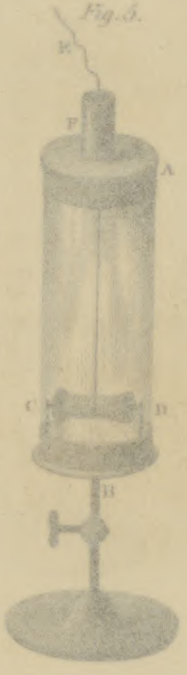

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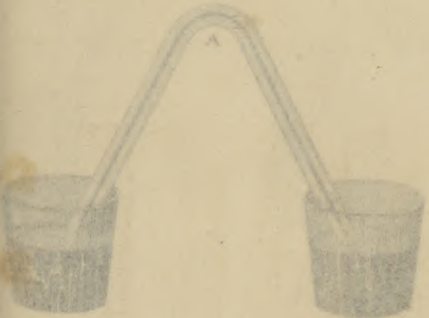

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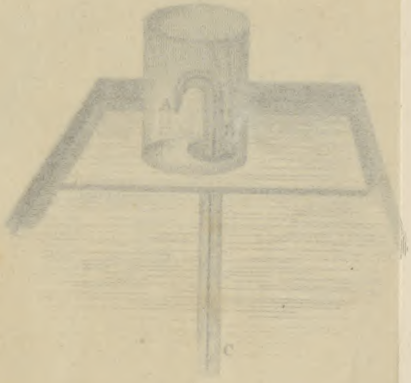

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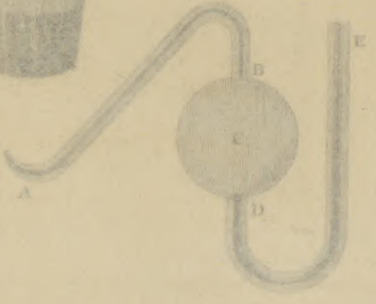

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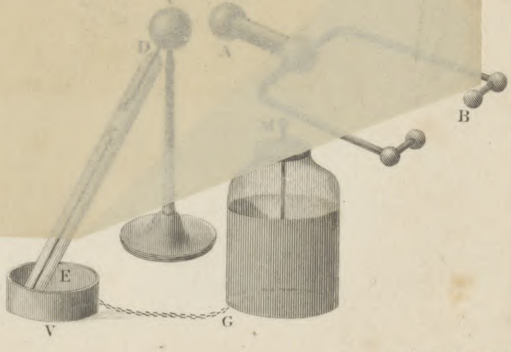

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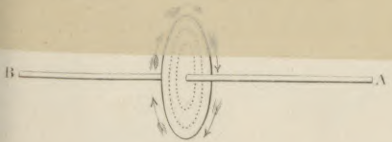
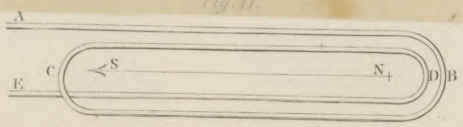


Fig. 11.



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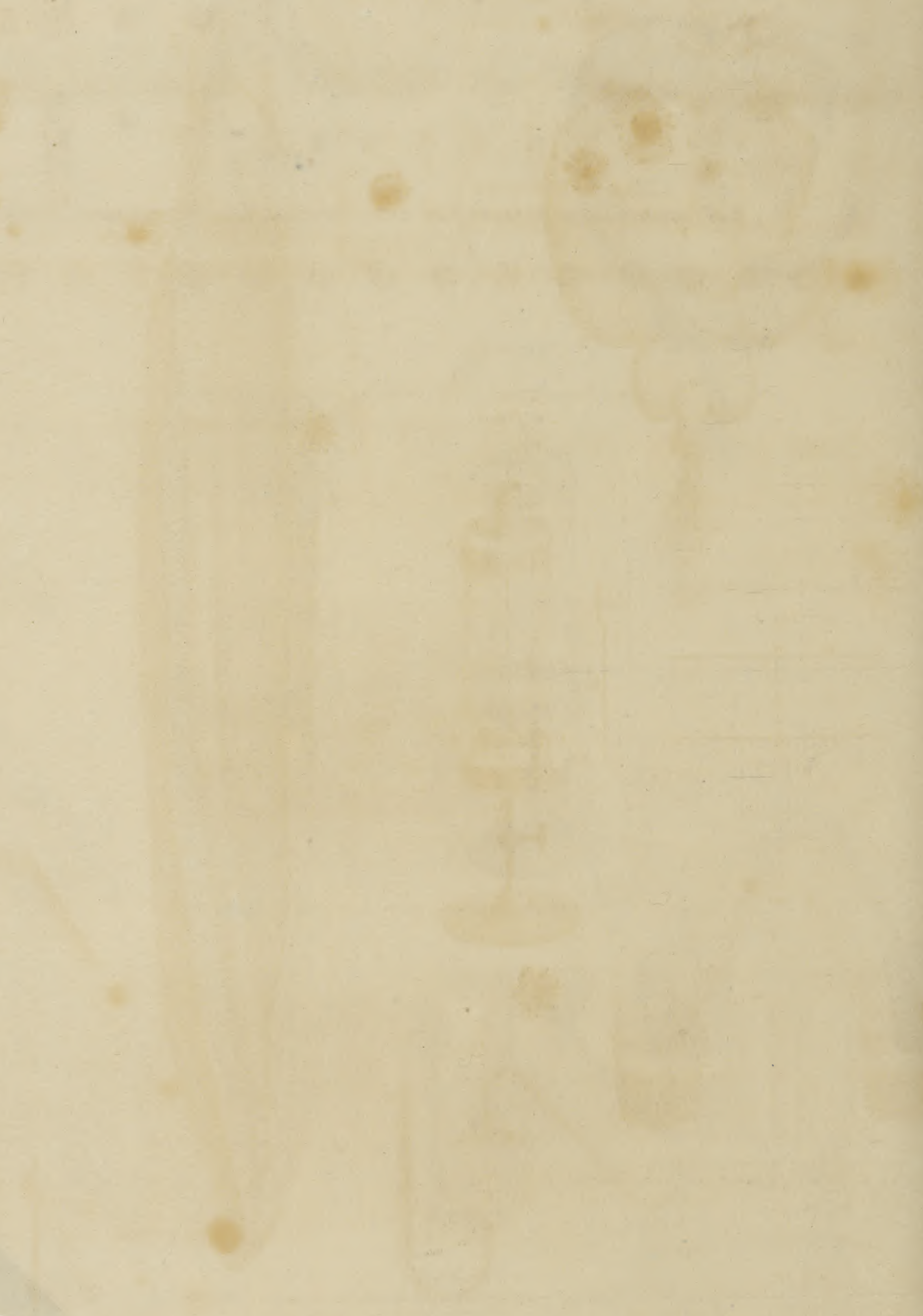


ELECTRICITY.

PLATE CCXIII.

TORPEDO.

Fig. 1.

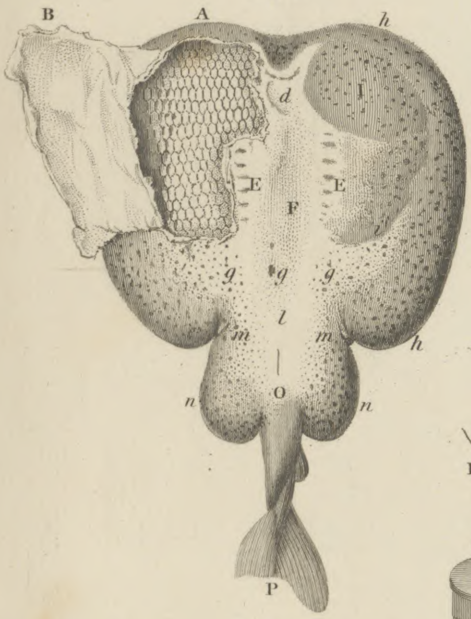


Fig. 2.

GYMNOTUS.

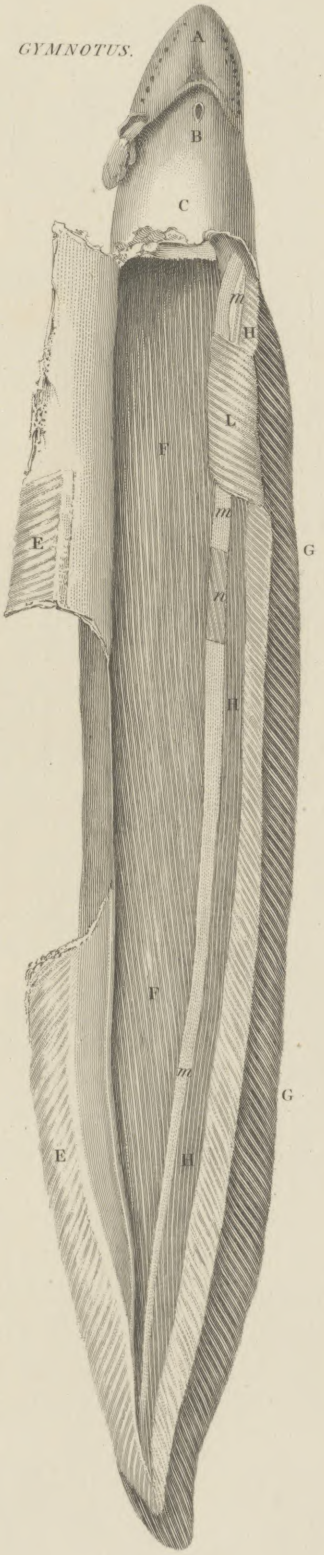


Fig. 3.

SILURUS.

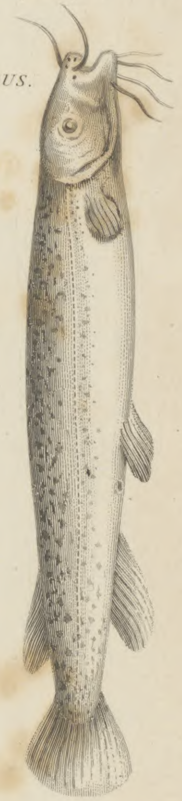


Fig. 4.

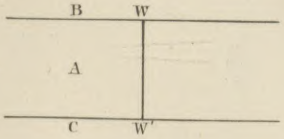


Fig. 5.

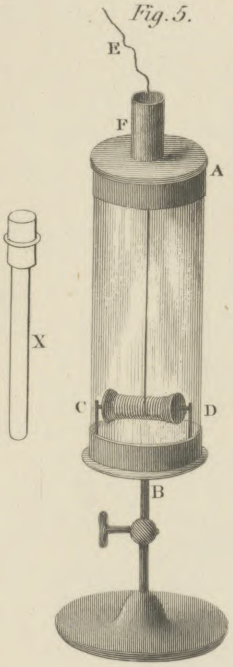


Fig. 6.

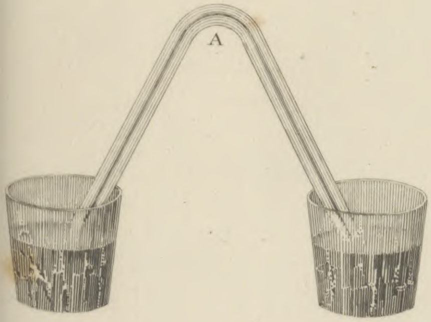
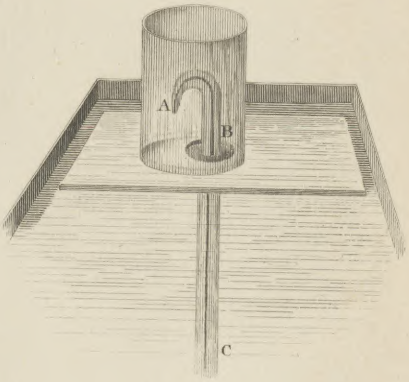


Fig. 7.



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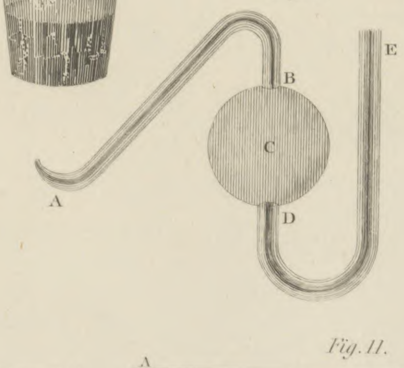
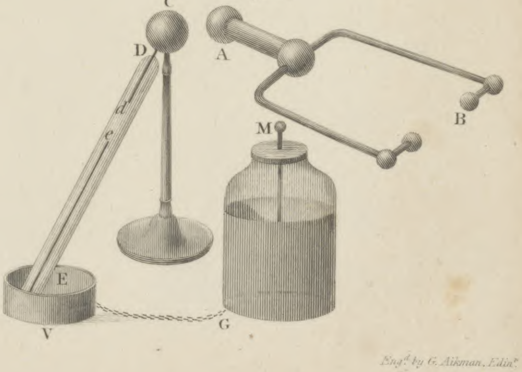


Fig. 9.



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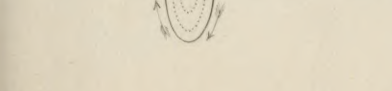

Fig. 11.

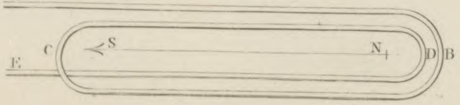

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Fig. 1.

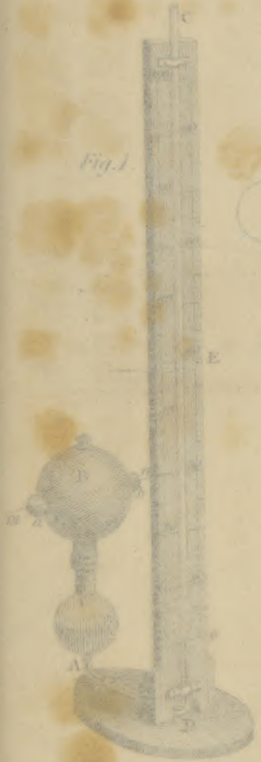


Fig. 2.

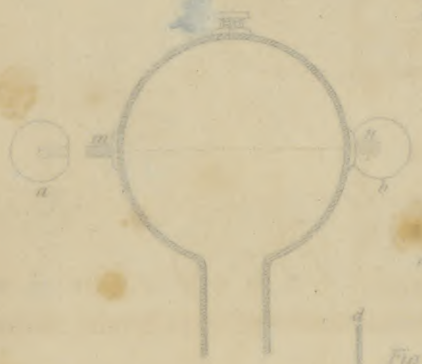


Fig. 3.

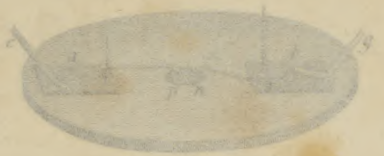
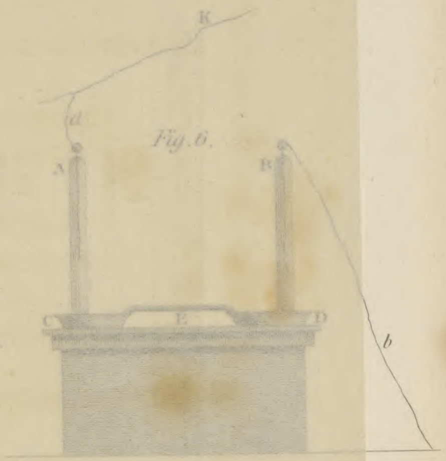


Fig. 6.



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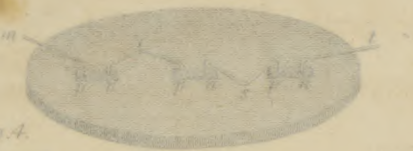


Fig. 4.

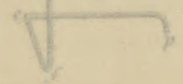


Fig. 12.

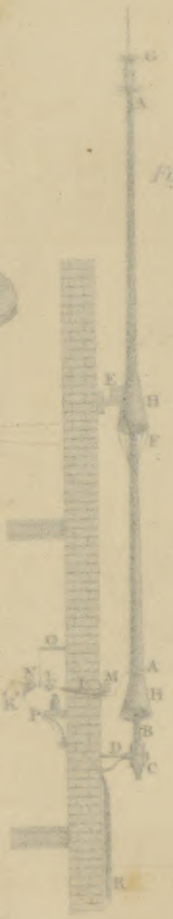


Fig. 7.

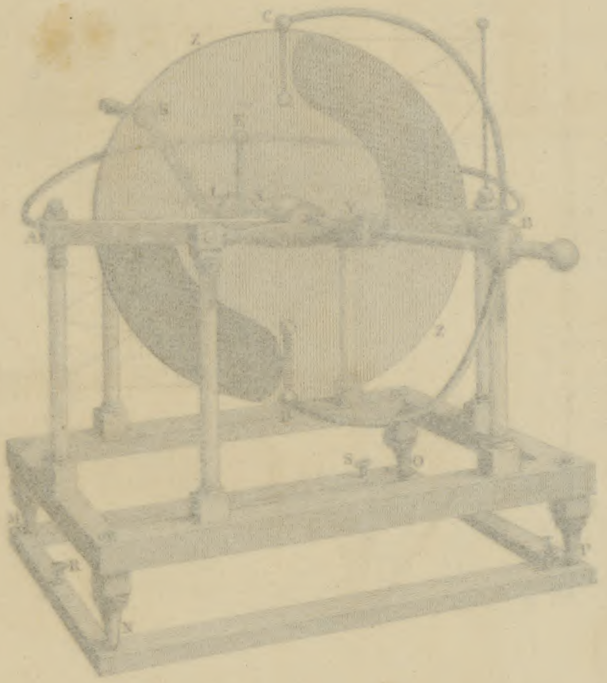
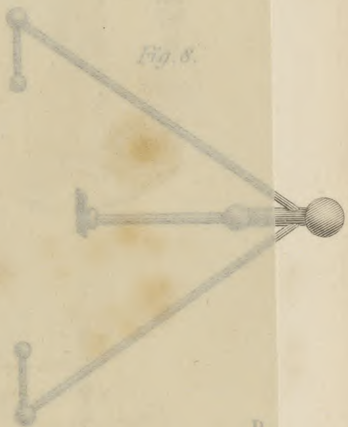


Fig. 8.



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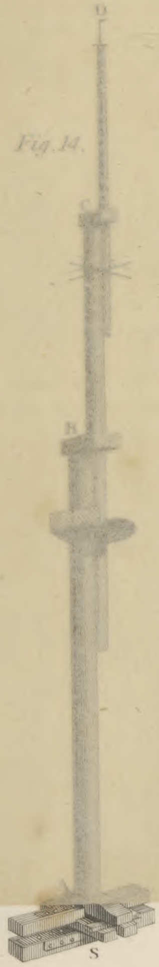


Fig. 15.

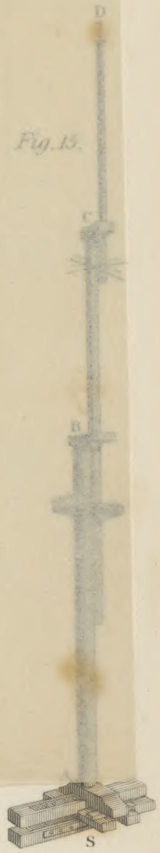
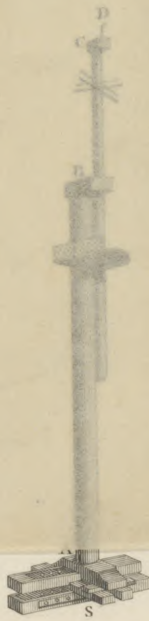


Fig. 16.



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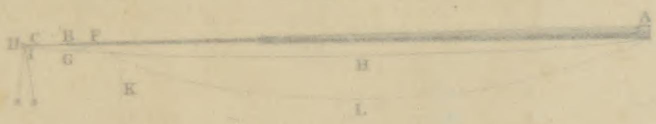

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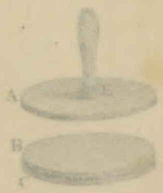

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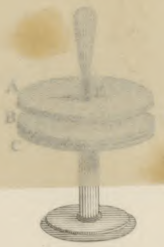

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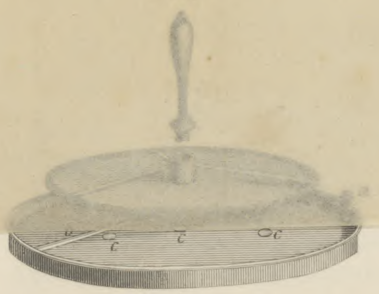

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ELECTRICITY.

PLATE CCXIV.

Fig. 1.

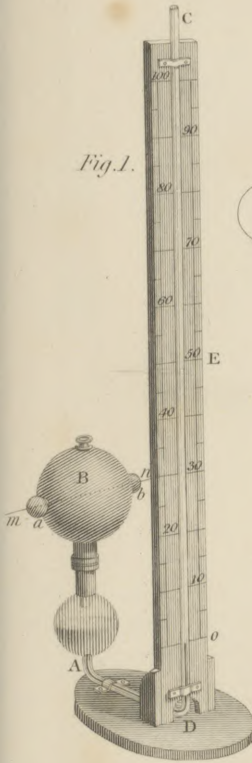


Fig. 2.

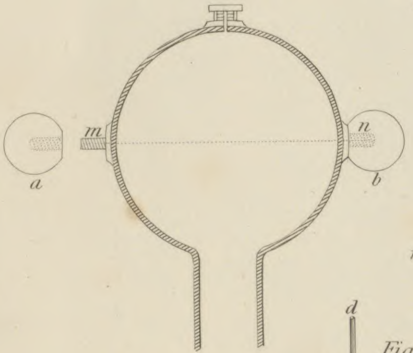


Fig. 3.

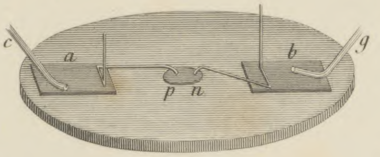


Fig. 6.

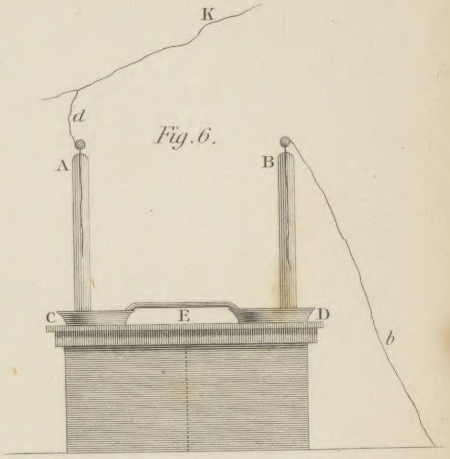


Fig. 5.

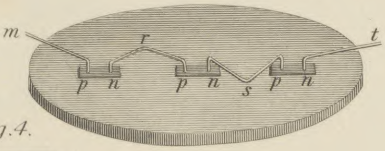


Fig. 4.

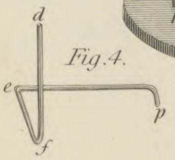


Fig. 7.

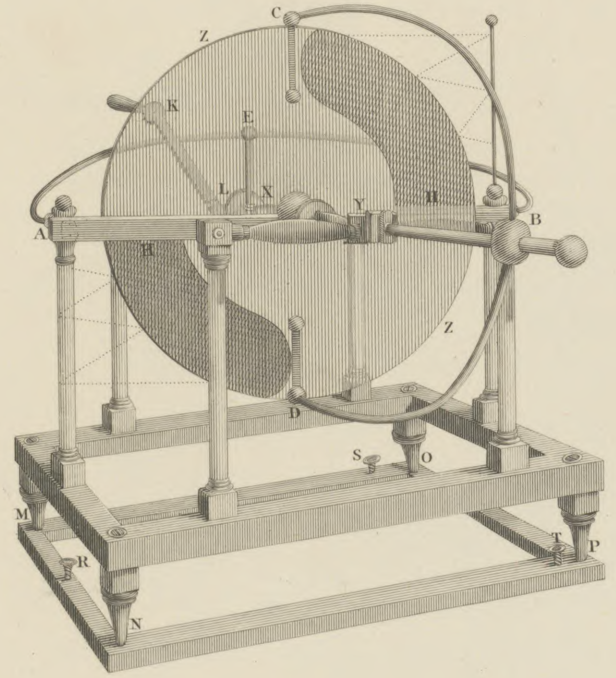


Fig. 8.

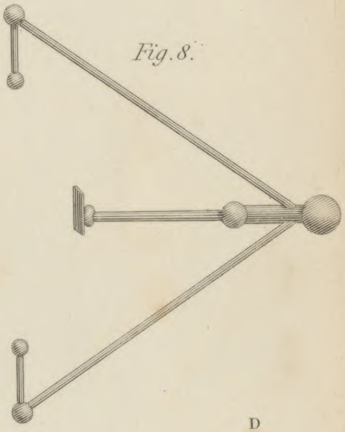
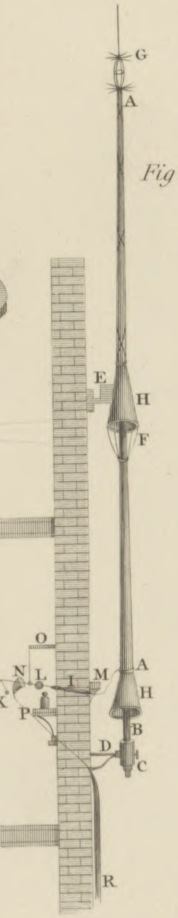


Fig. 12.



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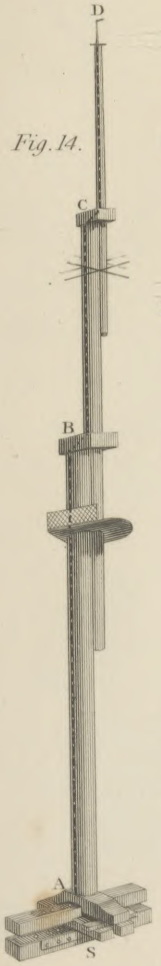
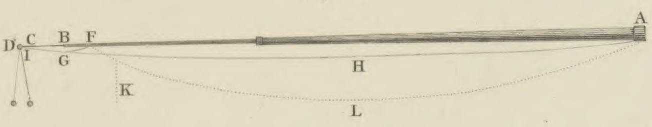


Fig. 13.



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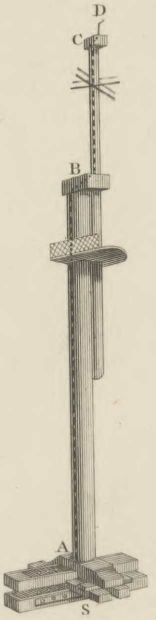

Fig. 15.

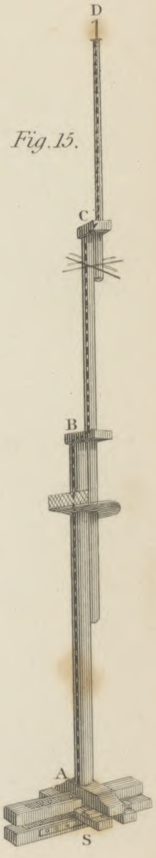

Fig. 9.

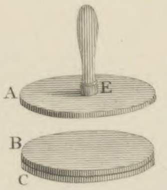

Fig. 10.

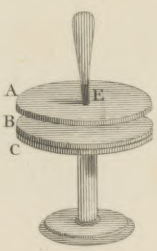

Fig. 11.

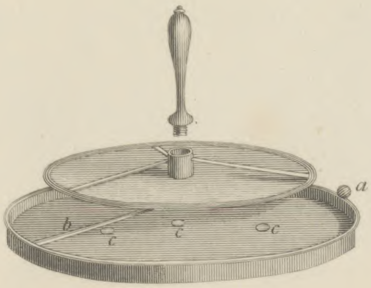

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Fig. 1.

Fig. 2.

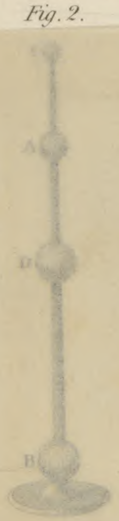


Fig. 3.

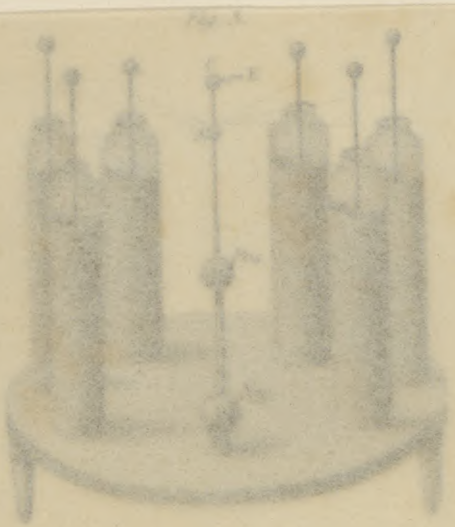


Fig. 4.

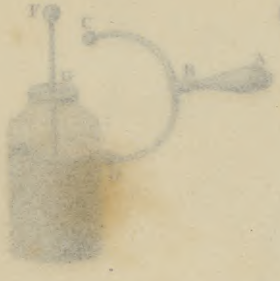


Fig. 5.

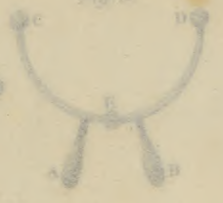


Fig. 7.

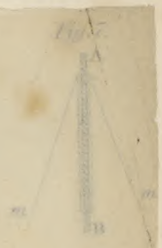
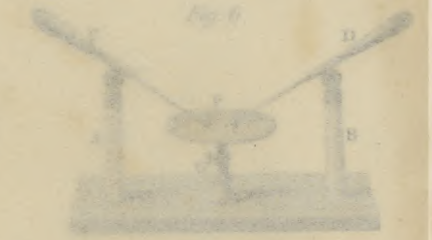


Fig. 10.

Fig. 6.



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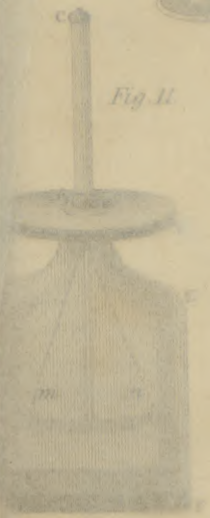

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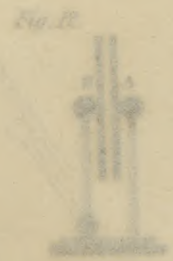

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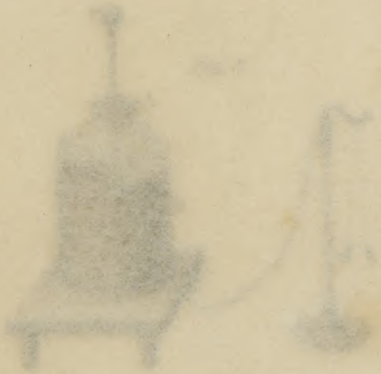
Fig. 8.



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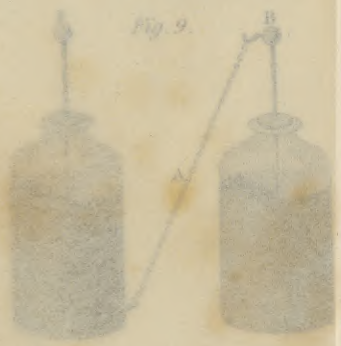

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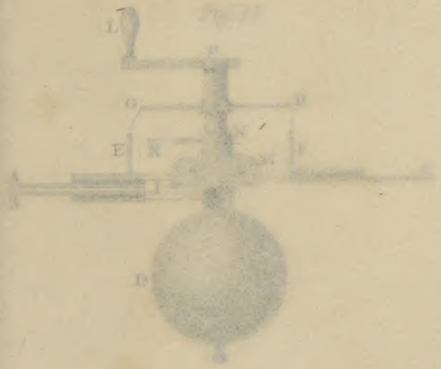

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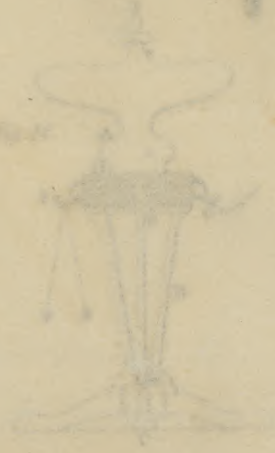

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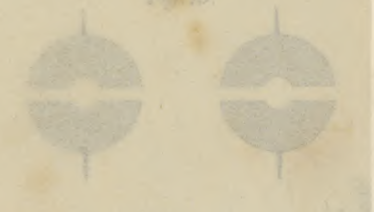

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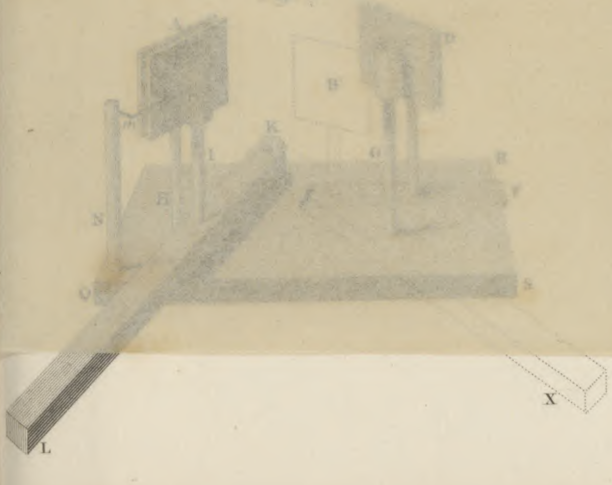

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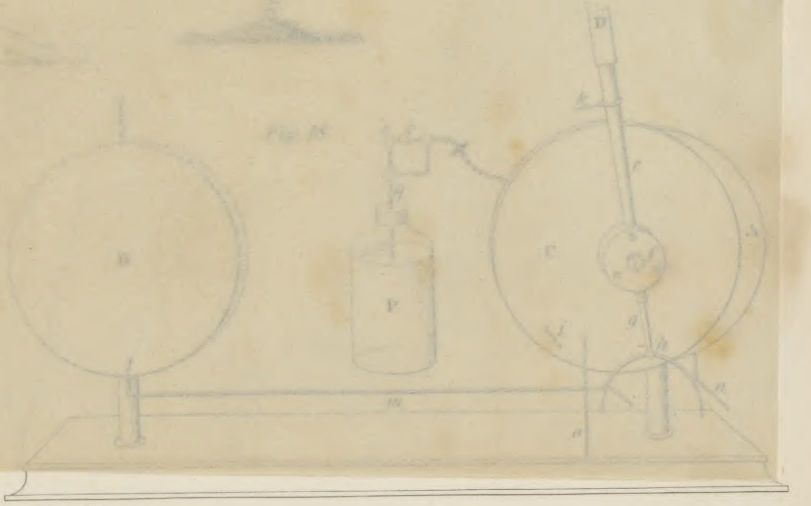

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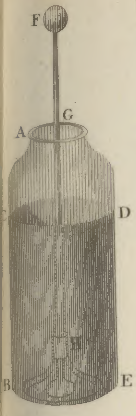
ELECTRICITY.

PLATE CCXV.

Fig. 1.



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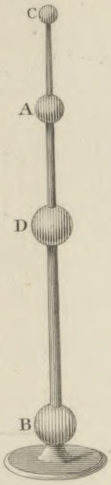

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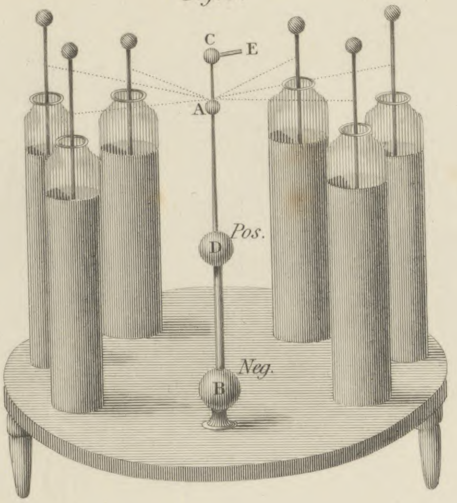

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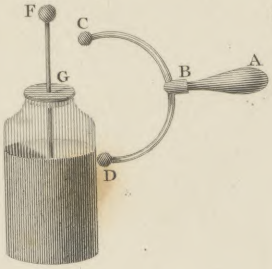

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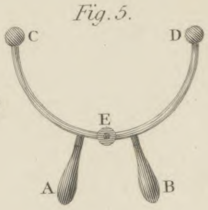

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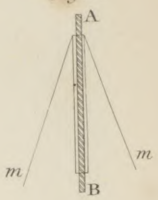

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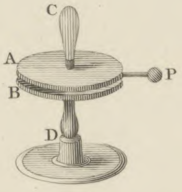

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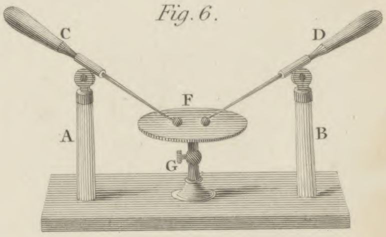

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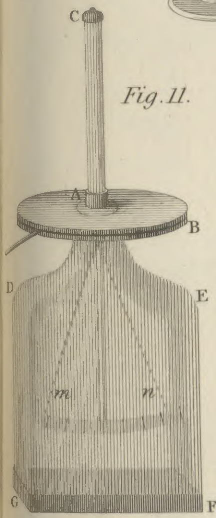

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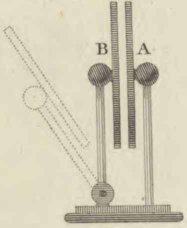

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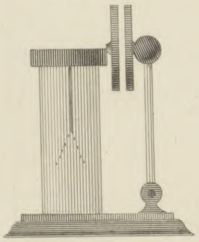

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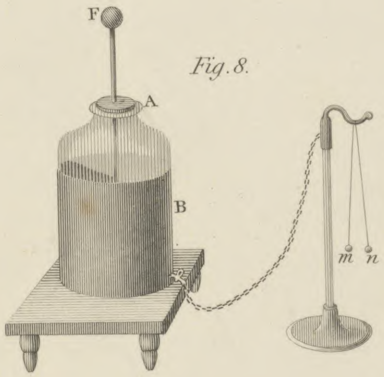

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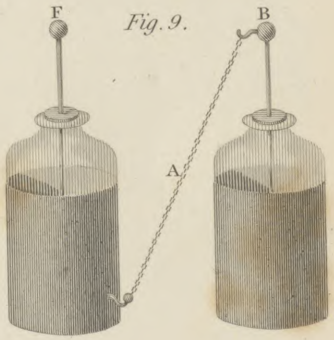

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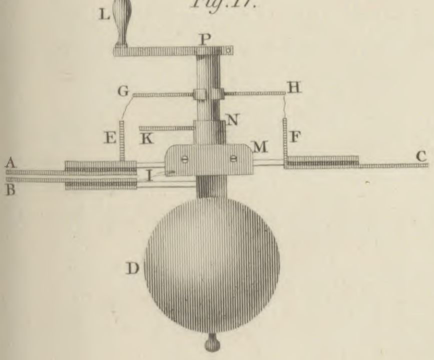

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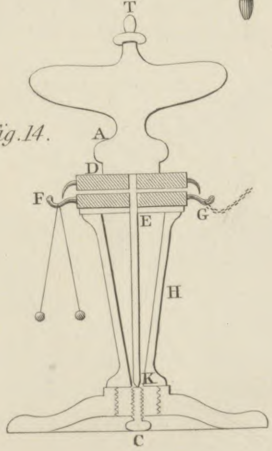

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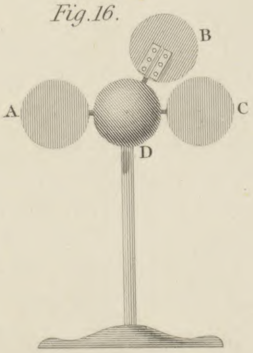

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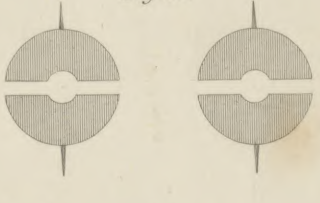

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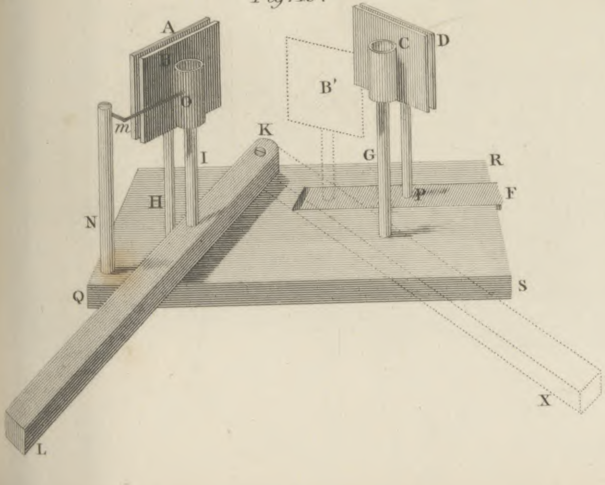

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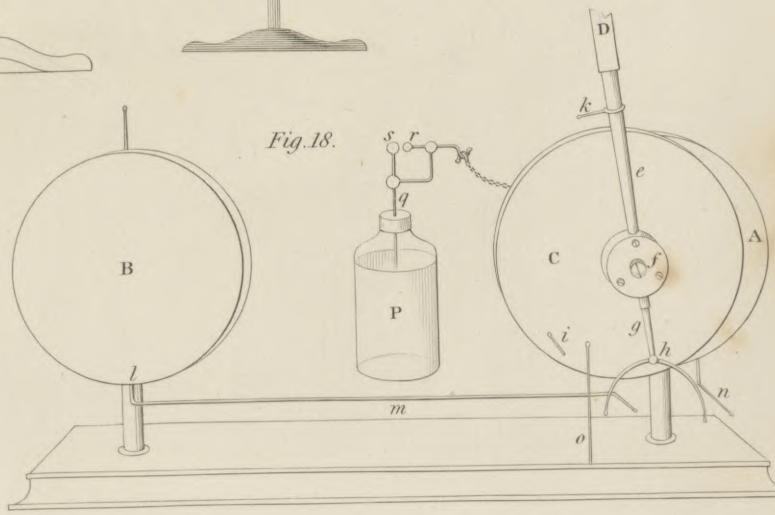

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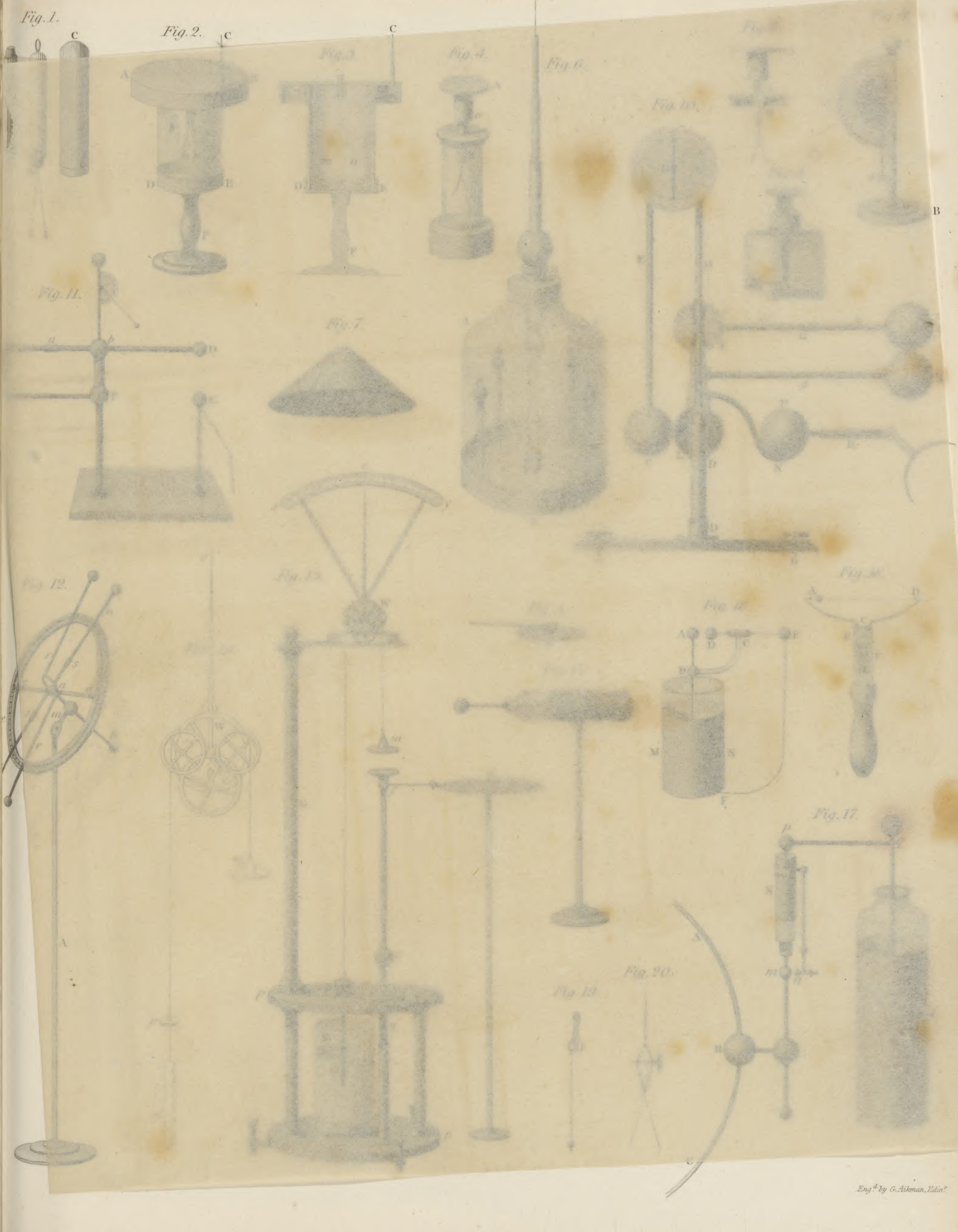
ELECTRICITY. *PLATE CCXVI.*



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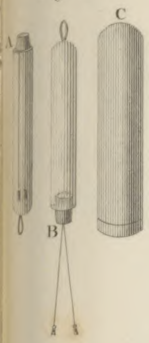

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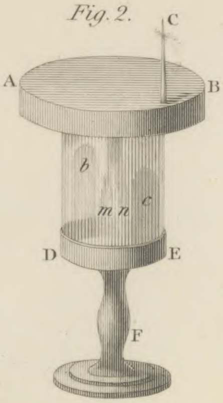

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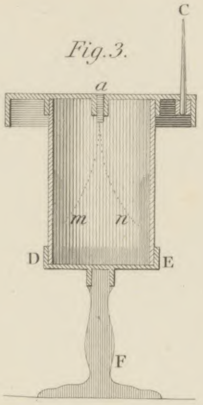

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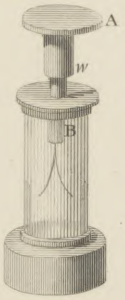

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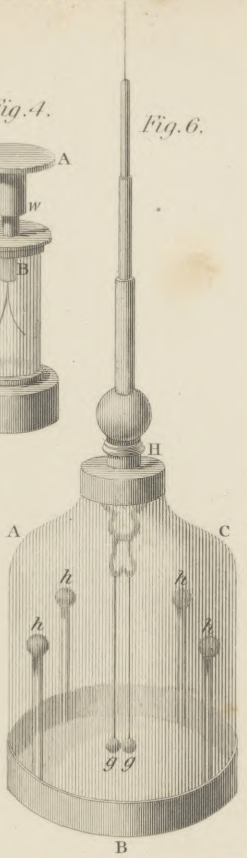

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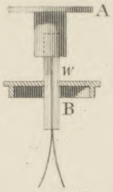

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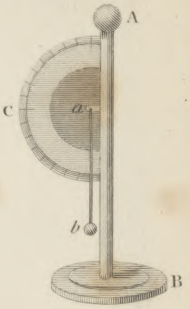

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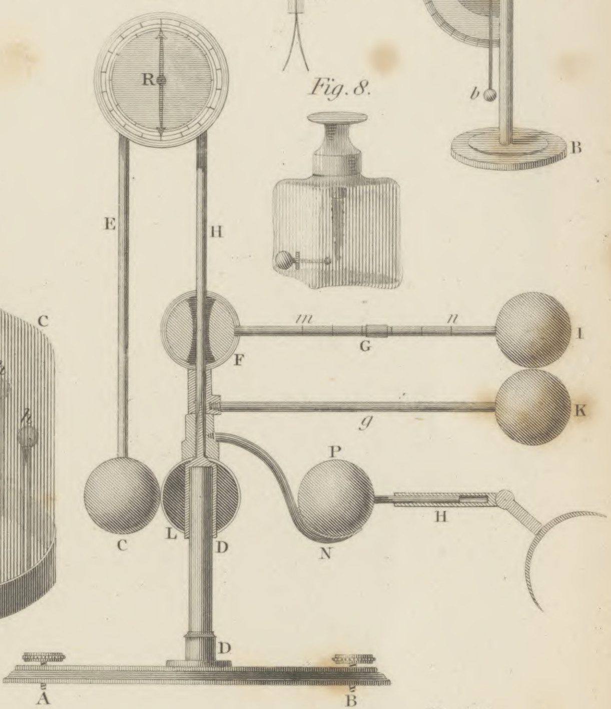

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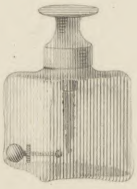

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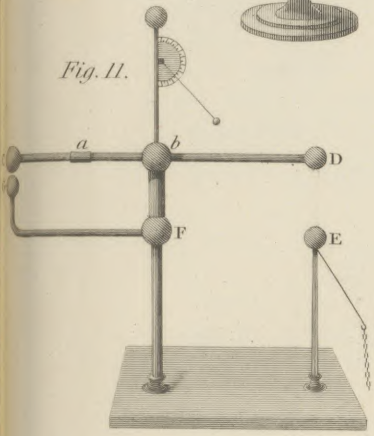

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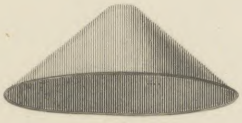

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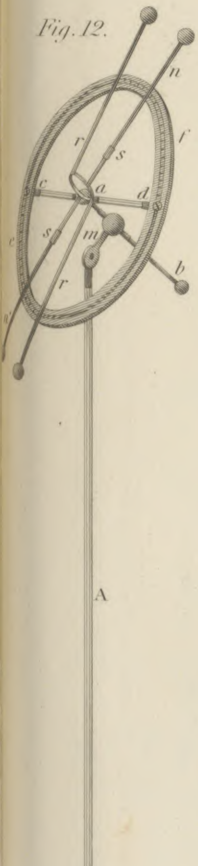

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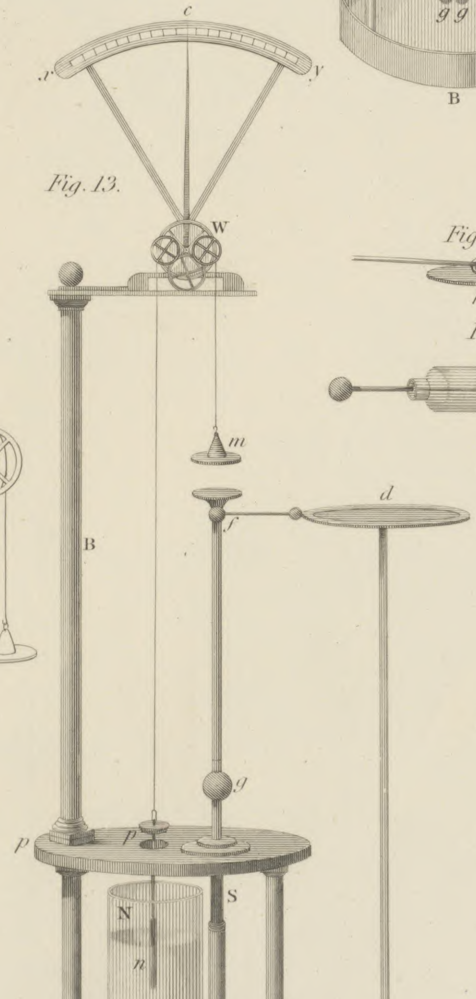

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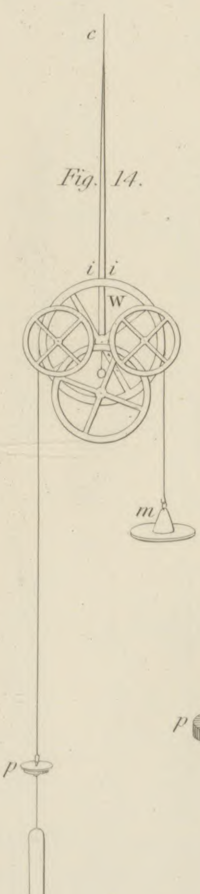

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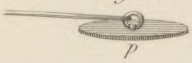

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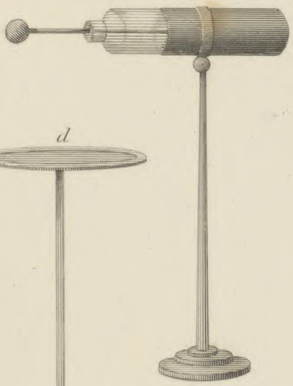

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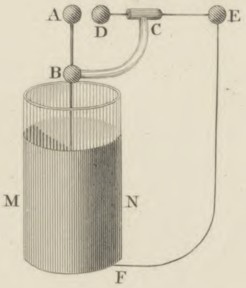

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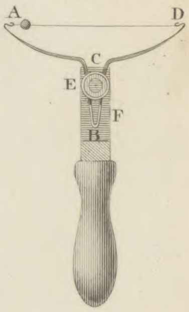

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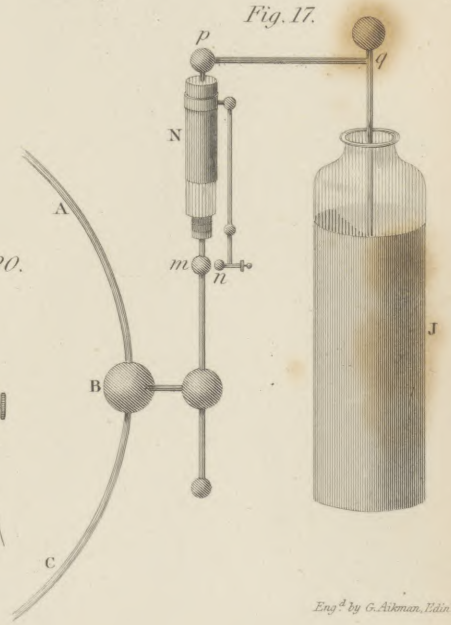

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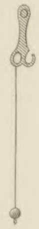

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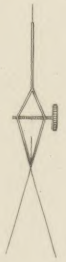

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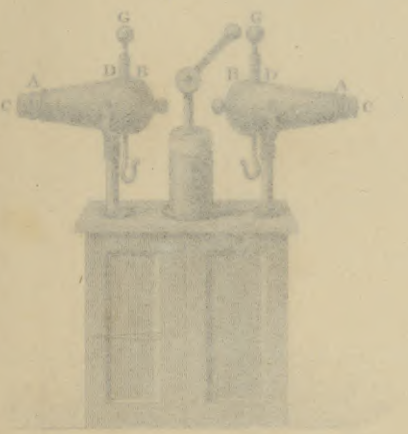
Fig. 6.



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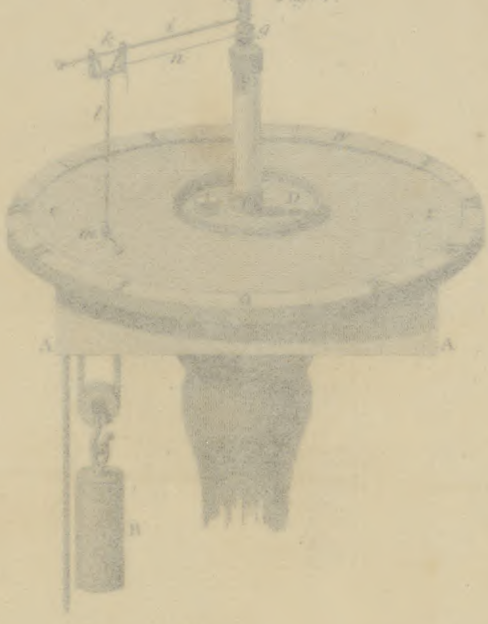

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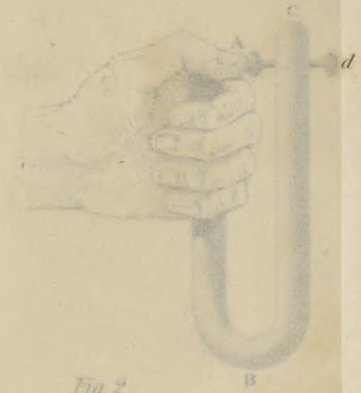

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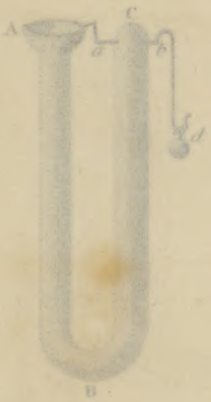

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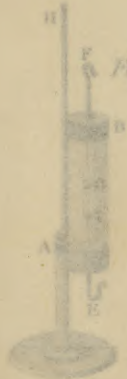

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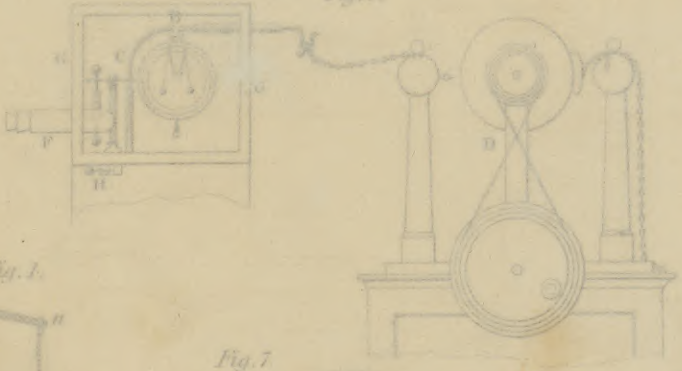

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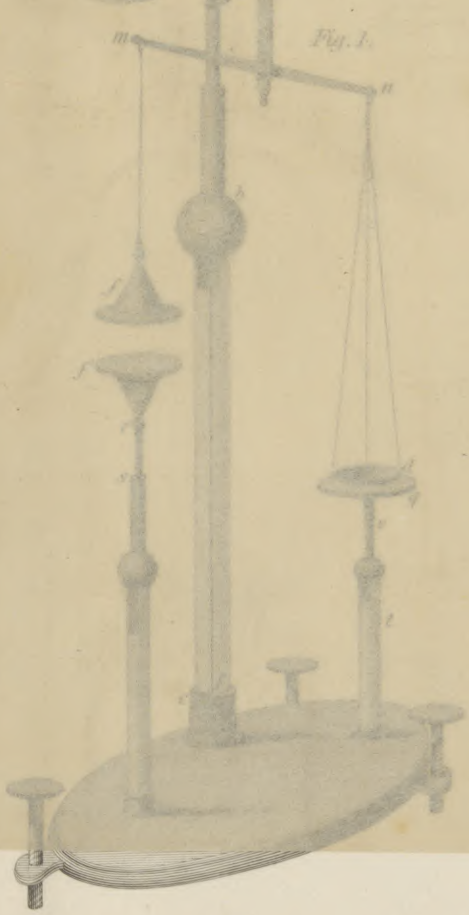

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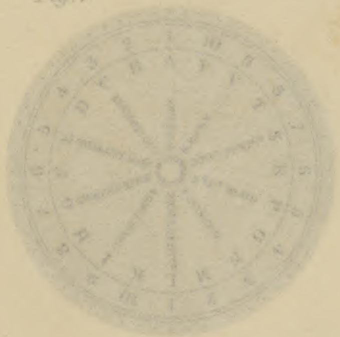

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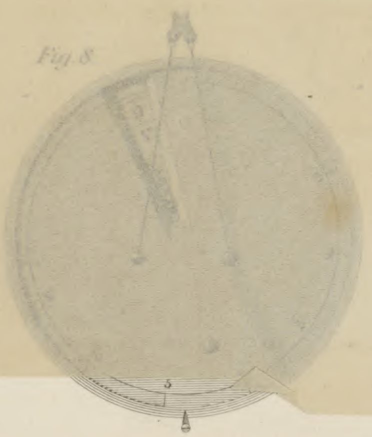

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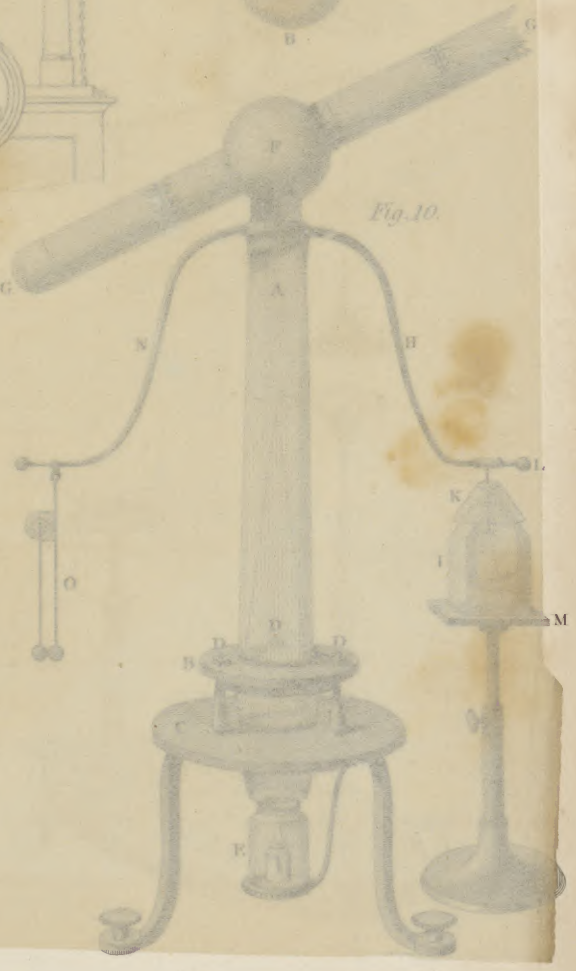

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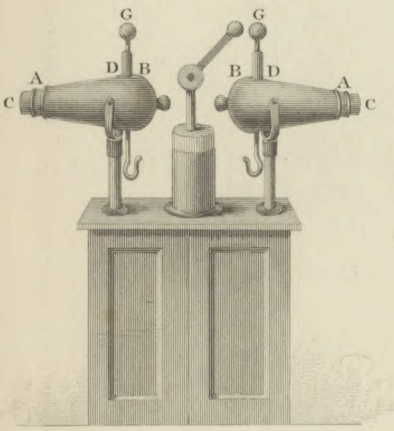
ELECTRICITY.

PLATE CCXVII.

Fig. 6.



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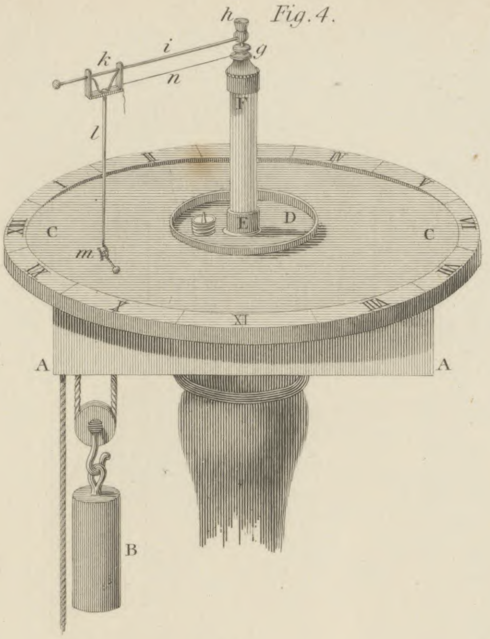

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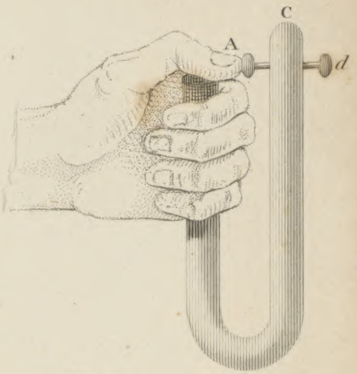

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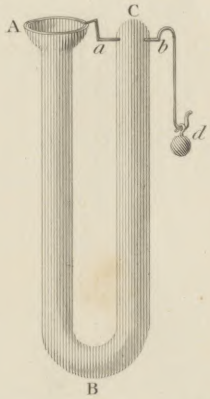

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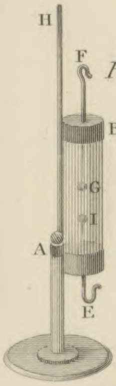

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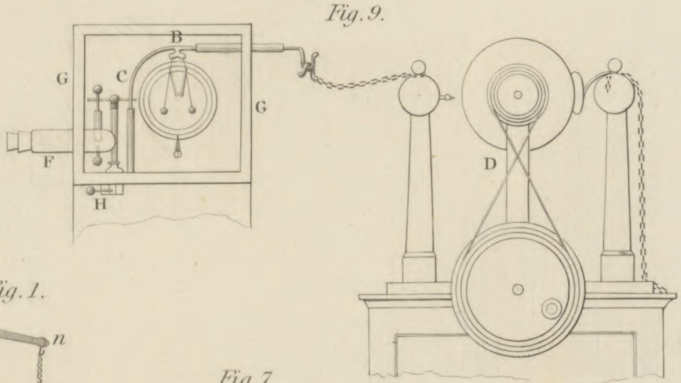

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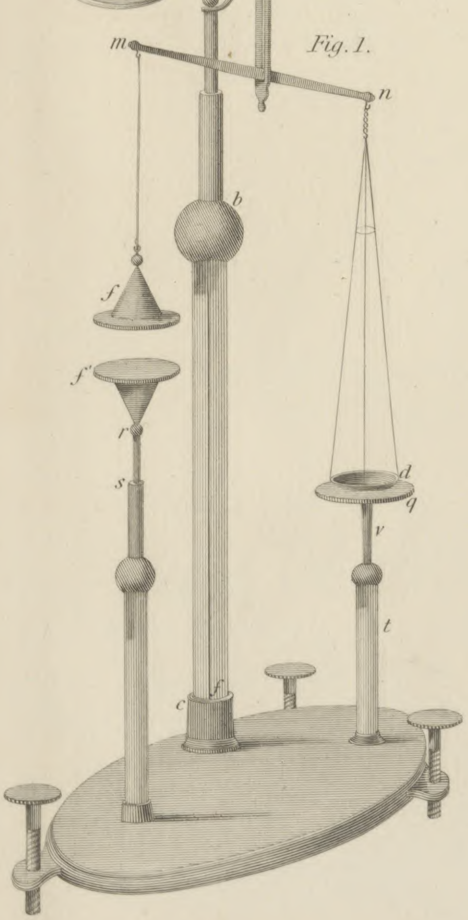

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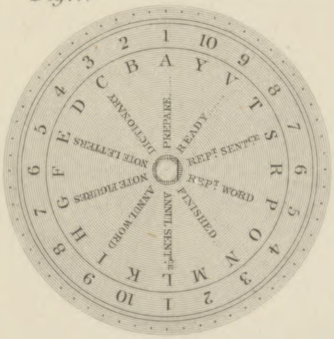

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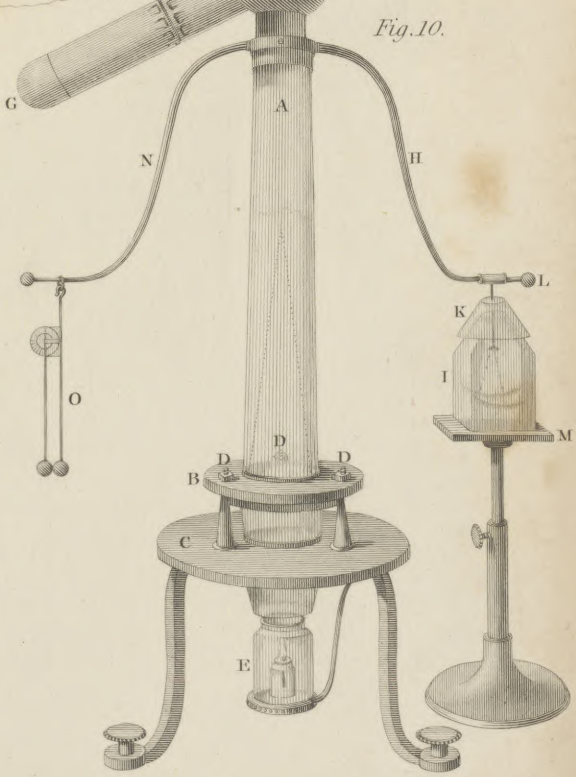

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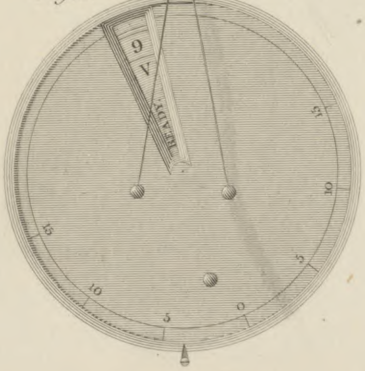

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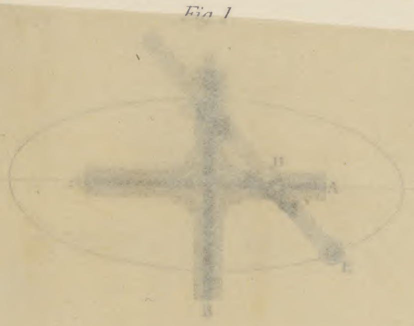
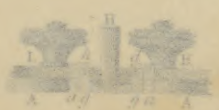


Fig. 7.



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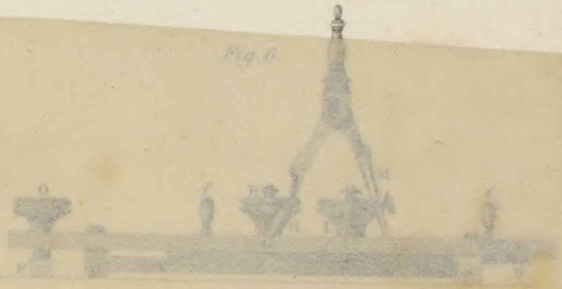


ELLIPTIC TURNING.

Fig. 2.

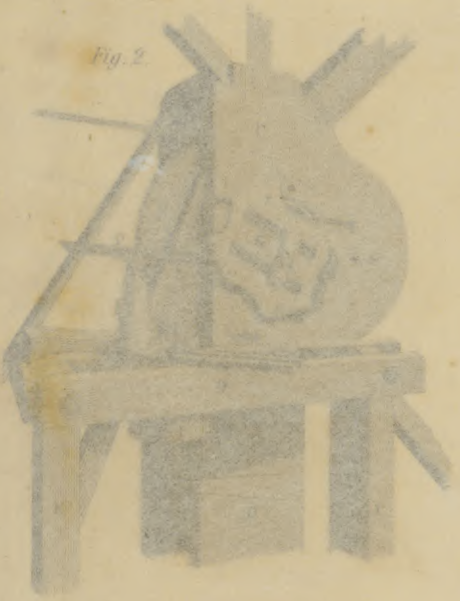
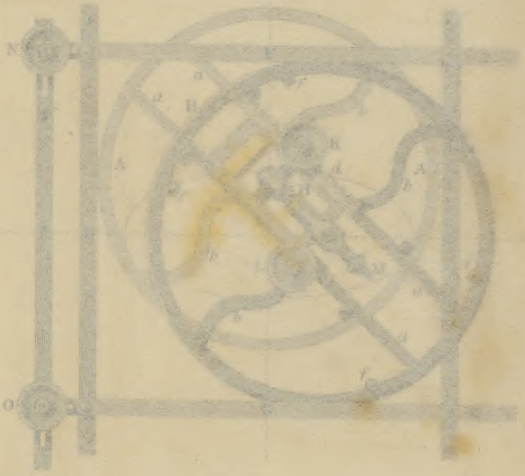


Fig. 3.

Fig. 4.

Fig. 5.



EMBANKMENT.

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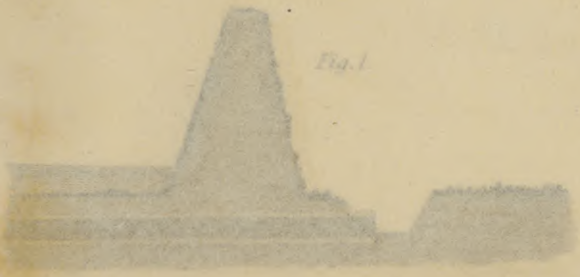


Fig. 2.

Fig. 3.

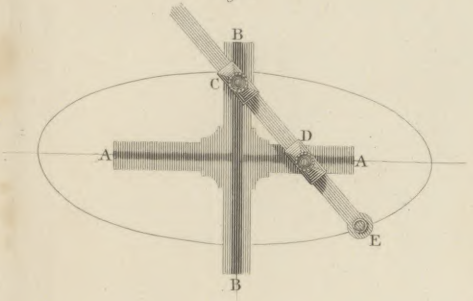
Fig. 4.

Fig. 5.

ELLIPTOGRAPH.

PLATE CCXVIII

Fig. 1.



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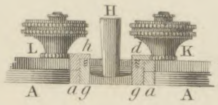

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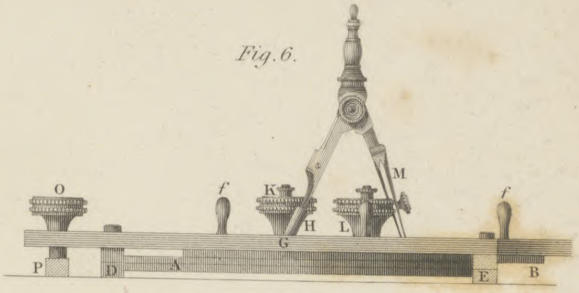


ELLIPTIC TURNING.

Fig. 2.

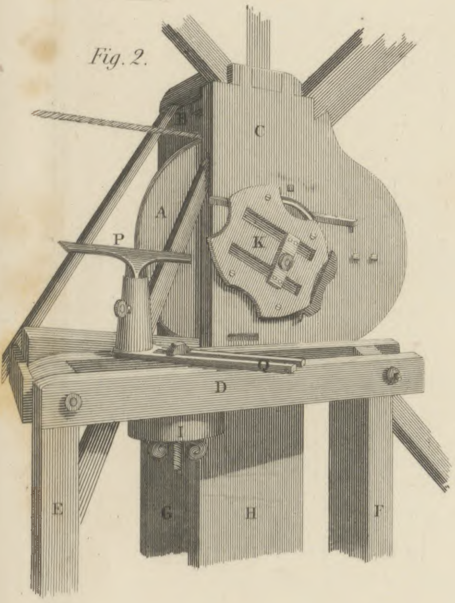
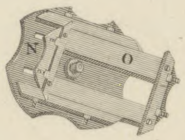


Fig. 3.



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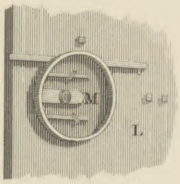

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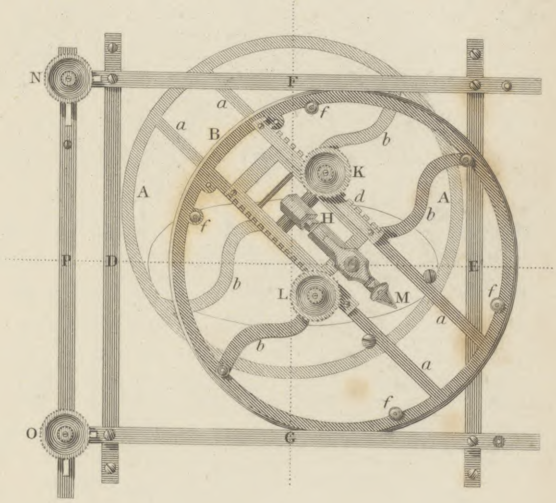

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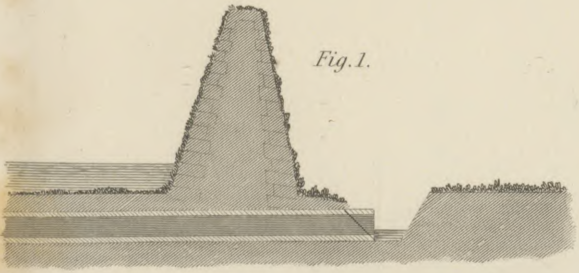


Fig. 2.

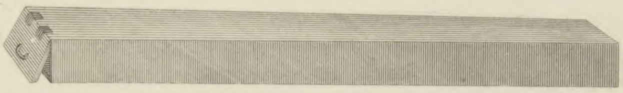
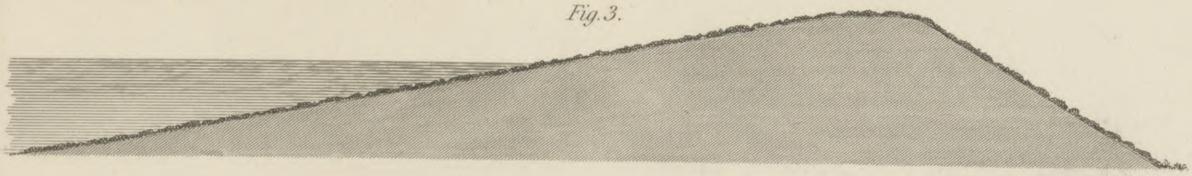


Fig. 3.



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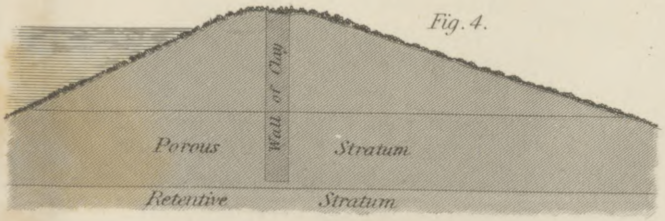

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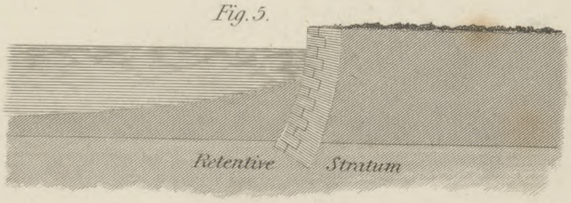
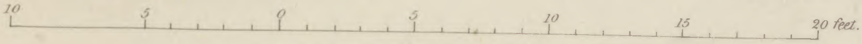
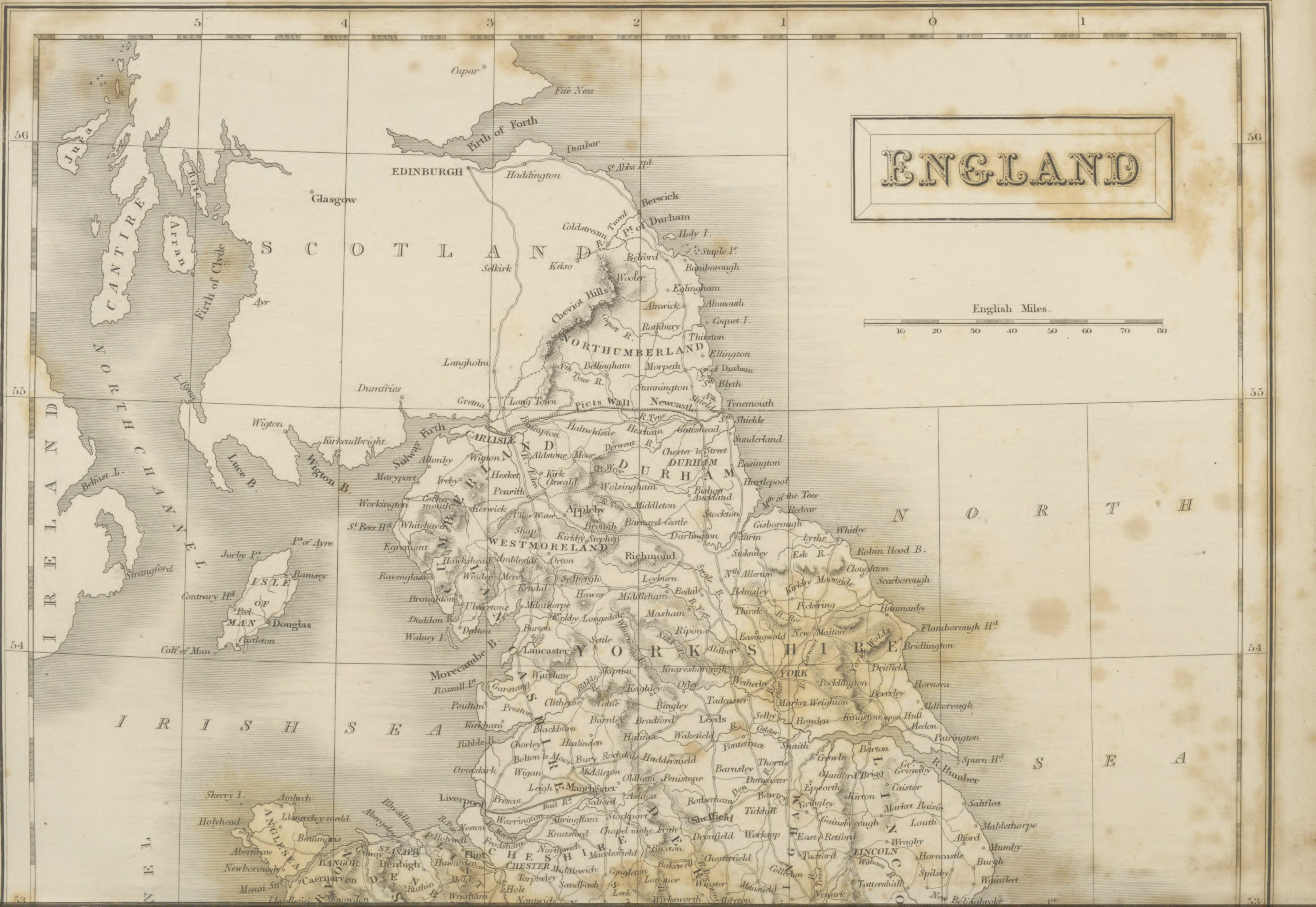




Engd. by G. Aikman. Edinr.

ENGLAND


English Miles.
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56 55 54 53
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NORTHUMBERLAND
DURHAM
CUMBERLAND
WESTMORELAND
YORKSHIRE
LANCASHIRE
CHESHIRE
DERBY
LINCOLN
NOTTINGHAM
NORTH SEA
IRISH SEA
NORTH CHANNEL
IRELAND
ISLE OF MAN
ANGLESEA
EDINBURGH
Glasgow
Cupar
Fife Ness
Firth of Forth
Dunbar
Haddington
St. Abbs Hd.
Berwick
Pt. of Durham
Holy I.
Staple Is.
Coldstream
Tweed R.
Belford
Bamborough
Selkirk
Kelso
Wooler
Eglingham
Alnmouth
Alnwick
Coquet I.
Cheviot Hills
Coquet R.
Rothbury
Thirston
Ellington
Langholm
Bellingham
Morpeth
Pt. of Durham
Blyth
Nth. Tyne R.
Stannington
Dumfries
Gretna
Long Town
Picts Wall
Newcastle
Nth. Shields
Tynemouth
Sth. Shields
R. Tyne
Haltwhistle
Hexham
Gateshead
Sunderland
Brampton
CARLISLE
Derwent R.
Chester le Street
DURHAM
Easington
Wigton
Kirkcudbright
Solway Firth
Allonby
Aldstone Moor
R. Wear
Hartlepool
Maryport
Ireby
Hesket
Kirk Oswald
Eden R.
Penrith
Wolsingham
Bishop Auckland
Mth. of the Tees
Redcar
Workington
Cockermouth
Keswick
Ulles Water
Appleby
R. Tees
Middleton
Stockton
Whitehaven
St. Bees Hd.
Shap
Brough
Barnard Castle
Gisborough
Whitby
Kirkby Stephen
Darlington
Yarm
Lythe
Egremont
Hawkshead
Ambleside
Orton
Richmond
Stokesley
Esk R.
Robin Hood B.
Ravenglass
Winder Mere
Sedbergh
Leyburn
Swale R.
Nth. Allerton
Kirkby Moorside
Cloughton
Scarborough
Broughton
Kendal
Hawes
Middleham
Bedale
Helmsley
Ulverstone
Milnthorpe
Masham
R. Yore
Thirsk
Pickering
Hunmanby
Duddon R.
Dalton
Kirkby Lonsdale
Wharfe R.
Nidd R.
Ripon
R. Rye
New Malton
Flamborough Hd.
Walney I.
Burton
Lune R.
Settle
Easingwold
Aldboro
Derwent R.
York Wolds
Bridlington
Morecambe B.
Lancaster
Skipton
Knaresborough
YORK
Driffield
Rossall Pt.
Garstang
Warshaw
Ribble R.
Keighley
Otley
Wetherby
Ouse R.
Pocklington
Beverley
Hornsea
Poulton
Preston
Clitheroe
Colne
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Market Weighton
Aldborough
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Blackburn
Burnley
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Leeds
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Howden
Kingston upon Hull
Hedon
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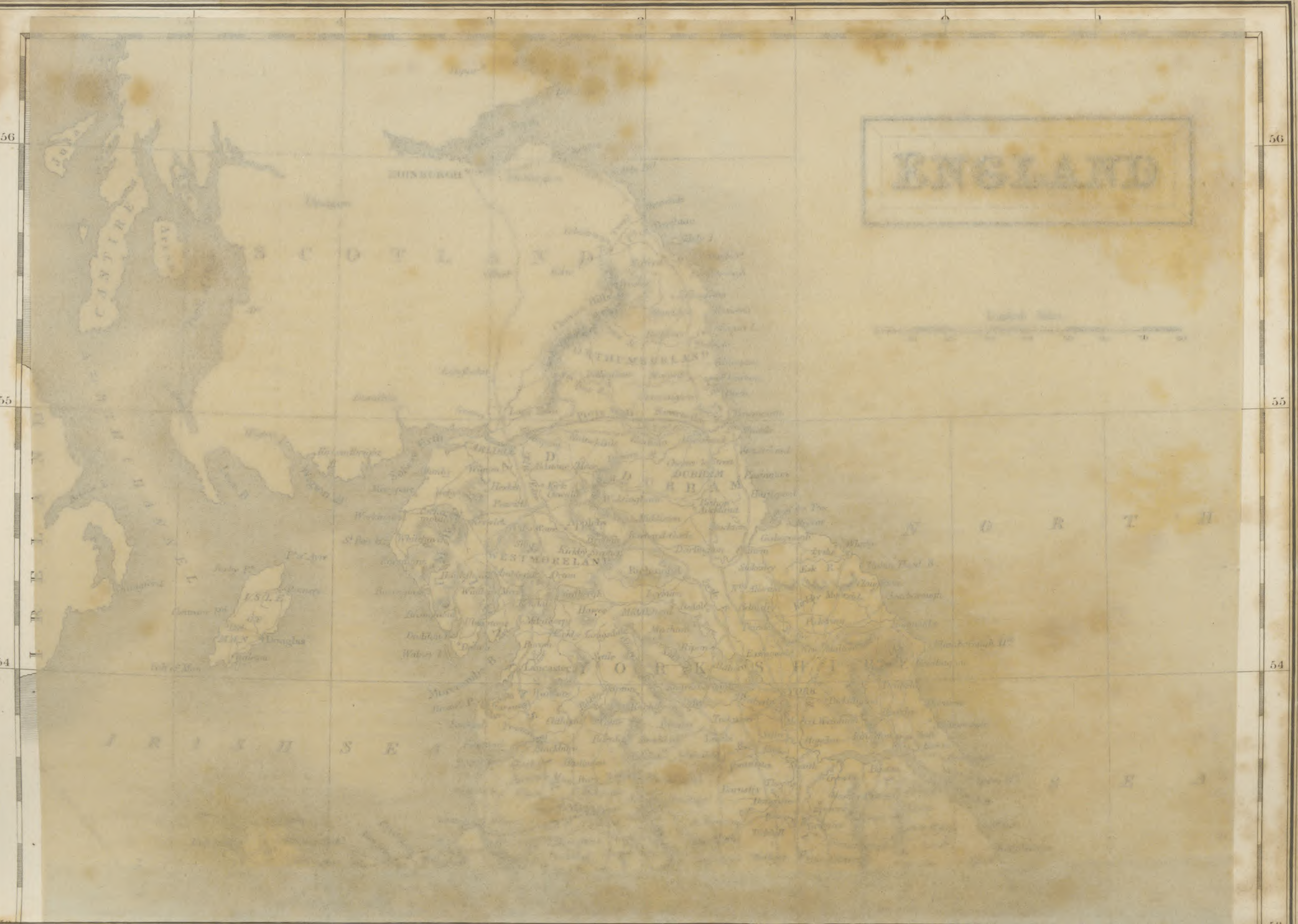
Chorley
Haslinden
Halifax
Wakefield
Calder R.
Pontefract
Snaith
Barton
Patrington
Bolton le Moor
Bury
Rochdale
Huddersfield
Thorne
Crowle
Glanford Brigg
Gt. Grimsby
R. Humber
Spurn Hd.
Ormskirk
Wigan
Middleton
Oldham
Penistone
Barnsley
Don R.
Doncaster
Epworth
Caistor
Leigh
Manchester
Ashton
Rotherham
Bawtry
Gainsborough
Kirton
Market Raisin
Saltfleet
Skerry I.
Amlwch
Liverpool
Prescot
Rail Rd.
Salford
Sheffield
Tickhill
Louth
Mablethorpe
Holyhead
Llanerchymedd
Rhyddlan
Warrington
Altringham
Stockport
Worksop
East Retford
Wragby
Alford
Mumby
Abergeley
Neston
R. Dee
Holywell
Mersey R.
Frodsham
Knutsford
Chapel in the Frith
Dronfield
Beaumaris
St. Asaph
Conway
Flint
Northwich
Macclesfield
Buxton
Chesterfield
Tuxford
LINCOLN
Witham R.
Horncastle
Burgh
Aberfraw
Newborough
BANGOR
Denbigh
Hawarden
CHESTER
Middlewich
Congleton
Bakewell
Mansfield
Trent R.
Spilsby
Wainfleet
Menai Str.
Caernarvon
Ruthin
Mold
Tarporley
Sandbach
Longnor
Winster
Ollerton
Tattershall
Snowdon
Wrexham
Holt
Nantwich
Leek
Wirksworth
Alfreton
Newark
New Bolingbroke
Jura
Cantire
Arran
Bute
Firth of Clyde
Ayr
L. Ryan
Luce B.
Wigton B.
Belfast L.
Strangford
Pt. of Ayre
Jurby Pt.
Ramsey
Contrary Hd.
Peel
Douglas
Castleton
Calf of Man

Engraved by S. Hall, Bury Str.t Bloomsb.y

PLATE CCXLV.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SCOTLAND
EDINBURGH
CANTIRE
Arran
Jura
NORTHUMBERLAND
CUMBERLAND
CARLISLE
DURHAM
WESTMORELAND
YORKSHIRE
YORK
Lancaster
ISLE OF MAN
Douglas
NORTH SEA
IRISH SEA
NORTH CHANNEL
IRELAND
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55
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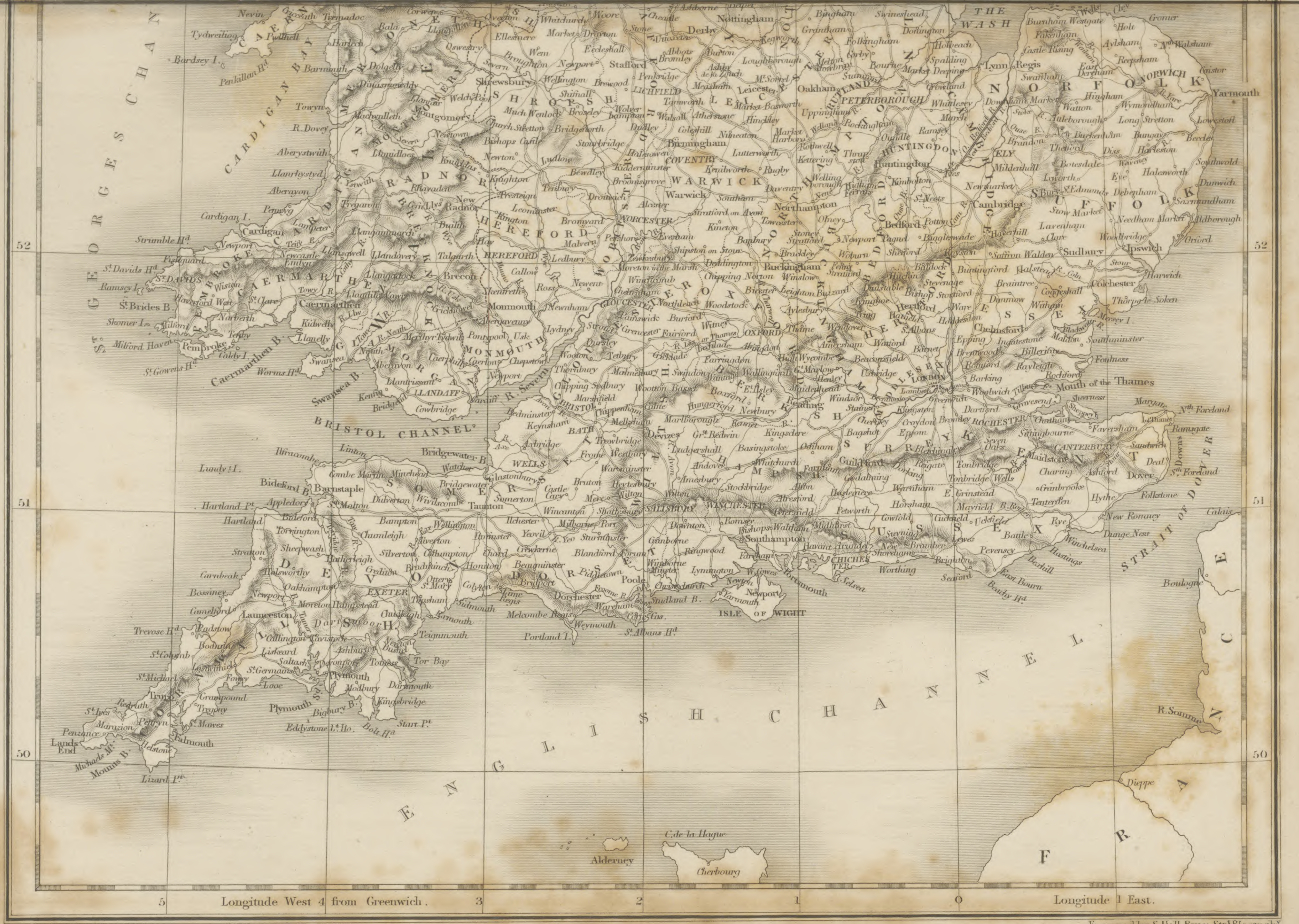
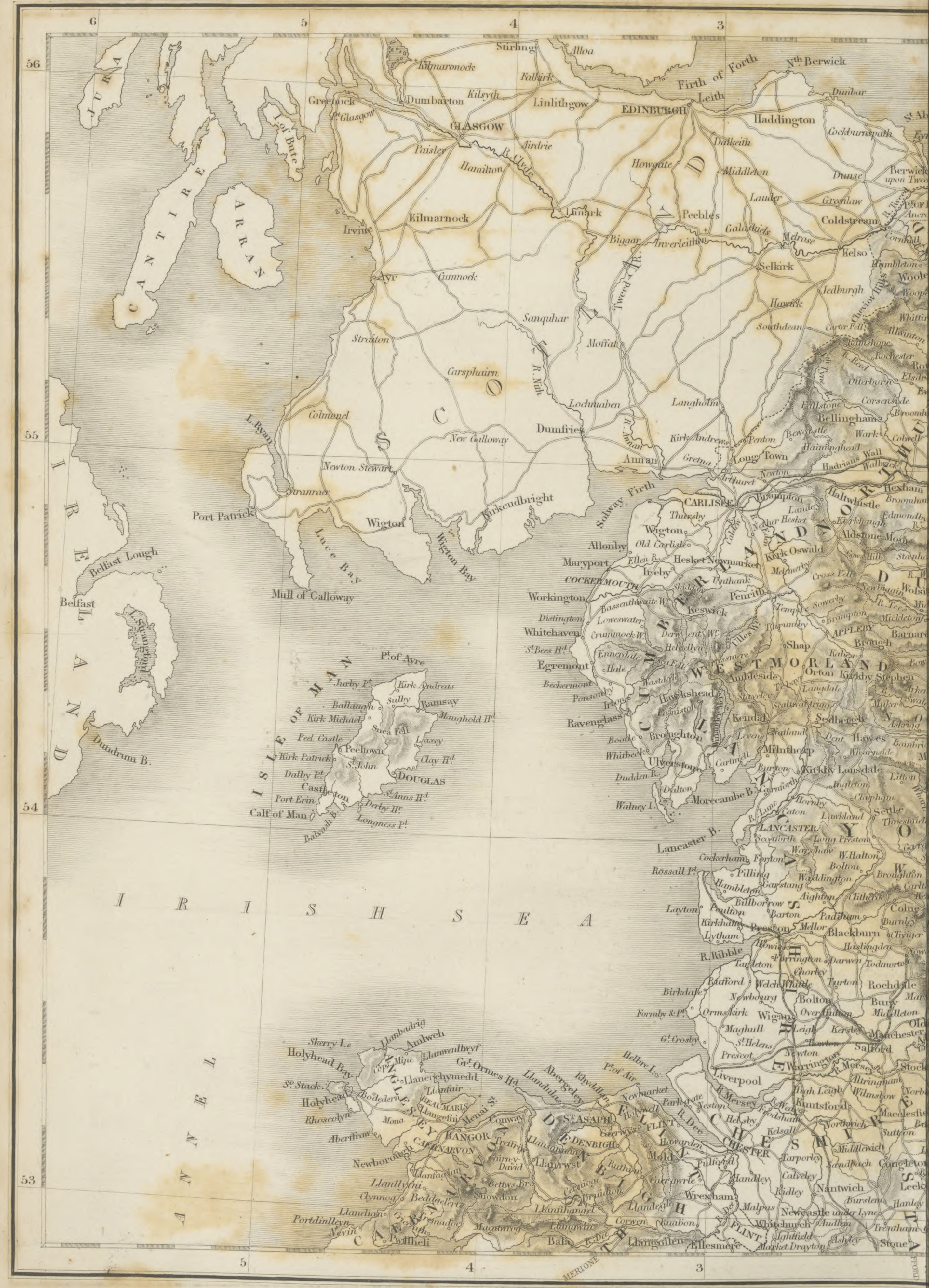


Engraved by S. Hall, Bury Str^t. Bloomsb^y.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Kilmaronock
Stirling
Alloa
Falkirk
Kilsyth
Linlithgow
Firth of Forth
Nth. Berwick
Leith
EDINBURGH
Dunbar
Haddington
GLASGOW
Paisley
Airdrie
Hamilton
R. Clyde
Dalkeith
Cockburnspath
Howgate
Middleton
Dunse
Berwick upon Tweed
Lauder
Greenlaw
Coldstream
Cornhill
Lanark
Peebles
Galashiels
Melrose
Kelso
Irvine
Kilmarnock
Biggar
Inverleithen
Tweed R.
Selkirk
Wooler
Ayr
Cumnock
Jedburgh
Hawick
Cheviot Hills
Sanquhar
Moffat
Southdean
Carter Fell
Alwinton
Straiton
Rochester
Carsphairn
R. Nith
Otterburn
Elsdon
Lochmaben
Langholm
Colmonel
Fallstone
Corsenside
Bellingham
L. Ryan
Dumfries
R. Annan
Kirk Andrews
Penton
Bewcastle
Wark
New Galloway
Annan
Gretna
Long Town
Haininghead
Hadrians Wall
Newton Stewart
Arthuret
Newton
Stranraer
Solway Firth
CARLISLE
Brampton
Hexham
Port Patrick
Kirkcudbright
Thursby
Haltwhistle
Wigton
Wigton
Wigton Bay
Luce Bay
Allonby
Old Carlisle
Nether Hesket
Kirkhaugh
Alston Moor
Belfast Lough
Maryport
Ellen R.
Hesket Newmarket
Kirk Oswald
Ireby
COCKERMOUTH
Skiddaw
Unthank
Melmerby
Cross Fell
Newbiggin
Mull of Galloway
Belfast
Workington
Bassenthwaite W.
Penrith
Keswick
Temple Sowerby
Distington
Loweswater
Crummock W.
Derwent W.
Ulles W.
Thrimby
Brompton
APPLEBY
Brough
Whitehaven
Helvellyn
Shap
St. Bees Hd.
Ennerdale
Grasmere
L. Strangford
Pt. of Ayre
Egremont
Hole
Scaw Fell
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Jurby Pt.
Kirk Andreas
Beckermont
Wastdale
Ambleside
Orton
Sulby
Ramsay
Ponsonby
Irton
Hawkshead
Langdale
Ballaugh
Kirk Michael
Maughold Hd.
Coniston
Staveley
Ravenglass
Kendal
Sedbergh
Hawes
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Bootle
Broughton
Levens
Natland
Dent
Peeltown
Dundrum B.
Kirk Patrick
St. John
Clay Hd.
Whitbeck
Ulverstone
Cartmell
Milnthorp
Dalby Pt.
DOUGLAS
Dudden B.
Burton
Kirkby Lonsdale
Castletown
St. Anns Hd.
Dalton
Ingleton
Port Erin
Derby Ht.
Walney I.
Morecambe B.
Carnforth
Calf of Man
Longness Pt.
Hornby
Clapham
Balvash B.
Caton
Settle
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Forton
Wyreshaw
W. Halton
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Pilling
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Hambleton
Garstang
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Broughton
Bilborrow
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Colne
Layton
Poulton
Barton
Padiham
Burnley
IRISH SEA
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Preston
Mellor
Blackburn
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R. Ribble
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Tarleton
Farrington
Chorley
Darwen
Todmorden
Rufford
Welch Whittle
Turton
Rochdale
Birkdale
Newbourg
Bolton
Bury
Formby & Pt.
Ormskirk
Wigan
Over Hulton
Middleton
Maghull
Leigh
Kersley
Manchester
Gt. Crosby
St. Helens
Newton
Prescot
Warrington
Salford
Skerry I.
Llanbadrig
Amlwch
Holyhead Bay
Llanwenllwyfo
Gr. Ormes Hd.
Hilbre I.
Pt. of Air
Liverpool
R. Mersey
Llanerchymedd
Llandudno
Abergeley
Rhyddlan
St. Stack
Llanfair
Newmarket
Parkgate
Neston
Altringham
Holyhead
Bodedern
BEAUMARIS
Holywell
R. Dee
High Leigh
Wilmslow
Rhoscolyn
Llangefni
Menai St.
ANGLESEY
Conway
ST. ASAPH
FLINT
Helsby
Frodsham
Knutsford
Macclesfield
Mona
BANGOR
DENBIGH
Kelsall
Northwich
Aberffraw
CAERNARVON
Llansannan
Hawarden
CHESTER
Tarporley
Middlewich
Sutton
Trefriw
Mold
Newborough
Cairny David
Llanrwst
Ruthin
Pulford
Sandbach
Congleton
Llandwrog
Cerrigy Druidion
Caerwys
Handley
Calveley
Leek
Llanllyfni
Bettws
Snowdon
Wrexham
Ridley
Nantwich
Burslem
Clynnog
Beddgelert
Llandegla
Malpas
Hanley
Llanelian
Llanfihangel
Newcastle under Lyne
Portdinlleyn
Criccieth
Tremadoc
Maentwrog
Llangwm
Corwen
Ruabon
FLINT
Whitchurch
Audlem
Trentham
Nevin
Pwllheli
Bala
Llangollen
Ellesmere
Ightfield
Market Drayton
Ashley
Stone
SCOTLAND
CUMBERLAND
NORTHUMBERLAND
DURHAM
YORK
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CHESHIRE
DENBIGH
FLINT
CAERNARVON
IRELAND
CHANNEL
MERIONE
5
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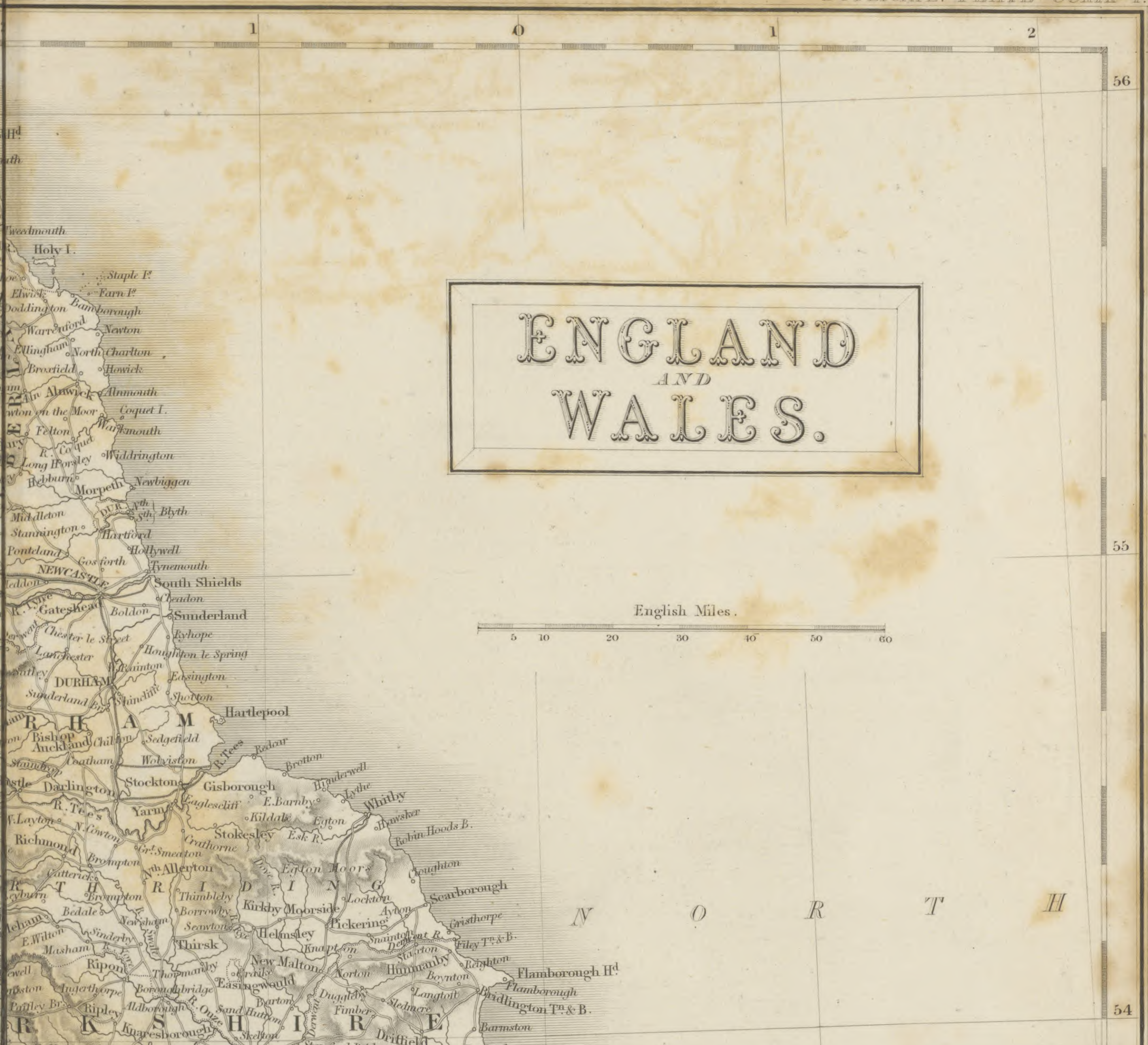
3

ENGLAND AND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AND
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English Miles.
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N O R T H
S E A
THE WASH
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Holy I.
Staple I.
Farn I.
Bamborough
Belford
Elwick
Doddington
Warrenford
Ellingham
North Charlton
Newton
Broxfield
Howick
Alnwick
Alnmouth
Coquet I.
Felton
Warkmouth
R. Coquet
Widdrington
Long Horsley
Bebburn
Morpeth
Newbiggen
Middleton
Blyth
Stannington
Hartford
Ponteland
Hollywell
Gos forth
Tynemouth
NEWCASTLE
South Shields
Cleadon
Gateshead
Boldon
Sunderland
Chester le Street
Ryhope
Lanchester
Houghton le Spring
DURHAM
Rainton
Easington
Sunderland Br.
Shincliffe
Shotton
Hartlepool
Bishop Auckland
Sedgefield
Coatham
Wolviston
Staindrop
R. Tees
Redcar
Brotton
Darlington
Stockton
Gisborough
Hinderwell
Lythe
Whitby
E. Barnby
Yarm
Egglescliff
Kildale
Egton
Hawsker
Robin Hoods B.
Richmond
N. Cowton
Stokesley
Esk R.
Crathorne
Brompton
Gr.t Smeaton
Nth. Allerton
Egton Moors
Cloughton
Catterick
Scarborough
Bedale
Thimbleby
Lockton
Ayton
Borrowby
Kirkby Moorside
Pickering
Gristhorpe
Masham
Thirsk
Helmsley
Filey Tn. & B.
Ripon
New Malton
Knapton
Hunmanby
Reighton
Flamborough Hd.
Easingwold
Norton
Boynton
Flamborough
Boroughbridge
Duggleby
Bridlington Tn. & B.
Ripley
Aldborough
Sledmere
Langtoft
Barmston
Knaresborough
Sand Hutton
Fimber
Skelton
Driffield
Harrogate
Wetherby
Stamford Bridge
Beeford
Acomb
YORK
Pocklington
Watton
Hornsea
Leathley
Fulford
Leven
Ilkley
Otley
Tadcaster
Mt. Weighton
Beverley
Cowden
Bilbrough
Eskrick
Holme
Aldborough
Abberford
Cawood
Walkington
Sutton
Bradford
Leeds
Selby
Bubwith
Nth. Cave
Kingston upon Hull
Owthorne
Halifax
Bowling
Hunslett
Howden
Hedon
Keyingham
R. Aire
Ferrybridge
Dewsbury
Armin
Laxton
Hessle
Patrington
Wakefield
Pontefract
Snaith
Sunk I.
Huddersfield
Fishlake
Thorne
Barton
Barrow
Easington
Crowle
Bonby
R. Humber
Spurn Head
Lockwood
Wooley
Sutton
Wrawby
Coates
R. Dearn
Glanford Briggs
Bigby
Gr.t Grimsby
Holme
Hickleton
Doncaster
Hibaldstow
Caistor
Laceby
Brigsley
Donna Nook
Penistone
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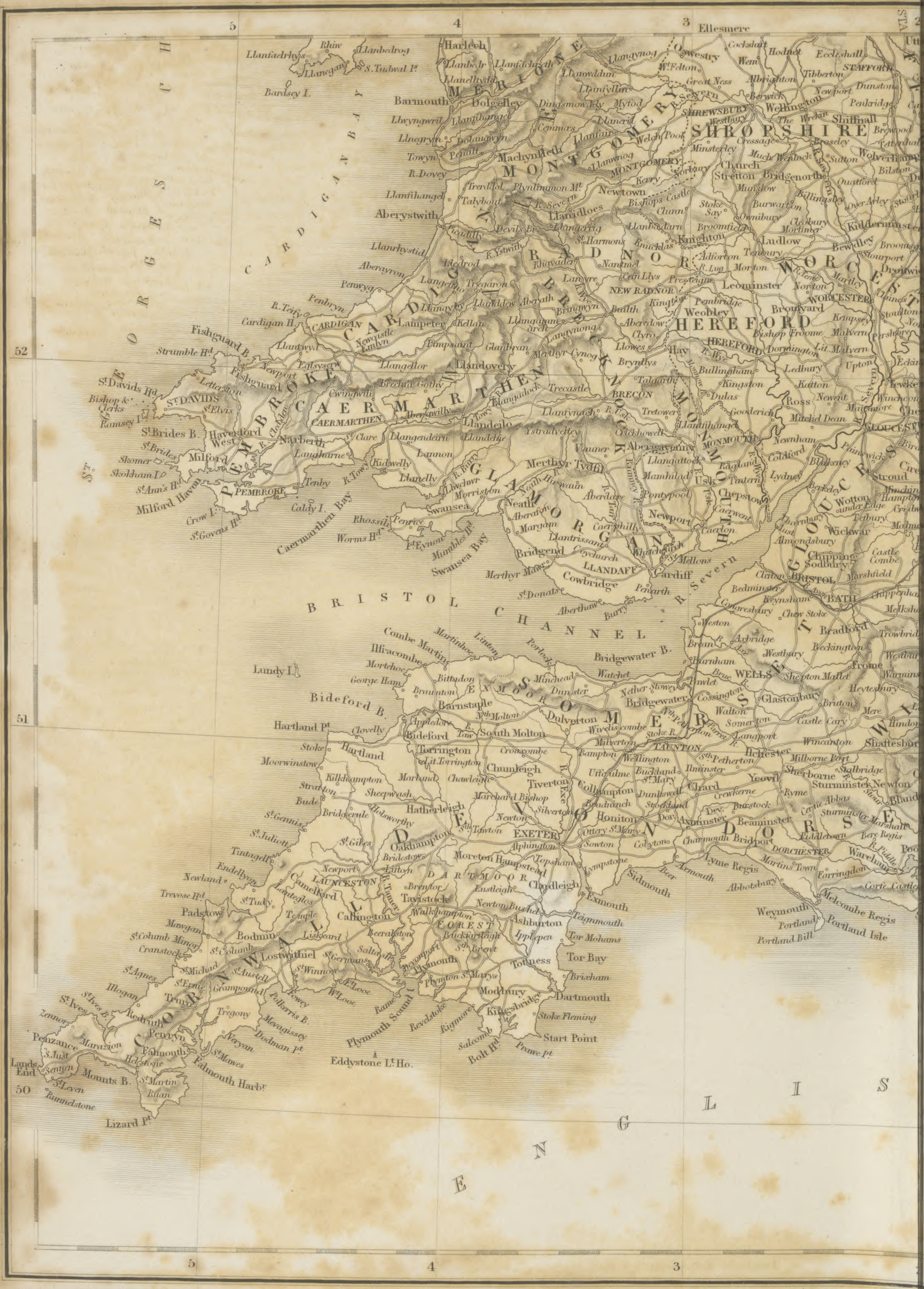
R. Don
Epworth
Ludborough
Wortley
Wadworth
Kirton
Ravendale
Saltfleet
Warsborough
Rotherham
Tickhill
R. Trent
Gainsborough
Mt. Rasen
Nth. Willingham
Spital
Louth
E. Theddlethorpe
Sheffield
Handsworth
Bawtry
Saxby
Hainton
Raithby
Sth. Beston
Beckingham
Chapel en le Frith
Ecclesfield
Anston
Blyth
Willingham
Dronfield
Worksop
E. Retford
Langworth
Wragby
Scamblesby
Alford
Tideswell
Baslow
Whitwell
Dunham
Horncastle
Hogsthorpe
Staveley
LINCOLN
Baumber
Ashford
Chesterfield
Tuxford
Bracebridge
Ulceby
Bakewell
Ollerton
Burgh
Winthorpe
Stretton
Mansfield
Harmston
Spilsby
Winster
Matlock
Kelham
N. Muskham
Billinghay
New Bolingbroke
Wirksworth
Alfreton
Southwell
Newark
R. Witham
Tattershall
Wainfleet
Ripley
Leadenham
Wrangle
Ashborne
Belper
Oxton
Balderton
Sleaford
Sibsey
Brailsford
Horsley
Arnold
Bennington
Aswarby
Boston
Freiston
Mackworth
NOTTINGHAM
Bingham
Swineshead
DERBY
Ratcliff
Grantham
Folkingham
Donington
Burnham Westgate
Wells
Morston
Cley
Weybourne
Runton
Cromer
Heacham
New Walsingham
Holt
E. Beckham
Sidestrand
R. Dove
Y O R K S H I R E
E A S T R I D I N G
N O R T H R I D I N G
W E S T R I D I N G
D U R H A M
L I N C O L N
N O T T I N G H A M
D E R B Y

ENGLAND AND
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BRECKNOCK
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PEMBROKE
CAERMARTHEN
GLAMORGAN
MONMOUTH
GLOUCESTER
SOMERSET
DEVON
DORSET
CORNWALL
Ellesmere
Oswestry
SHREWSBURY
Wellington
STAFFORD
Harlech
Barmouth
Dolgelley
Towyn
R. Dovey
Machynlleth
Aberystwith
Plynlimmon Mt.
Llanidloes
Newtown
MONTGOMERY
Welch Pool
Bishops Castle
Church Stretton
Bridgenorth
Ludlow
Knighton
Kidderminster
Aberayron
Cardigan H.
CARDIGAN
Lampeter
Tregaron
NEW RADNOR
Kington
Leominster
Bromyard
WORCESTER
Malvern
Builth
Hay
HEREFORD
Ledbury
Ross
Fishguard B.
Strumble Hd.
Newport
St. Davids Hd.
ST. DAVIDS
Ramsey I.
St. Brides B.
Haverford West
Skomer I.
Skokham I.
Milford
Milford Haven
PEMBROKE
Tenby
Caldy I.
Llandovery
CAERMARTHEN
Llandeilo
Kidwelly
Llanelly
BRECON
Crickhowell
Abergavenny
MONMOUTH
GLOUCESTER
Merthyr Tydfil
Usk
Chepstow
Stroud
Swansea
Caermarthen Bay
Worms Hd.
Mumbles Hd.
Swansea Bay
Neath
Caerphilly
Newport
Bridgend
Cowbridge
LLANDAFF
Cardiff
R. Severn
BRISTOL
BATH
Chipping Sodbury
Lundy I.
Ilfracombe
Combe Martin
Bideford B.
Barnstaple
Bideford
Hartland Pt.
Hartland
Torrington
South Molton
EXMOOR
Minehead
Dunster
Bridgewater B.
Bridgewater
WELLS
Glastonbury
Frome
Dulverton
TAUNTON
Wellington
Tiverton
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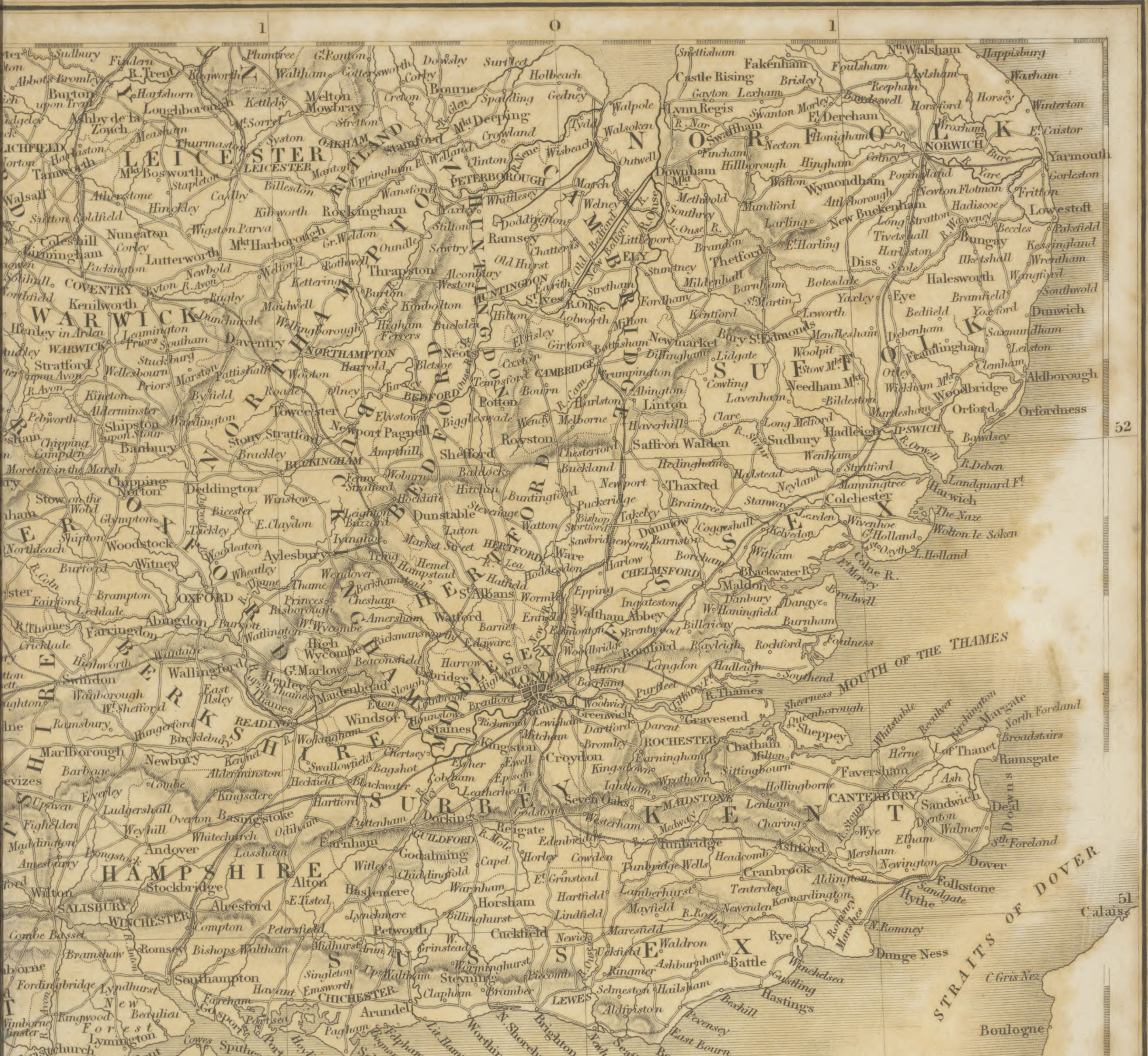
Portland Isle
Padstow
Bodmin
Callington
Liskeard
Ashburton
Newton Bushel
Tor Bay
Brixham
Dartmouth
Totness
Plymouth
Plymouth Sound
Modbury
Kingsbridge
Start Point
Bolt Hd.
Prawle Pt.
Salcombe
Eddystone Lt. Ho.
Lostwithiel
St. Austell
Truro
Redruth
Falmouth
Falmouth Harbr.
Penzance
St. Ives
Lands End
Mounts B.
Lizard Pt.
Dodman Pt.



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